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The European Green Deal and nephrology: a call for action by the European Kidney Health Alliance

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ABSTRACT

The world faces a dramatic man-made ecologic disaster and healthcare is a crucial part of this problem. Compared with other therapeutic areas, nephrology care, and especially dialysis, creates an excessive burden via water consumption, greenhouse gas emission and waste production. In this advocacy article from the European Kidney Health Alliance we describe the mutual impact of climate change on kidney health and kidney care on ecology. We propose an array of measures as potential solutions related to the prevention of kidney disease, kidney transplantation and green dialysis. For dialysis, several proactive suggestions are made, especially by lowering water consumption, implementing energy-neutral policies, waste triage and recycling of materials. These include original proposals such as dialysate regeneration, dialysate flow reduction, water distillation systems for dialysate production, heat pumps for unit climatization, heat exchangers for dialysate warming, biodegradable and bio-based polymers, alternative power sources, repurposing of plastic waste (e.g. incorporation in concrete), registration systems of ecologic burden and platforms to exchange ecologic best practices. We also discuss how the European Green Deal offers real potential for supporting and galvanizing these urgent environmental changes. Finally, we formulate recommendations to professionals, manufacturers, providers and policymakers on how this correction can be achieved.

Keywords: circular dialysis concept, ecology, environment, green nephrology, waste control

INTRODUCTION

The current unprecedented man-made climate change has been insufficiently countered. The alarming 2021 report from the Intergovernmental Panel on Climate Change (IPCC) pointed out that the average temperature will continue to rise under all scenarios. The dramatic consequences will become obvious well before a child born now reaches the age of 30. Only scenarios that lower greenhouse gas emissions can slow or correct this trend [1]. Also, the progressive worldwide build-up of unmanaged discarded waste generates tons of plastic that ends up in our rivers and oceans and ultimately in our food chain after their ingestion by fish. Unmanaged waste also has a devastating effect on biodiversity that will only grow without drastic (circular) measures. Particulate matter, mainly from traffic and industry, has become a crucial air pollutant, with substantial health consequences [2].

Kidney health is particularly vulnerable to the impacts of climate change: ecologic problems aggravate kidney diseases and dialysis therapy has a considerable environmental footprint driven by several interrelated factors, i.e. energy and water consumption plus greenhouse gas and waste production. Despite several international climate agreements, global responses remain grossly inadequate and the engagement by the nephrological community seems equally half-hearted.

This advocacy and policy article by the European Kidney Health Alliance (EKHA) aims to present the complex relationship between nephrology and ecology and provide a wake-up call toward a radical green shift in nephrology via

Table 1. Dialysis-related ecologic problems, contributing factors and potential solutions

Ecologic problem	Contributing factors	Solutions
Water consumption	Manufacturing Dialysate production RO reject	Reduce or recycle water used for manufacturing Reduce RO reject water Use RO reject water for other purposes Dialysate regeneration Reduction dialysate flow Water distillation
Energy consumption Greenhouse gas emissions Pollution	Manufacturing Dialysis process Dialysate production Dialysate warming Monitoring Unit climatization Unit lighting Transport of materials and patients Waste incineration	Energy neutral production Solar or wind energy Heat pumps Dialysate recycling Heat exchangers for dialysate warming[a] Switching off devices at end of activity Home haemodialysis Peritoneal dialysis Teleconsultation
Waste production	Dialyzers Tubing Machines Auxiliary material[c] Spent dialysis water	Reduction used material Careful triage of waste Recycling of dialyzer plastic[b] Refurbishing dialysis machines Biodegradable material Recyclable material Plastics based on organic oil Dialyzer reuse Waste management of auxiliary material Repurposing of dialyzer plastic[d] Repurposing of dialysis water[e]

