Citation: Mata-Lima A, Serrano-Olmedo JJ, Paquete AR. ICT-based approaches for managing hemodialysis therapy: a scoping review. J Exp Nephrol. 2025;5(1):34-44.

Supplementary Tables

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
01	Emotion sharing in remote patient monitoring of patients with chronic kidney disease	Robin Huang et al.	USA (2019)	RPM &HD	156 Patients	Improve the quality of life, and increase acceptance of these modalities of renal replacement therapy. Real-time visual chat between patients and clinicians Link outcomes with patent emotion Improvement in perceived autonomy and confidence. Increased level of oversight and education. Alleviates the need and associated costs of patient travel. Improve outcomes in ESKD patients.	This address concerns that the patient may need additional oversight to ensure safety. Lack of acceptance and education among physicians, social barriers. Lack of family and friend support. Cognitive barriers
02	On-line monitoring of electrolytes in hemodialysis: on the road towards individualizing treatment	Manoj Sharma et al.	Netherland (2016)	On-line monitoring /HD	Not reported	Improve hard medical outcomes. Optical ion-selective microsensors and microsystems form a promising pathway for individualizing dialysis treatment.	Microsystem technologies remain underutilized in the field of nephrology. The technological development in this field can offer a cheap and easily operational sensor for one-time use. It will be important in the future to integrate such optofluidic microdevices.
03	Smart sensors for real-time monitoring of patients on dialysis	Fokko Wieringa et al.	Netherland (2020)	RPM / PD & HD	Not reported	Unobtrusive wearable and/or ubiquitous smart monitoring may therefore make 4P medicine (that is, predictive, precise, preventive, and personalized), individualize treatments, and improve patient outcomes. Monitoring, therefore, represents a key opportunity to optimize treatment efficacy and patient care.	Longitudinal data might help clinicians to diagnose earlier and monitor disease progression, and perhaps help patients adopt a healthier lifestyle.

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
						That real-time monitoring of clinical parameters could help to individualize treatments for patients	
04	'My Home Hemo' app-a new telehealth tool for remote monitoring of patients on home hemodialysis	Mary Ann Nicdao et al.	Australia (2016)	RPM, app, web Portal & Telehealth/ HD	74 patients during 21 weeks	Patients with HHD are exposed to the same health risks as other dialysis patients. The HHD-RMS (My Home Hemo app) enabled nurses to monitor patients in multiple locations from the dialysis unit. Led to savings associated with patient and nursing time related to travel, enhanced patients' clinical decision-making, and improved patient and staff satisfaction. Health benefits to patients and cost savings to health services	Patients may feel isolated and discouraged to continue with the modality due to limited contact with clinical staff.
05	Remote Patient Management for Home Dialysis Patients	Eric Wallace et al.	USA (2017)	RPM / Home Dialysis (HD & PD)	Not reported	Remote patient management has exciting potential to improve home dialysis patient care and home modalities uptake. Improve the quality of life and reduce cost. RPM can help reduce the burden of travel, and improve the process of managing PD supplies. Additionally, the ability to receive vital patient information in real-time allows the physician to directly impact a patient's care sooner and hopefully lead to fewer complications.	Further, RCT and large registry-based studies focused on how and what to monitor are needed to guide the most efficacious use of telehealth as it applies to the dialysis patient and provider.
06	Evaluation of the experience with the use	Raquel Scofano et al.	Brazil (2022)	Telemedicine / HHD	17 Patients	Patients and nurses had positive experiences with telemonitoring, highlighted	Users indicated that telemonitoring does not replace face-to-face visits.

