Telemonitoring: An Opportunity for Nephrology?

Bruno Rodrigues[1*], *Inês Clemente*[1], *Catarina Abrantes*[1]
1. Nephrology Department, ULS Estuário do Tejo, Vila Franca de Xira, Portugal.

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INTRODUCTION

Chronic kidney disease (CKD) care increasingly requires longitudinal surveillance across outpatient clinics, day hospitals, emergency departments, inpatient wards and patients' homes. Hypertension, fluid overload, heart failure, multimorbidity and frequent therapeutic changes create periods in which clinically relevant deterioration may develop between scheduled encounters. Telemonitoring, the structured remote collection of patient-generated clinical data linked to a predefined professional response, may help nephrology services identify such changes earlier and improve continuity of care. Evidence in kidney disease suggests that remote patient monitoring is feasible and may improve resource use, treatment oversight and patient participation, although robust evidence for hard clinical outcomes remains limited.[1] For Portuguese nephrology, the opportunity is particularly relevant. More broadly, remote monitoring may connect the patients' homes with nephrology consultation and cardiorenal programmes, potentially reducing unnecessary travel while allowing earlier reassessment when clinically justified.

FROM MONITORING DATA TO CLINICAL CARE

Telemonitoring should not be understood as the simple accumulation of measurements. Its clinical value lies in selecting data that can answer a specific question and trigger a useful intervention. In nephrology, potentially relevant parameters include body weight, blood pressure, heart rate, peripheral oxygen saturation, urine output, temperature and structured symptom questionnaires addressing dyspnoea, orthopnoea, oedema, effort tolerance or general functional decline.

The Portuguese National Health Service already provides a digital framework for this model. The *Telecuidados* SNS platform allows professionals to prescribe individual monitoring plans, receive measurements and manage alerts, while the Telemonit SNS 24 application allows patients to record biometric parameters and complete self-assessment questionnaires.[2] This shared national infrastructure offers an important starting point for implementation without requiring each nephrology department to develop an independent technological solution. Beyond nephrology, this platform has already been used in programmes for chronic obstructive pulmonary disease, congestive heart failure, diabetes, hypertension, severe asthma, oncological pulmonology and hospital-at-home care.

LESSONS FROM A CARDIORENAL PILOT

Within our Cardiorenal Programme, a pilot phase using the *Telecuidados* SNS platform included 10 patients between February 2025 and the present. Patients were selected from the cardiorenal programme if they had digital literacy or caregiver support to perform measurements; advanced age and limited digital literacy were the main barriers to enrolment. Biometric parameters were recorded three times weekly and symptom questionnaires once weekly. Adherence to scheduled measurements was around 80%. Two patients discontinued the programme, mainly because of registration burden and technical platform issues. This experience showed that telemonitoring can be integrated into an existing nephrology day-hospital pathway rather than operating as an isolated digital service.

It also exposed a practical limitation: adherence to regular measurements was lower and less consistent than expected in some patients. A technically functional system produces little clinical value when measurements are sporadic, delayed or absent. Adherence must therefore be treated as a core outcome of the programme, not as an assumption. Initial training, confirmation of measurement

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* **Corresponding Author:** Bruno Rodrigues |bfgrodrigues@gmail.com | ULS Estuário do Tejo, Hospital de Vila Franca de Xira, Estrada Carlos Lima Costa Nº 2, Povos, 2600-009 Vila Franca de Xira
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technique, simple schedules, caregiver involvement when appropriate, reminders and early contact after missed measurements should be incorporated into the care pathway. Persistent non-adherence should prompt reassessment of barriers, monitoring intensity and, when no meaningful data can be obtained, continuation in the programme.

The pilot was built around explicit clinical aims: earlier identification of symptomatic or hemodynamic deterioration, detection of congestion, support for treatment titration, closer surveillance after discharge or day-hospital treatment, and avoidance of hospital visits that offer little clinical benefit to stable patients. Telemonitoring was conceived as a complement to consultation, telephone contact, laboratory testing and face-to-face assessment—not as an emergency service, continuous 24-hour surveillance or a substitute for clinical judgement.

