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Gaining Insights Into Patients' Experiences of Remote Diagnostic Screening for Chronic Kidney Disease in Patients With Diabetes

Carl Deaney, MSc, MBBS, MRCGP, MRCP[1] and Danielle Reesby, MSc[1]

Abstract

Introduction: Chronic kidney disease (CKD) affects a significant portion of the UK population and is a pressing public health issue. Current screening methods have a low patient uptake rate. This retrospective study explores the patient experience of remote diagnostic screening. **Objective:** This article retrospectively analyses patient-reported experiences, focusing on at-home urinary screening to detect CKD. **Intervention:** Our primary care network commissioned a remote diagnostic service for adult patients with diabetes (Types I and II) who had not taken urinary albumin: creatinine ratio test within 12 months. Patients were provided with an at-home kit and guided by a smartphone application. Qualitative clinical data was collected during screening, with a questionnaire capturing patients' experiences. **Impact:** A total of 60% of eligible patients performed testing, and 35% were detected to have abnormal results. A total of 80% of patients preferred remote screening. **Conclusions:** This study provides evidence for remote CKD screening and opens avenues for innovation. Most patients reported a positive experience, underscoring the potential of this approach to improve health outcomes, especially in higher-risk populations.

Keywords

access to care, diabetes, patient engagement, patient experience, patient feedback, patient-reported experience measures, remote ACR testing, chronic kidney disease screening

Introduction

Chronic kidney disease (CKD) ranks as the 10th leading cause of mortality globally, with an estimated 7.2 million people suffering from some degree of CKD in the United Kingdom. This results in a significant financial burden on the National Health Service (NHS), with an estimated £7 billion spent annually from the NHS budget. The critical driver is dialysis costs, estimated at £34 000 per year per patient in 2023. Despite CKD emerging as a UK public health emergency, little is spent on research funding, as low as 1.4% of relevant funding budgets in the 2021/2022 financial year.[1]

While there are a variety of risk factors which lead to the development of kidney damage, the most common causative disease is diabetes mellitus, with chronic and sustained hyperglycemia causing alterations to the glomerular hemodynamics, among other mechanisms.[2] These effects lead to progressive kidney fibrosis and destruction of the normal architecture of the kidney.

The current focus of practical guidelines from the National Institute for Health and Care Excellence (NICE) for CKD (NG203) is to promote screening, earlier detection, and prompt intervention to improve health outcomes and disease trajectory significantly.[3] *The Kidney Disease: Improving Global Outcomes* (KDIGO) 2024 guidelines emphasize obtaining serum estimated glomerular filtration rate (eGFR) and urinary albumin: creatinine ratio (ACR), with proteinuria considered a marker for kidney injury and a predictor of poor cardiovascular outcomes and disease progression.[4] Serum kidney function tests are among the most ordered healthcare tests,[5] however, urinary ACR testing is low. The 2017 UK National CKD Audit found that only 54% of diabetic patients have annual ACR results, and those with hypertension have ACR rates below 30%.[6]

[1] Marsh Medical Practice, Louth, UK

Corresponding Author:
Carl Deaney, Marsh Medical Practice, Keeling St, North Somercotes, Louth LN11 7QU, UK.
Email: carldeaney@doctors.net.uk

While screening for CKD is crucial to improving early detection and intervention, the underutilization of urinary ACR testing presents a significant challenge to achieving better outcomes. This is particularly important for populations with low socioeconomic status, as it is a well-known factor contributing to healthcare disparities. There is strong evidence that disadvantaged communities face a higher burden of undiagnosed and inadequately treated CKD.[7]

One promising approach to addressing this issue is the use of remote diagnostic tools, which can improve screening uptake in harder-to-reach patients, such as those living in rural areas of higher deprivation and those with poor health literacy.[8] This places significance on the development of innovative strategies to reach those in the most at-risk communities, making testing more accessible and convenient.