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
	of telemedicine in a home dialysis program—a qualitative and quantitative study				12 Nurses during 24 weeks	feelings of being cared for, and improved confidence. Telemonitoring is a useful tool to increase satisfaction with and confidence in home hemodialysis, experiences with telemedicine were positive mainly because it increased their confidence and sense of care during HHD. Telemedicine could be considered a valuable tool for coping with distancing while providing HHD health professionals expressed their confidence in and acceptance of this delivery method	The initial resistance of nurses was probably greater than that of patients due to the possibility of evaluating their care performance, creating a feeling of discomfort. Telemedicine was deemed an acceptable way to receive health care but was regarded as complementary to face-to-face visits with the doctor. Further studies are needed to show the impact of telemedicine on physicians, nurses, social workers, and dieticians participating in an HHD program.
07	The Mobile Health Readiness of People Receiving In-Center Hemodialysis and Home Dialysis	Wael Hussein et al.	Australia (2021)	Mobile / HD & Home Dialysis	949 Patients (632 HD + 317 Home dialysis	Home dialysis participants had higher proportions of younger patients, employment, and higher education and a lower proportion of Hispanic patients. The majority reported the ability to use mobile devices and to access the internet independently and were currently using or interested in using mobile health-related activities Findings suggest that even though most patients on dialysis are mobile health ready, a one-size-fits-all approach to mobile health is unlikely to be successful. Our findings that mobile health readiness is independently associated	The main limitation is that this is a cross-sectional design, and we cannot propose a causal relationship between patient variables and mobile health readiness or proficiency.

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
						with younger age, higher education, employment, and ethnicity support previous findings in non-dialysis contexts. In people with kidney disease, Bonner et al. found that greater mobile health readiness was associated with younger age, higher education, and decreased indigeneity. Higher mobile health readiness and proficiency in our patients on home dialysis compared with patients on in-center dialysis. This important finding can stimulate the use of mobile health in home dialysis given that the vast majority of home dialysis nurses believe that its use would improve care, decrease travel time, and enhance patient-centered care in patients on home dialysis. Higher mobile health readiness and proficiency in our patients on home dialysis compared with patients on in-center dialysis. The use of mobile health for patients on in-center hemodialysis has received less attention than home dialysis, even though the technology is highly pervasive in in-center hemodialysis. The capacity to improve treatment adherence; address patient-reported	

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
						symptoms in real time; and encourage the use of nutrition, activity, and mental health apps could assist in empowering patients to reverse the predominantly one-way care delivery system and place the patient on dialysis at the center of his or her own health care. The knowledge is that most users stop mobile health application usage soon after initial use. Suggests a need for additional healthcare professional education and support to help ensure that mobile health communications can lead to significant improvements in patient experience with home dialysis care	
08	Support of Self-Management for Chronic Kidney Failure Patients	Yosuhiko Sota et al.	Japan (2011)	Mobile Phone / HD & PD	Not reported	The design of the visual interface was considered satisfactory. The interface is quite easy to use, and the contents can be easily understood at a glance. It is easy to take note of symptoms and write a self-review on one screen." The list contains sufficient items for daily health management." More precise information is expected in the case when conditions are not good," No more information is needed because simplicity is best." The system may help some to improve their motivation	More precise information is expected in the case when conditions are not good. Further investigations will be required to find the best balance between detail and simplicity. Ratings on the usefulness of the system for self-review and helpfulness in creating motivation for self-review are not satisfactory. The system at this stage does not provide sufficient incentives for those patients who are used to their present condition.

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
						for self-management; the patients can access their own records of blood test results through a mobile phone.	Further study to improve the effectiveness of the system so that it functions adaptively depending on the patient's condition is needed. The incorporation of a social network service into the system seems promising. A preliminary experiment carried out at a hospital showed that the system is used to some extent, although further study to improve the efficiency of the system so that it functions adaptively depending on the patient's condition is needed.
09	Integrated Self-management Program Effects on hemodialysis patients: A quasi-experimental Study	OK Lae PARK et al.	South Korea (2019)	Mobile Application / HD	84 HD patients +30 additional patients	The integrated self-management program had significant effects on self-efficacy, treatment compliance, and the ratio of inter-dialytic weight gain to dry weight. This study aimed to incorporate the multifaceted characteristics of hemodialysis patients' self-management, including dietary management, exercise, medication, arteriovenous fistula management, and dialysis schedule management	Further research is needed to develop and assess a nursing intervention program that can improve the physiological indicators of serum potassium and phosphorus levels. It is necessary to develop a nursing intervention program that involves a mobile application to improve the self-management of hemodialysis patients. Further research is needed regarding nursing interventions for hemodialysis patients to improve their self-management based on various theoretical frameworks.

