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RESEARCH ARTICLE

Sustainable Renal Care through Chronic Kidney Disease Prevention: A Survey Study

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Abstract

Background: Chronic Kidney Disease (CKD) is a growing global health challenge associated with substantial clinical, economic, and environmental burdens. Preventive strategies are increasingly recognized as essential to reduce reliance on resource-intensive Renal Replacement Therapy (RRT).

Methods: A cross-sectional online survey was conducted between June and December 2024 among Healthcare Professionals (HCPs) in nephrology and primary care in Spain and Portugal. The questionnaire explored perspectives on CKD prevention, use of information and communication technologies (ICT), and awareness of environmental sustainability practices. Descriptive statistics were used.

Results: A total of 21 HCPs participated (Spain n = 11; Portugal n = 10), most with over 10 years of experience. ICT tools were considered necessary for CKD management by 90.9% of Spanish and 77.0% of Portuguese respondents. Key barriers included limited training in primary care, poor communication between care levels, and time constraints. Approximately 40% reported difficulty applying KDIGO guidelines in routine practice. Awareness of environmental sustainability measures in RRT was low.

Conclusion: CKD prevention supported by ICT tools and improved coordination between healthcare levels may enhance both clinical outcomes and environmental sustainability. Targeted training and system-level interventions are needed to strengthen preventive nephrology.

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- Sustainable Kidney Care
- Early detection
- Questionnaire

Introduction

Chronic Kidney Disease (CKD) is a progressive condition characterized by a decline in kidney function, commonly identified through reduced estimated Glomerular Filtration Rate (eGFR) or increased albuminuria over at least three months [1]. Globally, approximately 850 million people are affected, many of whom remain undiagnosed [2-4].

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The prevalence of CKD continues to increase due to aging populations and the rising incidence of diabetes and hypertension. CKD imposes a significant burden on healthcare systems due to frequent monitoring, long-term management, and progression to kidney failure [5,6].

At advanced stages, patients require Renal Replacement Therapy (RRT), including dialysis or kidney transplantation [7]. These treatments are resource-intensive and associated with substantial financial and environmental costs. Dialysis contributes significantly to water consumption, energy use, and waste generation [8-11].

Given these challenges, there is growing interest in sustainable nephrology, focusing on prevention, early detection, and efficient care delivery. Preventive strategies not only improve patient outcomes but also reduce dependence on high-impact treatments such as dialysis [12-22].

This study aims to explore healthcare professionals' perspectives on CKD prevention, the role of ICT tools in improving care, and awareness of environmental sustainability practices in renal care in Spain and Portugal.

Materials and Methods

A cross-sectional online survey was conducted between June and December 2024 targeting healthcare professionals involved in kidney care, including nephrologists, renal nurses, and primary care physicians in Spain and Portugal.

Participants were recruited through institutional mailing lists from nephrology societies, healthcare centers, and professional associations. Invitations containing the survey link were distributed *via* email, followed by one reminder. Participation was voluntary and anonymous.

Inclusion criteria were:

- Active involvement in kidney patient care
- Practice in Spain or Portugal

Ethical approval was obtained from the Ethics Committee of Universidad Politécnica de Madrid. All participants provided informed consent prior to completing the questionnaire.

A convenience sampling strategy was used due to the specialized nature of the target population. While the sample size (n = 21) is limited, it is consistent with exploratory survey studies in specialized clinical settings and is appropriate for identifying preliminary trends.

This study survey received ethical approval from the Ethical Committee of *Universidad Politécnica de Madrid – Vicerrectorado dew Investigation, Innovación y Doctorado.*

Statistical Analysis

Data was analyzed using descriptive statistics. Results are presented as frequencies and percentages. Given the exploratory nature of the study and small sample size, no inferential statistical analysis was performed.

Results

A total of 21 healthcare professionals participated (Spain n = 11; Portugal n = 10), with most respondents reporting more than 10 years of clinical experience (Table 1).

The limitations and common management of potential and current kidney patient is shown in the table 2 and the table 3 shows the opinion of respondents about the recommendable priorities for ICT intervention tools for kidney prevention and care.

ICT tools were widely perceived as necessary to improve CKD management, particularly among Spanish respondents (90.9%) compared to Portuguese respondents (77.8%). Reported benefits included improved communication, enhanced clinical decision-making, and better patient monitoring.

Table 1: Baseline respondent characteristics / considerations.

	Baseline respondent characteristics / Considerations	Portugal (%)	Spain (%)
Genre	Female	90.0	45.5
	Male	10.0	54.5
Professional Role	Physicians	70.0	54.5
	Nurses	20.0	27.3
	Others	10.0	18.2
Age Group	Over 65 years old	20.0	18.2
	From 55 to 64 years old	0.0	45.5
	From 45 to 54 years old	30.0	9.1
	From 35 to 44 years old	40.0	18.2
	From 25 to 34 years old	10.0	9.1
	Under 25 years old	0.0	0.0
Years working in Healthcare	> 20	12.5	50.0
	11-20	50.0	10.0
	6-10	25.0	10.0
	1-5	0.0	20.0
	< 1	12.5	10.0

Key barriers identified across both countries included:

- Limited training in CKD management in primary care
- Poor communication between primary care and nephrology services
- Time constraints due to high patient workload
- The majority of respondents reported that patient education for self-care management is the main role of primary care in the kidney prevention. More details concerning challenges faced by Kidney HCPs are shown in the table 4.