Minuteful-Kidney, a smartphone-based diagnostic service, exemplifies this innovation by providing patients with at-home urinary ACR test kits, empowering them to participate in their own care. It consists of a single-use ACR test kit sent to patients' homes in the post, alongside a downloadable mobile application which uses image recognition software to turn patients' smartphones into an ACR urine strip analyzer.[9] While these types of patient-centered pathways have been shown to increase screening uptake, there is a need to understand patient experiences surrounding remote health diagnostics to help promote patients' acceptance of these tools and better understand their chronic conditions.[10]

The process of how receiving care feels to the patient is a critical element of providing quality healthcare. A growing body of evidence focuses on the importance of understanding patient experience in improving health services.[11,12] By capturing patients' experiences, the aim is to achieve more feasible, valuable, and preferable healthcare.

This article retrospectively examines the experiences of diabetic patients using such remote diagnostics within a rural primary care network (PCN), focusing on how this intervention can facilitate earlier detection of CKD and potentially improve health outcomes in this high-risk cohort.

Intervention

The study was conducted within a PCN serving 38 000 people in a rural area, ranked as the 30th most deprived in England. Eligible patients were over 18, diagnosed with diabetes mellitus (Type I or II), and had not submitted a urinary ACR in the past 12 months. These patients were identified through clinical searches embedded in SystmOne®, our electronic record system (ERS), and were included in the screening program if they had access to a smartphone. The test kits were sent by the service provider, Minuteful-Kidney. After completing the test, patients were asked to voluntarily fill out an anonymized app-based questionnaire to share their experiences. This was a retrospective qualitative review of those patient experiences using at-home urinary ACR testing kits.

Impact

The KDIGO CKD guidance classifies CKD into 6 categories based on eGFR. It includes staging based on 3 levels of albuminuria (A1, A2, and A3).[4] Of the 636 eligible patients, 394 (62%) performed the test. Of the respondents, 65% of the results were A1 normal, 29% were A2 abnormal, and 6% were A3 high abnormal (Figure 1).

Early detection of CKD allows for timely pharmaceutical optimization, which can slow the progression of kidney damage and dysfunction. In patients with diabetes, optimal CKD management often involves up to 3 pillars of treatment. The first pillar focuses on inhibiting the renin-angiotensin-aldosterone system, typically through angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers. These medications offer reno-protective benefits that extend beyond lowering blood pressure. Reno-protection can be further enhanced by adding sodium-glucose transport protein 2 inhibitors, which help reduce intraglomerular pressure. The final pillar involves the use of a nonsteroidal mineralocorticoid receptor antagonist. This drug works through anti-inflammatory and anti-fibrotic mechanisms to prevent further kidney damage.[13] Current guidelines recommend combining these treatments for eligible patients to maximize renal protection.[14] The sooner these therapies are initiated, the better the long-term outcomes. Early intervention not only reduces morbidity and premature mortality but also has the potential to lower costs across the broader healthcare system

Beyond pharmacological recommendations, understanding disease trajectory plays a crucial role in managing chronic conditions like CKD. Gansevoort's model illustrates distinct patterns of renal decline over time, emphasizing the importance of intervention points.[15] While all trajectories ultimately lead to end-stage renal disease (ESRD), the timing of this progression can be markedly affected by early diagnosis and staging of CKD. This early identification creates opportunities for intervention, potentially delaying the onset of ESRD. Furthermore, gaining insight into disease trajectory from the patient's perspective helps shape their expectations for the future, which can in turn affect their treatment choices and acceptance.[16]

Although the importance of screening and early intervention in CKD is well-established, understanding patient experience is just as crucial. To explore patients' experiences with the at-home urinary ACR testing service, a questionnaire was administered via their mobile phone application.