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
							Self-management mobile applications that are similar to the one developed in this study should be developed by analyzing and further reflecting on hemodialysis patients' needs
10	The role of patient portals in enhancing self-care in patients with renal conditions	Adil Hazara et al.	UK (2019)	Patient Portals / HD & PD	257 Patients	Actively engaged in the management of their condition, increasing patient knowledge, seeking their participation in decision-making, and equipping them with tools that enable them to monitor and react to changes in their condition could lead to improved outcomes and prevent complications associated with long-term conditions. Supporting patients in using the available information to understand and monitor their conditions could help in increasing patient portal use.	Future research needs to focus on identifying and addressing the barriers to patient participation in the use of portals
11	Clinical and social advantages of remote patient monitoring in home dialysis	Massimo Morosetti	Italia (2020)	RPM using Doctor Plus Nephro / Home Dialysis -CKD	16 Patients during 80 weeks	Was a reduction of systolic pressure in 69% of the patients and of diastolic pressure in 62,5%. The mean heart rate decreased from 69,4 bpm to 68,8 bpm The perceived health status of all patients had improved. The number of patients accessing emergency services also decreased. Doctor Plus® Nephro could improve access to home treatment; the results of this study show it to be a useful tool for Nephrological	Not reported

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
						Centers to monitor patients undergoing home dialysis	
12	The COVID-19 infection in dialysis: are home-based renal replacement therapies a way to improve patient management?	Mario Cozzolino	Italia (2020)	Home-Based RRT / Home Dialysis Treatment	330 HD patients and 50 PD patients	Home-based treatment - Makes it possible to limit exposure to the hospital setting. Remote counseling- A good way to avoid isolation; should integrate direct follow-up. Flexibility—empowerment- Patient empowerment is associated with better survival and better quality of life. Biochemical controls at home - Practical, reduces the need for going to a laboratory or hospital. Family involvement- Can provide important psychological support. Residual kidney function- This may be better preserved in tailored dialysis programs. Assisted home dialysis- Allows limiting exposure to the hospital setting and eliminates travel time. Reduction of travel time—lower carbon footprint - The ecologic advantages are debated but are likely to be relevant especially if patients live far from the dialysis units. The clinical results of home dialysis are usually at least competitive with hospital-based therapy.	Isolation - Acute intradialytic problems can be challenging. Fragile and elderly patients may not be able to clearly explain their problems. Patient-designed dialysis may differ from prescriptions. This can be dangerous. Standard pre- and post-dialysis controls may be difficult to organize. The burden may be heavy and create tension, monitoring may be difficult to carry out, and a slow loss of kidney function could go unnoticed. May fail to guarantee privacy, and the advantage of empowerment is usually lost, in some settings, the costs for the patients may be high. Waste management needs to be organized in advance. Home dialysis may be time-consuming for the healthcare team, in particular, if a personalized schedule is chosen
13	Telehealth for Home Dialysis in COVID-19 and Beyond: A Perspective From	Susie Q. Lew et al.	USA (2020)	Telehealth / Home Dialysis	30 Patients	Urban communities are intuitively thought to have greater access to home dialysis, home dialysis facilities allow the patient to	Many dialysis units are unable to provide home dialysis; challenges remain in the implementation and