SELECTING PATIENTS AND OBJECTIVES

Telemonitoring should be offered selectively. Appropriate candidates have an explicit, potentially modifiable clinical objective; sufficient stability to remain at home; capacity to perform measurements independently or with a caregiver; reliable means of contact; and willingness to participate. Just as importantly, the clinical team must have the capacity and authority to act on the information received.

Initial implementation may focus on patients in cardiorenal programmes, especially those with recurrent congestion, difficult blood-pressure control, recent hospitalisation or active therapeutic titration. Subsequent expansion could include selected patients with advanced CKD receiving conservative kidney management, patients recovering from acute kidney injury, individuals exposed to immunosuppressive or nephrotoxic therapy and patients receiving peritoneal dialysis. The variables, frequency, duration and alert thresholds should be individualised according to the clinical question and the patient's baseline values.

DESIGNING AN ACTIONABLE SYSTEM

An alert is not a diagnosis. Abnormal values may result from measurement error, incorrect device use or transmission failure and should be confirmed whenever possible. Conversely, the absence of an alert cannot exclude deterioration; patients must retain clear instructions on when to contact the team, seek urgent care or call emergency services.

A tiered response pathway must be implemented. Depending on severity and context, action may include repeating the measurement, correcting technique, temporarily increasing monitoring frequency, telephone assessment, laboratory testing, clinician-validated treatment adjustment, earlier consultation, day-hospital evaluation or referral for urgent assessment. Alerts, clinical interpretation, decisions and instructions should be documented. Programmes should avoid generating data when no timely response can be provided, as this risks alert fatigue, patient anxiety and false reassurance.

EVIDENCE WITHOUT OVERPROMISING

Evidence from heart failure illustrates why implementation design matters. A large randomised trial of telephone-based telemonitoring after heart-failure admission did not reduce readmission or mortality.[3] In contrast, a more comprehensive programme combining daily monitoring with individualised telecoaching in high-risk patients was associated with lower mortality and fewer heart-failure hospitalisations.[4] A recent systematic review of 32 randomised trials found heterogeneous effects on mortality, readmission and quality of life, with substantial variation in technology, feedback and patient engagement.[5]Accordingly, Portuguese nephrology departments should present telemonitoring as a tool for earlier recognition of deterioration, better-supported therapeutic decisions, continuity between care settings, improved self-management and more rational use of in-person resources. These outcomes should be measured prospectively.

IMPLEMENTATION IN THE PORTUGUESE NHS

Portugal has a major advantage in having a national platform, patient application and connected-device ecosystem. Nevertheless, our pilot experience also showed that the current platforms are still far from perfect. Some functions and workflows do not yet fully match the concrete needs of nephrology and cardiorenal care. Importantly, there has been openness from the teams responsible for the platform to consider and implement adaptations in response to the practical needs we have identified. This dialogue between clinical teams and platform developers should continue, because successful telemonitoring requires technology to adapt to care pathways, not the reverse.

Expansion should be progressive and linked to service capacity. Evaluation should include active patients, adherence to scheduled measurements, missing-data patterns, alerts per patient, proportion of actionable alerts, contacts generated, professional time, unplanned assessments, technical failures, hospital use and patient-reported experience. If workload exceeds capacity or adherence remains inadequate, services should revise eligibility, education, measurement frequency, alert thresholds or staffing before recruiting further patients.

CONCLUSION

Telemonitoring is a credible opportunity for Portuguese nephrology, particularly in cardiorenal care and during vulnerable transitions. The technology can extend observation beyond the hospital, but it cannot compensate for an undefined clinical objective, poor patient adherence

or the absence of a response pathway. Its success will depend on careful selection, individualised plans, actionable alerts, protected clinical capacity, iterative platform improvement and continuous evaluation. Used as a structured extension of care rather than a replacement for clinical assessment, telemonitoring may help nephrology move from episodic reaction towards earlier, more continuous and more patient-centred intervention.

Ethical Disclosures

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BR: Conception of the article and literature review.
IC: Drafting of the manuscript.
CA: Drafting of the manuscript, data collection, and critical review of the final version.
All authors contributed to this work, approved the final version of the manuscript for publication, and agree to be accountable for all aspects of the work, ensuring the accuracy and integrity of the data presented.

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