The survey included a combination of Likert-scale questions, and an open-ended question designed for qualitative analysis. These questions aimed to prompt patients to describe their experiences with the diagnostic service in their own words. The qualitative data collected from the patient surveys were analyzed using thematic analysis to identify key patterns and insights into their experiences with at-home urinary ACR testing. Responses from the open-ended questions were read multiple times to ensure

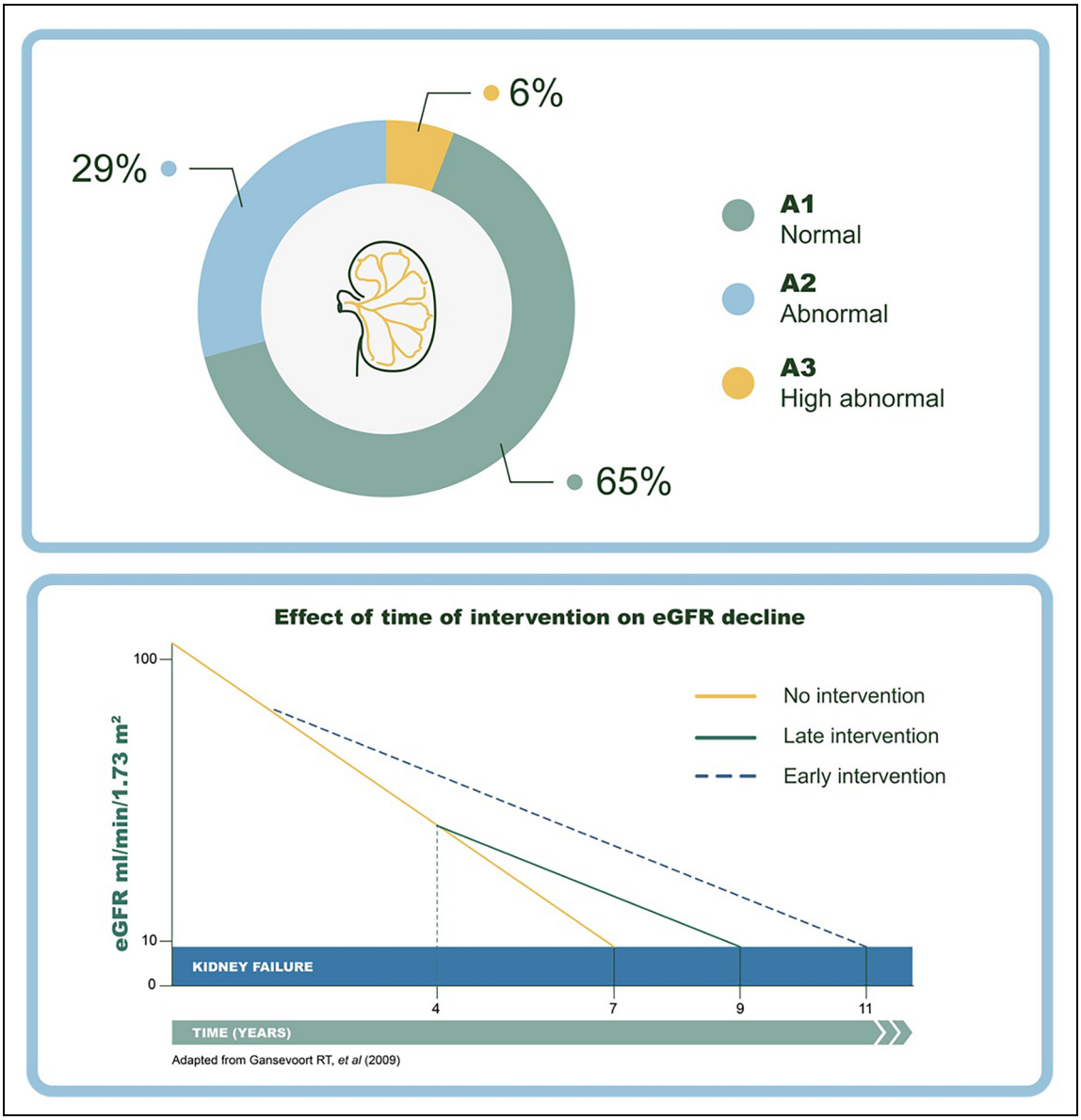

Figure 1. ACR test results breakdown with corresponding illustration of disease trajectories in CKD in relation to the timeliness of intervention.
Abbreviations: ACR, albumin: creatinine ratio; CKD, chronic kidney disease.