RO: reverse osmosis.
[a]Outgoing dialysate to warm incoming dialysate.
[b]Same polymers used for the same purpose.
[c]Auxiliary materials: gloves, protective clothing, food packages, drug wrappings, drinking cups, containers.
[d]Material used for a different purpose, e.g. plastic in concrete.
[e]Such as fertilizer or as source of hydrogen gas.

an achievable but as yet unaccomplished ecologic roadmap. It is authored by physicians, patients, nurses, biomedical engineers and chemists, all with an interest in ecology and the intention to expand the efforts engendered by the European Renal Association (ERA) for enhancing ecologic awareness in European nephrology [3]. Nephrology care should become more resilient to climate changes and increase its contribution to the reduction of human-induced climate change. This article also discusses the potential impact of the European Union (EU) in this process, since the European Commission took drastic steps toward an ecologic transition (the European Green Deal) supported by a broad spectrum of facilitating programmes.

Climate changes as causal factors of kidney disease

There is significant geographic variation in the prevalence of kidney disease, with climate playing a substantial role. Due to global warming, the geographic reach of tropical diseases as potential causes of acute kidney injury (AKI) is increasing and has reached Europe [4, 5]. Heatwaves increase the risk of dehydration, kidney stones and AKI [6], which may evolve into chronic kidney disease (CKD) or kidney failure, increasing cardiovascular risk and shortening expected lifespan [7]. Labour in high ambient temperatures, often in agriculture and combined with nephrotoxic agents (e.g. pesticides), is a cause of CKD, mainly among manual workers [8]. Air pollution [mainly fine dust (≤2.5 μm particulate matter), sulphur dioxide (SO_2) and nitrogen dioxide (NO_2), all of which are associated with the burning of fossil fuels], has been associated with a higher risk of kidney disease [9] and related comorbidities [10, 11]. Furthermore, the increasing severity of hurricanes, floods and blizzards may interfere with the functioning of hospitals. Dialysis units are especially vulnerable to water and power outages, necessitating patients to relocate or miss dialysis sessions, which enhances complication risks [12]. The recent coronavirus disease 2019 (COVID-19) pandemic has had not only an overwhelming impact on kidney patients, with an increased risk for infection [13, 14] and high mortality [15] and the frequent occurrence of AKI [16], but also environmental overtones, with its rapid worldwide spread through unprecedented mobility and social mixing [17]. In addition, the waste stream was significantly increased due to the discarding of personal protective equipment, testing devices, etc., although there was a temporary environmental benefit due to travel reductions.

The environmental impact caused by kidney disease

The ecologic burden of the medical sector is substantial [18] due to water and energy consumption for manufacturing, interventions and waste production [19]. The pharmaceutical industry generates significant amounts of greenhouse gases and contaminants that threaten biodiversity [20]. However, in

Table 2. Estimated ecologic impact[a] of the different elements of dialysis procurement

		Water consumption	Greenhouse gas[b]	Pollution	Waste production
Manufacturing[c]	PD	++++	++	+	+
	HD	++	++	+	+
Treatment	PD	+	−/+[d]	−/+[c]	+++
	HD	++++	+++	+++	++
Auxiliaries[d]	PD	++	++	+	+++
	HD	+	+	+	++
Transport[e]	PD	−	+	+	−
	HD	−	++	++	−

[a]Impact is estimated since detailed objective information on several elements is incomplete.
[b]Greenhouse gas production due to energy consumption.
[c]+ only in case of automated PD.
[d]Auxiliary items to enable treatment performance such as masks, gloves etc.
[e]Transport of therapeutic material to the patient or of the patient for treatment. The number of crosses (+) illustrates the subjective perception by the authors of the harm and may be modified if more exact data become available.

proportion to other therapeutic approaches, dialysis imposes a greater than average burden (Table1).