Approximately 40% of respondents reported difficulty using KDIGO guidelines in daily practice due to complexity and time limitations.

Regarding environmental sustainability, most respondents reported limited awareness of measures related to water consumption, energy use, and waste management in dialysis.

Discussion

This study highlights key systemic barriers to effective CKD prevention, particularly within

Table 2: Renal Care/ Patient Management Needs.

Renal Care/ Patient Management Needs	Portugal (%)	Spain (%)
Knowledge about CKD high prevalence	100.0	90.9
Promote frequent patient screening	62.5	45.5
Enhance collaboration and cooperation between HCPs	66.7	54.5
Efficient communication channel	42.9	81.8
Lack of training and specific Knowledge	42.9	36.4
Use ICT to enhance CKD management	77.8	90.9
Know and Use KDIGO**	62.5	63.6

**Kidney Disease Improving Global Outcomes.

Table 3: Priorities in ICT Interventions.

Priorities for ICT Interventions	Portugal (%)	Spain (%)
Usability and Interoperability and Integration with existing system	75.0	54.4
Support Multidisciplinary care	77.8	81.8
Support screening / early detection	88.9	72.7
Support patient education and engagement	77.8	45.5
Research and innovation	55.6	54.5
Integration with existing system	75.0	54.5

Table 4: The challenges for healthcare professional.

The challenges for healthcare professional	Portugal (%)	Spain (%)
Regular screening	88.9	72.7
Too many Patients per day	50.0	77.8
Scarcity of time for consultation	66.7	0.0
Lack of clear and effective referral pathways to specialist	83.3	66.7
Limited resource	58.0	54.5
Inefficient channel for communication and coordination between Primary Care and specialists (nephrologist and Cardiologists)	87.5	
Knowledge and Use KDIGO**	62.5	63.6

**Kidney Disease Improving Global Outcomes

primary care. The consistency of findings across Spain and Portugal suggests that these challenges are structural rather than country specific.

The strong perceived need for ICT tools supports existing evidence that digital health solutions can enhance coordination across care levels, improve early detection, and facilitate patient monitoring. These tools may play a critical role in strengthening preventive nephrology [23-25].

A notable finding is the limited usability of KDIGO guidelines in routine clinical practice. This suggests a gap between guideline recommendations and real-world applicability, particularly in high-demand clinical environments.

Importantly, awareness of environmental sustainability practices in renal care was low. Given the significant environmental footprint of dialysis, this represents an important gap. Integrating sustainability into clinical education and policy frameworks could improve both environmental and healthcare system resilience [25-33].

The small sample size reflects the challenges of engaging busy healthcare professionals and should be interpreted as exploratory. However, the consistency of responses supports the relevance of the identified themes.

Conclusion

CKD prevention is essential for improving both patient outcomes and healthcare sustainability. This study identifies key barriers, including limited training, poor coordination between care levels, and low awareness of sustainability practices.

Strengthening primary care capacity, integrating ICT solutions, and promoting environmental awareness in nephrology are critical steps toward more sustainable renal care. Future research should focus on larger samples and implementation strategies.

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Conflict of interest statement / disclosure statement

The author(s) declared that there is no potential conflict of interest concerning the research, authorship, and/or publication of this article.

Ethics approval and consent to participate

Despite the participant had to answer the first and mandatory question about consent to participate, we get the Ethical approval from Ethic Committee of Universidad Politécnica de Madrid.

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Consent for publication /Informed consent

Consent was asked of all participants before starting to answer the questionnaire.

Author contributions

Abel Mata-Lima conceived and conducted the study. José Javier Serrano-Olmedo reviewed and edited the manuscript and approved the final version of the manuscript. Abel Mata-Lima conceptualized and developed the questionnaires and wrote de first draft of the manuscript. Abel Mata-Lima and José Javier Serrano-Olmedo undertook the survey review, distribution, and diffusion. J.J. Serrano provided project guidance and ethical approval management. Abel Mata-Lima and José Javier Serrano-Olmedo undertook the questionnaire and manuscript review and informed the interpretation of findings. All authors contributed significantly to the study design. Material preparation, data collection, and analysis were performed by all authors. All authors commented on previous versions of the manuscript, read and approved the final manuscript;

Abel Mata-Lima verify the data used in these analyses. All authors confirm they ad full access to all the data in the study and accept responsibility to submit for publication.

Supplementary material

This article contains the following online survey questionnaires: https://docs.google.com/forms/d/1Owc81qpVVaPSsJBCEGonW9UDC2Plu4DOyzR2zNSjCh0/viewform?edit_requested=true

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