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
	the American Society of Nephrology COVID-19 Home Dialysis S ubcommittee					safely isolate at home during the COVID-19 pandemic	widespread use of telehealth. The future landscape for advancing telehealth usage in home dialysis depends on integrating technology with an efficient home program workflow, addressing internet infrastructure, technology literacy, and socioeconomic determinants of health.
14	Remote Monitoring Systems for Chronic Patients on Home Hemodial ysis: Field Test of a Co-presence-Enhanced Design / Our HHD system aims to address the limitations associated with existing self-monitoring tools for HHD patients	Na Liu et al.	Australia (2017)	Home Hemodialysis (HHD)	3 nurses and 74 patients	Patients felt assured to share their emotions with health care professionals. Healthcare professionals were able to prioritize the review of the entries. HHD system was able to improve patients' feelings of being connected with their health care professionals Enhance patient self-care on HHD. The health care professionals felt better assured with patients' status with the use of the system and reported improved productivity and satisfaction with the co-presence enhancement mechanism. The survey has a good result	The co-presence enhancement design complements the conventional use of a digitized HHD logbook and will further benefit the design of future telehealth systems.
15	Effectiveness of a Web-Based eHealth Portal for Delivery of Care to Home Dialysis Patients: A Single-Arm Pilot Study	James Kiberd et al.	Canada (2018)	Home Dialysis (HD & PD)	41 Patients during 16 weeks	Patients had a positive experience with the care and communication provided by their nephrologist, The portal was found to have a neutral or mildly positive impact on patient management of several domains of their dialysis care (including reductions in stress, improved	The study is limited by the small sample size. High rate of patient dropout, Limited response rate, In this study of home dialysis patients, we identified that eHealth communication did not lead to significant improvements in patient experience with home

Table 1. Characteristics of studies included in the systematic review.

#	TITLE & AIM	First Author	COUNTRY / YEARS / Ref.	ICT TOOLS / RRT MODALITY	SAMPLE SIZE / DURATION (weeks)	FINDINGS / OUTCOMES / RESULTS	LIMITATIONS & FUTURE RESEARCH
						understanding of medications, increased personal independence, and access to a kidney specialist). Was a small but statistically significant reduction in patient telephone usage after the adoption of the eHealth portal. Patients found the portal easy to use and were satisfied with the portal. The portal was found to have a neutral or mildly positive impact on patient management of several domains of their dialysis care. Reductions in stress, improved understanding of medications, increased personal independence, and access to a kidney specialist. ICT has been shown to improve self-management and satisfaction of care in various settings, with evidence of improved health outcomes in chronic disease populations. ICT has spread to the dialysis population with the advent of online self-management support tools and advances in telemedicine technologies	dialysis care. A larger, multicenter trial is needed to evaluate the utility and feasibility of online communication portals more rigorously for home dialysis patients.

Table 2. Number of publications by type of ICT Interventions in HD. We used HD for Hemodialysis.

Type of ICT Intervention	HD	Most Relevant FINDING
RPM	3	✓ Improve Outcomes ✓ Reduce Health cost ✓ Lower Hospitalization ✓ Improve the quality of life ✓ Alleviates the burden of travel ✓ More personalized prescriptions ✓ Alerts, notifications and Reminders ✓ Reinforcement of patient confidence ✓ Increase Patient Satisfaction
Telehealth	4	➢ Improve the quality of life ➢ Improve outcomes in ESKD patients ➢ Improvement in perceived autonomy ➢ Health benefits to patients ➢ Cost Savings to health services ➢ More Assistance and support ➢ Reduce patient needs of assistance
Home Dialysis	3	➢ Reducing Travel Time
PC/Mobil Phone	3	➢ Better maintenance of blood pressure control
web or Patient Portal	1	➢ More information ➢
Telemedicine	1	➢ Expand coverage area of Nephrology ➢ Positive experience with tele-monitoring ➢ Lower number of hospital visit
Tele homecare	1	➢ Enhancing the care of patients undergoing HD ➢ Increased real-time communication ➢ Improve outcomes and decrease complications
Artificial Intelligence	1	➢ AI and robots will offer great opportunities for dialysis therapy ➢ AI can be essential in the future to integrate and manage such micro devices.