Little is known about the exact ecologic impact of the production of dialysis consumables. The production of plastic—which is the most important component of dialyzers and dialysis tubing—undeniably requires considerable amounts of chemicals, energy and water [21]. Next to this manufacturing burden, each dialysis session consumes several hundred litres of potable water [22]. This includes dialysate generation as well as reverse osmosis water, the reject of which is usually discarded together with spent dialysate. For an average unit, water consumption can easily amount to >1 million litres/year, with thousands of such units worldwide [21, 23]. The extensive drug intake by CKD patients contributes to water pollution since their urine, as well as spent dialysate, are discarded via the drain and contain considerable amounts of drug metabolites.

Energy consumption is multifaceted and includes manufacturing of filters, machines and other consumables, dialysis *per se,* as well as dialysate production and heating, monitoring, lighting and climatization of the unit and transport of material and patients, which all contribute to extensive greenhouse gas and pollutant production [24–26].

There are at least four types of waste associated with the current dialysis therapies, originating from packages, non-contaminated and contaminated disposables and electronic equipment. Fossil fuels (oil and gas) are presently the principal raw materials used to produce polymers, the main constituents of dialyzers and tubing, which are meant for single use and thus generate massive plastic waste [27]. Once discarded, and if not recycled, this material is disposed of in landfills or incinerated. The waste burden is further increased by discarding auxiliary resources (gloves, protective clothing, food packages and drinking cups for meals provided during dialysis, drug wrappings and containers). Disposal is complicated by the presence of biohazardous or toxic materials, which often impede recycling or are even not allowed to be recycled by local or European regulations. Furthermore, waste disposal is expensive, as landfills are polluting and incineration both pollutes and produces greenhouse gases [27]. In addition, the current dialysis machines were conceived to have a limited lifespan and are discarded after a number of working years, contributing to equipment and electronic waste.

There is limited information on the comparison of the overall ecologic burden between haemodialysis (HD) strategies and peritoneal dialysis (PD) strategies. In one analysis, the estimated environmental impact of both dialysis options was reportedly about the same, while the impact of transplantation was 90–95% less [28]. Although PD is often considered more ecologically sound than HD, because of the lower carbon footprint and water consumption of the treatment *per se,* this is presumably offset in part by the water and energy needed to produce the considerable quantity of plastic composing dialysate bags and dialysate *per se* and for transporting those bags [26, 28]. Similar reasoning applies to some modes of portable home HD, which use smaller water volumes than traditional HD, but use dialysate stored in plastic bags. A comparison of the estimated ecologic burden of both HD and PD is illustrated in Table 2.

Approaches to decrease the ecologic impact of kidney disease

Prevention and reducing the progression of kidney disease. Prevention is the best approach to avoid disease burden [29]. Primary lifestyle prevention (reduction of sedentarism, unhealthy diet, obesity and smoking) is in principle inexpensive, but necessitates careful organization [30]. A healthy lifestyle also implies an ecologic bonus, by limiting unhealthy nutritional habits like consumption of processed foods and red meat [31], while reliance on organic farming and local products reduces fuel utilization. However, current investment by authorities in primary prevention is minimal compared with cure. A progressive shift from cure to prevention might thus combine public and patient health, cost-effectiveness and eco-effectiveness.

Adequate prevention necessitates lifestyle education of the entire population, including children [29], with specific measures to tackle health illiteracy [32] as a cause of inadequate self-care [33] and mortality [34]. Unfortunately, education typically reaches the educated and does not specifically tackle health illiteracy.

Secondary prevention of the progression of kidney dysfunction and its complications necessitates timely screening, but also this process is often inadequate [35, 36]. Apart from drugs correcting hypertension, dyslipidaemia, hyperglycaemia and acidosis [37], there has been only limited development of drugs to counter kidney disease progression [37, 38].

Kidney transplantation. Transplantation combines optimal outcomes and costs with an undeniably lower ecologic burden than dialysis [39], but <40% of European patients on kidney replacement live with a functioning transplant [39] and only 4% of transplants avoid dialysis by pre-emptive grafting [40]. Substantial differences in transplantation rates and donation types among European countries suggest ample room for improvement and indicate the need for a new boost in transplantation activity mirroring the 2009–2015 EU action plan on organ donation and transplantation [41].