familiarization with the data, and an inductive approach was employed to generate initial codes directly from the responses. These codes were then grouped into broader themes that reflected recurring patterns in the data, such as "Ease of Use," "Convenience," and "Confidence in Technology." To further enhance the credibility of the analysis, triangulation was employed by cross-referencing the qualitative findings with quantitative survey results (eg, Likert-scale responses). Direct quotes from patient feedback were used to support and illustrate the thematic findings. Throughout the process, patient anonymity and confidentiality were maintained, and the analysis was conducted with consideration of ethical standards. This rigorous approach to qualitative data analysis ensures transparency and improves the replicability of the study's findings.

The survey results (n = 42) revealed that 90% of patients encountered no issues using the remote service, and 90% reported the test was "very easy" or "easy" to complete. When asked about recommending the technology to others, 85% scored between 8 and 10, with 64% giving a perfect score of 10. Additionally, 88% expressed a preference for using at-home testing technology in the future, and 81% indicated they would rather use at-home ACR testing instead of in-practice testing (Figure 2).

The qualitative analysis of free text responses indicated an overall positive experience, with patients describing the service as "very good," "easy," and "useful." Responders appreciated the clarity of instructions provided via the mobile application. Feedback also emphasized the convenience and efficiency of the service, with comments such

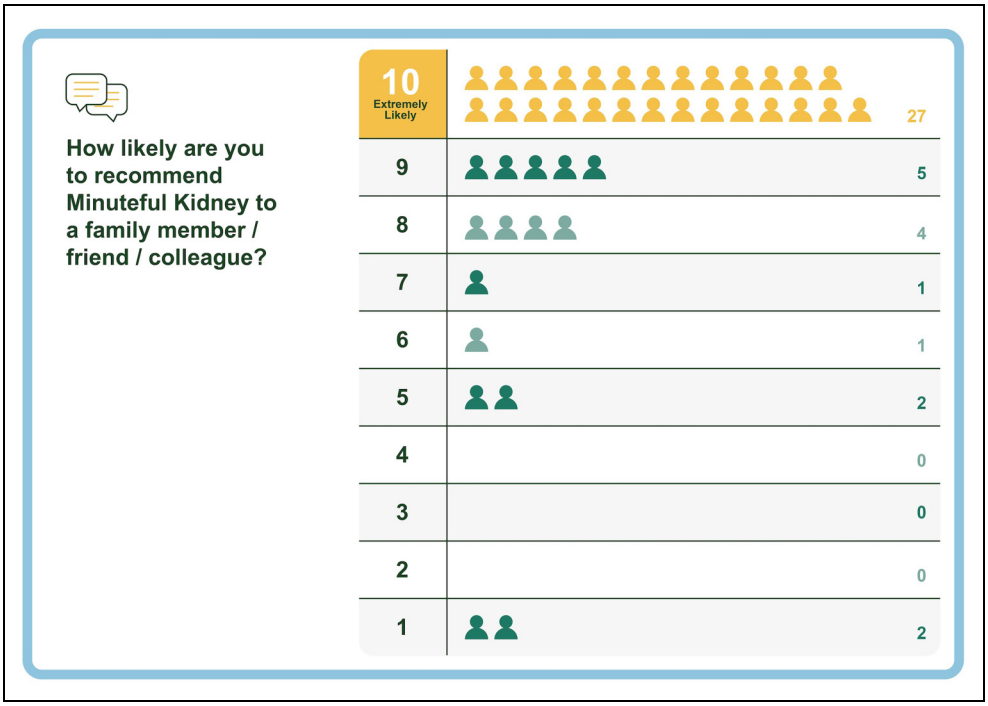

Figure 2. Results of patient experience question "How likely are you to recommend Minuteful Kidney to a family member/friend/colleague?"

as "quick," "'done in no time," and "more convenient" being used to describe the process. Several responses indicated that the procedure exceeded expectations and was more accessible than anticipated despite initial hesitation. Overall, the service was deemed straightforward and comprehensive, leaving patients satisfied. The data collated throughout this pilot scheme was retrospective, gathered during the routine delivery of clinical service with patients who had consented to participation before the service delivery.