Also, regenerative medicine approaches to generate kidney organoids and, in the future, complete kidney organs might liberate patients from dialysis without an organ shortage and save energy and water, an aim also realized with xenotransplantation [42, 43]. However, these innovations are still far from full clinical deployment.

Green(er) dialysis. With most kidney failure patients on dialysis, ecologic optimization is imperative and should be pursued from production to delivery and waste management (Table 1). Several industrial stakeholders have taken planet-friendly measures [44–46], however, these have been focussed on lowering the impact of manufacturing rather than the clinical application. Improvements have been noticed in packaging, transportation and delivery, but production secrecy often seems to overrule a detailed reporting of specific ecologic measures. Likewise, transnational mapping of the ecologic burden of clinical dialysis remains fragmentary [25, 27]. Healthcare sustainability is rarely discussed at environmental conferences and environmental issues are rarely discussed at medical conferences.

Reverse osmosis reject water is usually discarded but could easily be used for everyday purposes like toilet flushing, laundry or bathing [23], and even as drinking water. Economization of reverse osmosis water production and consumption should certainly be a primary aim of newly built units but is also feasible in many existing units if a coordinated approach is followed [47]. Thinking even more outside the box, spent dialysate may also be recycled as fertilizer, considering its high phosphorus and nitrogen content. In addition, urea, one of its main constituents, may be transformed into green fuel and can be used as a source of hydrogen or to develop direct urea fuel cells to power engines.

Dialysate regeneration is another solution [22, 48–50]. Several compact dialysis systems (wearable or portable) are currently in use or being developed, which, along with the ecologic benefit of less water consumption, might also allow more flexibility, user-friendliness and lower cost [50–52]. Dialysate flow reduction for smaller patients [53], compensation of low dialysate flow by sorbent use [54] and distillation systems [55] also deserve more attention. Most dialysate recycling systems use sorbents to adsorb uraemic toxins and urease to break down urea. The ecologic benefit of those systems due to lower dialysate water consumption would be substantial only when the ecologic footprint of sorbent and urease production and sorbent recycling is subtracted from the bonus of the dialysis procedure *per se*. Likewise, the implementation of portable artificial kidney systems using reduced water volumes may necessitate the implementation of daily HD, which could increase the ecologic impact of dialyzer and tubing production and waste generation.

The generation of greenhouse gases [23, 26] needs solutions from both manufacturers and providers to make dialysis greenhouse neutral, e.g. by a shift to solar or wind energy, heat pumps [56], dialysate recycling or using heat exchangers to transfer heat from dialysate effluent to fresh incoming dialysate [24]. Energy consumption can be reduced further by simple actions, such as turning off lights and computers at the end of daily activities or the use of low-energy lighting [26]. Home dialysis offers the advantage of reducing travel and making use of ambient energy consumption on a domestic scale. To control the energy consumption of healthcare, ambitious targeted approaches are needed, such as the aim set by the National Health Service in the UK to become carbon neutral by 2040 for direct emission [18]. Central dialysate delivery systems allowing preparation of acid dialysate concentrate on-site also reduce greenhouse gas emissions because of limiting transport needs of plastic canisters as well as plastic waste generated when those containers are discarded. The judicious use of teleconsultation may further reduce travelling and the related carbon footprint. Multicentre coordination to reduce water and energy consumption and waste production by providers can have significant results, as exemplified by concerted action undertaken in recent decades in France [47].

Corrective actions for waste production are indicated at all levels, from a reduction in used material and careful triage of contaminated and non-contaminated disposables before recycling, to recycling of auxiliary articles like gloves [25, 57]. The current dialysis machines are often not designed for dismantling, interfering with the cradle-to-cradle (circular) concept [27], although circular approaches to reduce electronic waste and optimize the lifespan of dialysis hardware might be more easily accomplished compared with plastics recycling.