Discussion

App-based questionnaires offer a convenient way to gather patient feedback, capturing timely responses after using the diagnostic service. However, technological barriers may affect older patients or those less familiar with smartphones, potentially reducing engagement. Providing support, such as clear instructions or alternative survey methods (eg, telephone or paper-based), could enhance inclusivity and ensure more comprehensive participation. Recognizing these challenges is important for understanding patient engagement and addressing digital exclusion.

Conclusion

Incorporating remote diagnostics into long-term condition screening, specifically, CKD, can significantly increase adherence rates compared to in-clinic testing. By combining reports from our ERS with remote diagnostic technology, 62% of previously untested patients provided urinary ACR results, with over 35% being abnormal. This may lead to earlier evidence-based interventions in this group, improving disease trajectory while reducing morbidity and mortality. It may also reduce future healthcare-related costs.

Remote diagnostics enable patients to actively participate in their health and well-being management by including them in their diagnostic process. This may help their understanding of the disease and potentially enhance their self-management. While, in certain instances, patients may require more support and prefer human contact, remote diagnostics appears to be a preferred screening option. This may have been driven by shifts in the delivery of healthcare services caused by the COVID-19 pandemic.

Ultimately, patient experience is essential in helping to drive best practices by enabling a collaborative approach between healthcare providers and patients to make healthcare decisions that align with the patient's preferences, values, and goals. The findings of this retrospective study highlight that most patients are willing and able to engage with remote home ACR screening and, in most cases, prefer this option to traditional in-clinic alternatives. This allows primary healthcare services to focus on patients with CKD who need optimization.

Key Findings

1. Remote ACR testing improves adherence to screening by 20% above the UK national average,
2. 80% of patients prefer at-home ACR testing,

3. 64% of patients indicated they would be "extremely likely" to recommend remote testing (*Minuteful-kidney*) to others.

Author Contributions

CD and DR conceived and planned this retrospective study. They also designed the methodology, analyzed the data, and wrote the paper. CD completed the final editing

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

Our institution does not require ethical approval for reporting individual cases or case series. This study was conducted as a retrospective analysis of previously collected data. The review examined data from the electronic record system, originally gathered for routine clinical work. The local ethics committee (LEC) reviewed the protocol and approved it as a retrospective review (Ref: #1/Apr24).

The data were used solely for this retrospective review. Both authors, who were directly involved in the data analysis, are trained in ethical research practices and comply with the guidelines and principles of ethical reporting. All findings are reported accurately and honestly, without fabrication, falsification, or inappropriate data manipulation.

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Statement of Human and Animal Rights

Analysis of data in this study was conducted in accordance with the LEC's (Ref: #1/Apr24) approved protocols. All data utilized were de-identified and anonymized before analysis to protect participant confidentiality and stored securely in compliance with the UK Data Protection legislation. Access to the data was restricted to authorized personnel only. The authors declare that they have no conflicts of interest that could have influenced this study's design, conduct, or reporting. This review was not funded, although the PCN did receive a nonpromotional grant from Bayer to commission the remote service from an external provider.

Statement of Informed Consent

Informed consent for patient information to be published in this article was not obtained because the LEC waived the requirement due to the nature of the study, which posed minimal risk to the participants and involved using existing data. Questionnaires were used for feedback during routine clinical work, and informed consent was obtained from all participants at the time of their administration. All patients were assured that their participation was voluntary and that they could withdraw at any time.

ORCID iD

Carl Deaney https://orcid.org/0000-0002-2709-7960

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