The entire dialysis procedure necessitates the use of hazardous chemicals and replacement by green, biodegradable products is urgently needed. Many disinfection procedures are aggressive and unecologic, e.g. citrate-thermic disinfection of dialysis machines consumes much electrical energy and chemical disinfection uses damaging substances such as hypochlorite and peracetic acid.

A circular dialysis model might involve biodegradable or recyclable materials or their repeated use. Polymers are used in medicine because of their low-cost mass producibility and their unique properties, matching strict performance and biocompatibility standards. Creating replacement materials with the same specifications and a lower ecologic burden is difficult, but by feeding certified recycled materials into existing medical polymer manufacturing, all these specifications are inherently met. Presently the most applied approach to produce certified eco-friendly polymers is via International Sustainability and Carbon Certification, using the Ellen MacArthur Foundation's mass balance concept [58]. This method matches output (i.e. products with recycled content) with input (i.e. quantity of

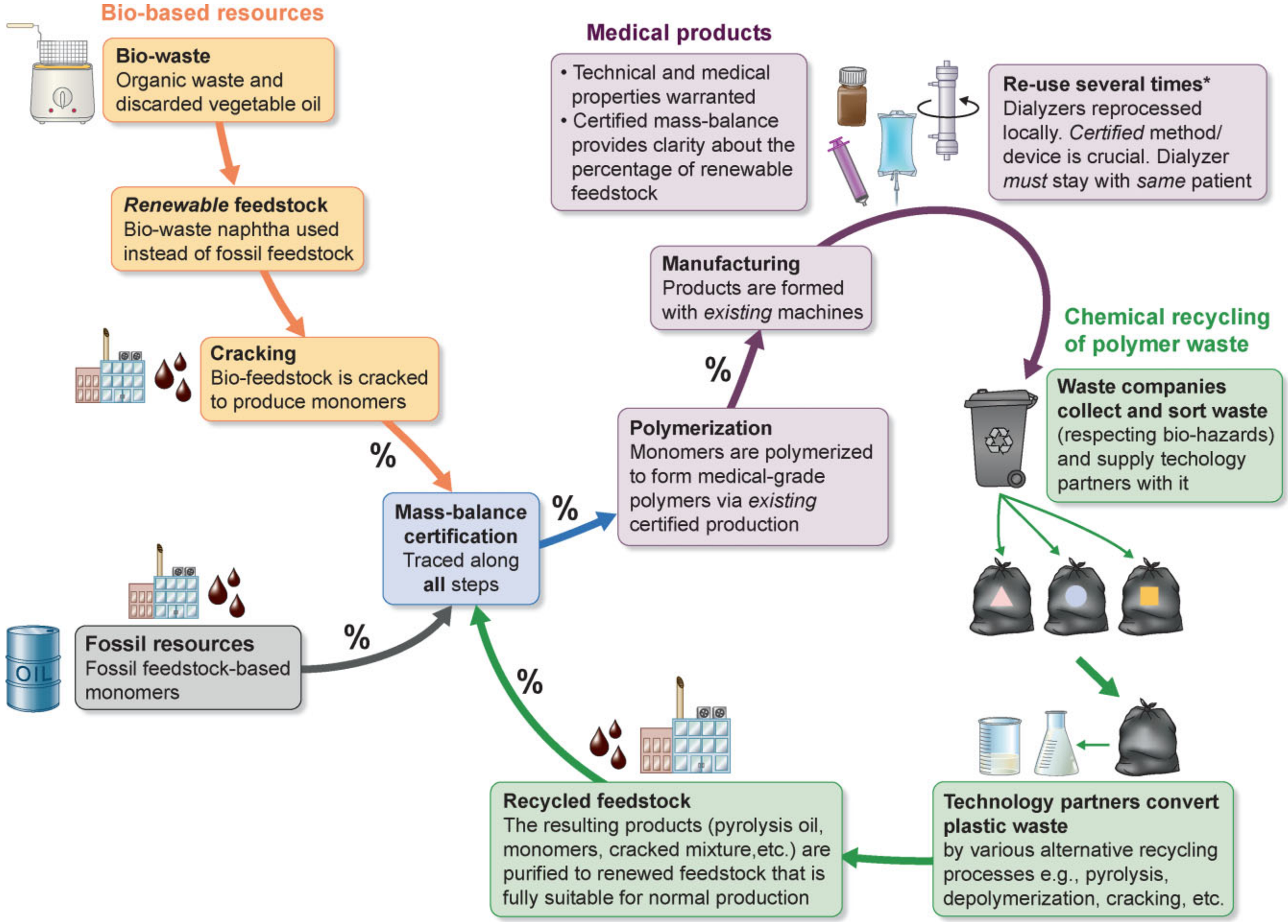

FIGURE 1: Medical polymers with exactly the same technical and medical properties as can be made from renewable bio-waste feedstock (orange arrows), fossil feedstock (black arrow) or via chemical recycling (green arrows). The percentage of renewable feedstock can be guaranteed via certification. A small circular loop (top right) around the dialyzer depicts an option to apply certified local reprocessing of dialyzers. The latter can only be considered if allowed by National Health Authorities.

Table 3. Examples of commercially available certified medical grade plastics with certified sustainable content[a]

Polymer resin	Typical applications	Sustainable content	Manufacturer product name	Manufacturer
Bio-modified co-polyester	Dialyzer housings, electronics housings, blood test tubes, connectors, IV systems	Up to 18% from plant-based feedstock	EcoZen	SK Chemicals
Polycarbonate (PC)	Dialyzer housings, fluid connectors, luer connectors	Up to 72% recycled	Makrolon RE	Covestro
Polyethylene (PE)	Containers, bottles and thin packaging bags	Up to 100% recycled	Purell PE Circulen Renew	LyondellBasell
Polypropylene (PP)	Face masks, syringes, protective gowns, cuvettes and labware	Up to 100% recycled	Purell PP Circulen Renew	LyondellBasell
Styrenic block copolymer (SBC)	Fluid bags, IV bottles, tubing, luer connectors, and IV drip chambers. Becoming popular as polyvinyl chloride replacement	Up to 100% recycled	Styrolux ECO; Styroflex ECO	INEOS Styrolution

[a]Table is not exhaustive.

recycled feedstock) within predefined boundaries for a given period. It is also applicable to plastics generated from bio-based material, like bio-waste or carbon dioxide-capturing vegetable oils (Figure 1) and allows the introduction of recycled materials into the existing manufacturing infrastructure. This lowers production investment while guaranteeing the same polymer quality and biocompatibility. This approach is now gaining acceptance within the plastics industry. Table 3 provides examples of available medical-grade polymers using either bio-waste, recycled plastic waste or plant-based material. They are fully identical to their counterparts based on fossil fuels and thus are easily adaptable by the medical industry. Repurposing dialysis plastics may be another solution, such as shredding waste materials into small particles and adding them to concrete, thereby increasing the physical strength of the material [59]. However, if this construction is dismantled

Table 4. EU programmes promoting ecologic transition and points of interest for European nephrology

Programme	Target points	Points of interest for nephrology
European Green Deal	Clean energy Decrease pollution Sustainable industry Sustainable mobility Adaptation to climate change Societal transformation Climate neutral cities	Ecologic transformation of: Production processes of therapies Delivery of therapies Hospital management
Farm to Fork Strategy	Sustainable food production Sustainable food distribution Organic farming Promotion of healthy food Promotion of vegetables and fruits Minimal food processing Minimal waste and plastic	Favouring public health Favouring kidney health Reduction additives: Salt Phosphorus More fibre intake Stimulation health-promoting activities
Life 2021–2027	Promote nature and biodiversity Circular economy Quality of life Climate change mitigation Climate change adaptation Clean energy transition	Reduction waste production Reduction water consumption Production Therapy delivery Making entities climate neutral
Horizon Europe 2021–2027	EU research funding programme[a] Circular economy Lifestyle changes Climate neutral cities Cancer[b]	Refrain progression CKD Adaptation therapies Production Therapy *per se* Less greenhouse gas Climate neutral Hospitals Medication Technologies
Beating Cancer Plan	Prevention cancer Prevention other NCDs[c]	Prevention kidney disease Prevention cancers as consequence of: Other comorbidities linked to CKD Transplantation
EU4Health	Prevention Crisis preparedness Health systems Health personnel Telemedicine Resilience health care	Prevention kidney disease Approach to: Pandemics Other disasters Prevention personnel burnout Home treatment[d]

NCDs: non-communicable diseases.
[a]Only ecologic topics supported by Horizon Europe are mentioned.
[b]Also part of the Beating Cancer plan (see one row of boxes below).
[c]The reasoning is that other chronic diseases are both a cause and consequence of cancer and that in the Beating Cancer Plan all chronic diseases should be considered together.
[d]As opposed to in-hospital treatment.

at a later date, concrete recycling should be guaranteed to avoid that the plastic material ultimately ending up as waste.

Dialyzer reuse, nowadays mainly applied for economic reasons and used on a large scale until the end of the last century, could become an ecologic solution [24] and may also reduce the economic burden of dialysis technology [60], provided patient safety can be guaranteed and reprocessing causes no ecologic harm [60]. Donating dialysis material to low-income countries for their indicated use or for repurposing, even with the best of intentions, may transfer the waste management problem to those emerging countries where strategies for waste discarding are often less developed than in high-income countries.

Finally, in analogy to other industrial branches, dialysis manufacturing companies should develop clear plans to reach zero emissions, including plastics recycling and implementation of bio-based processes.

A Green EU. The European Commission launched several programmes to make the EU an ecologic forerunner. We call on all European nephrology stakeholders to align with these initiatives and avoid missing the boat of ecologic transition vis-à-vis other European innovation areas or—within nephrology—other world regions. Below and in Table 4, we offer examples of EU programmes available to European nephrology and where financial support can be found for these initiatives.

A potential drawback may be the lack of awareness of the ecologic burden of nephrology and nephrology at large among assessors. The EKHA has in recent years made substantial advocacy efforts at the EU policy level to promote the idea of green nephrology and made green nephrology its 2022 theme,

Table 5. Recommendations for several levels of the community

All		
	Minimize or ban greenhouse gas emissions	
	Minimize water consumption	
	Minimize waste production	
	Optimize waste triage	
	Optimize recycling (cradle-to-cradle concept)	
Manufacturers		
	Transparency on own ecologic measures	
	Allow independent assessment of manufacturing and distribution process	
Providers (hospitals, dialysis units, provider organizations)		
	Organize reporting and registration system on the ecology of the therapeutic process	
	Exchange ecologic ideas and measures	
	Shift to transplantation and home medicine	
	Organize telemedicine	
	Stimulate specific detail measures minimizing	
		Waste production
		Inappropriate waste management
		Energy and water wasting
	Promote	
		Circular strategies
		Use of biodegradable products
	Allow independent assessment of manufacturing and distribution process	
Professionals (physicians, nurses, technicians)		
	Activate screening and prevention of CKD	
	Consider ecologic impact in each therapeutic decision	
	Shift to transplantation and home medicine	
	Create awareness by peers and general public on ecologic impact of nephrology	
	Collaborate to find solutions	
	Participate in and develop ecologic research projects	
	Confront provider and manufacturer levels with their ecologic liabilities	
Professional and learned societies		
	Organize registration of ecologic impact of nephrology	
	Organize detailed recommendations to the nephrological communities	
	Organize platforms for exchange of ideas and measures	
Patients and patient organizations		
	Optimize lifestyle	
	Instigate ecologic attitudes in caregivers	
	Strive for empowerment on therapeutic decisions and consider ecology in that choice	
Policymakers and authorities		
	Facilitate screening and prevention of kidney diseases	
	Promote kidney transplantation and home dialysis	
	Facilitate nephrological research with ecologic impact	
	Promote telemedicine	
	Facilitate assessment measures on the (lack of) ecologic impact of the healthcare process and implement corrections	

and we welcome other stakeholders to join this effort, with this article as a framework.

The European Green Deal is the new overarching EU programme to tackle environmental challenges. It comprises a set of policy initiatives and programmes that aim to make Europe climate neutral by 2050 and cut greenhouse gas emissions by 55% by 2030. The Farm to Fork Strategy aims to make agriculture and food provision ecologic and recognizes the inextricable link between healthy people, healthy societies and a healthy planet. The LIFE Program 2021–2027 is the EU's funding instrument for environment and climate action. Any legal entity or consortium residing within the EU can apply. EU support for ecology-oriented research can be obtained from Horizon Europe 2021–2027, which is the eighth framework programme, succeeding Horizon 2020. Horizon Europe offers ample ecology-oriented research opportunities.

The current European Commission has put forth cancer as a major health priority (Europe's Beating Cancer Plan) and there is an undeniable link between cancer and the environment [61]. Cancer and cancer treatment cause other chronic diseases and other chronic diseases are often complicated by cancer. Since prevention is one of the focus points of the plan, these preventative efforts will also impact other chronic diseases such as CKD in view of the many common causes [29]. Specific to kidney disease, cancer and its treatment may damage the kidneys or promote other risk factors of kidney insufficiency, such as diabetes and cardiac failure, while kidney disease and kidney transplantation are risk factors for cancer. Hence prevention plans for cancer should include kidney disease, while kidney research should include links with cancer.

The EU4Health Program was instituted in response to COVID-19, gearing up the EU's involvement in health. EU4Health will provide funding to health organizations and non-governmental organizations. Activities that respect the climate and environmental priorities of the EU and the 'do no harm' principle of the Green Deal receive specific consideration.

CONCLUSIONS

Ecology and kidney health are connected. Kidney replacement therapies, especially dialysis, are far from adequate regarding the fight against climate change and environmental damage. This is a major concern, both from a medical and a societal viewpoint. The more one reflects on kidney care, the more one sees its ecologic relevance and the need for proper eco-burden assessments. This article proposes several pathways toward solutions and stresses that multiple measures are needed. We offer various recommendations for several levels of the community in Table 5.

The European Commission decided to tackle current ecologic threats. In view of the bidirectional relationship between the environment and kidneys, it is necessary that the nephrological community takes action without delay. This implies profound shifts in structures, planning, targets and actions of industry, hospitals, medical professionals and patients alike. Professionals, patients and insurers as the main end-product consumers have a responsibility to enforce this move upon manufacturers and providers. There is an urgent need for transparent registries of the ecologic burden of consumables, hardware and drugs, including water consumption and wastewater production, to make production processes, applications and waste management planet-friendly. Such registries would also allow one to compare countries, sectors and end products. Also, platforms and work groups discussing and exchanging ecologic measures in nephrology, like the one launched in the UK [62], are urgently needed and we suggest international and national nephrological societies align their efforts in this direction.

Research proposals should strive for innovations offering ecologic benefits vis-à-vis standard options, and for novel developments, ecologic aspects should be detailed. As EU programmes have already commenced, there is no time to waste for European nephrology to keep up with ecological investments that are quickly gathering speed on other continents [63].

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CONFLICT OF INTEREST STATEMENT

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