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# Green nephrology: an editor's journey

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Climate change, pollution, and depletion of our natural resources represent some of the most significant threats facing society [1]. It is imperative that we urgently reduce overall global carbon emissions and seek new and novel solutions to reduce the environmental impact of all sectors across society, including healthcare [2]. Healthcare, while almost invisible compared to power plants, transportation, and fuel production, is actually a significant contributor to global carbon emissions, with kidney care ranking among the most carbon-intensive of all medical specialties [3]. This is largely due to the heavy environmental burden associated with hemodialysis (HD) and peritoneal dialysis (PD) [3]. As such, the nephrology community has been at the forefront of international efforts promoting and advocating for more sustainable and environmentally responsible healthcare practices [4]. Motivated by the need to highlight this pressing issue, *Kidney International* embarked on its own journey into Green, Sustainable Nephrology recently and launched a series of mini-reviews dedicated to the topic [4]. Here we highlight some of the key points stemming from these reviews and from our own personal journey and perspective as editors that we believe warrant further consideration (Fig. 1). We will also touch base on the importance of knowledge dissemination and on the need to implement open science.

## A green angle in nephrology

First and foremost, while most people associate green nephrology mainly with the need to cut back on dialysis “waste”, the term encompasses so much more. The “green angle” goes beyond simply saving water, electricity and energy. It is a *forma mentis* that requires a profound change in our habits as clinicians and researchers. Resource wasting is an existing and growing problem, particularly in high-income countries. Repetitive testing, lack of effective workflows to diagnose and manage rare diseases, slow implementation of chronic kidney disease (CKD) screening and prevention, and finally excessive use of dialysis in the elderly represent an obstacle to Green Nephrology. Some of these issues could be (at least partially) mitigated by promoting effective sharing and dissemination of data [5]. For example, the implementation of electronic health records within the hospitals as well as the reuse of previously collected data, both clinical and scientific, and their correct dissemination could potentially prevent costly and useless repetition of experiments, facilitate reproducibility and lastly, promote inclusivity, i.e., by giving access to data otherwise not available due to lack of resources. In addition, while the environmental impact of the “clinical” aspect of kidney care is well recognized (albeit not necessarily properly addressed), the impact of kidney-related laboratory research remains unquantified [3, 4]. Few papers have addressed this issue in any meaningful way [6]. Nevertheless, there are many practical ways to begin to address the environmental burden of laboratory research including substituting hazardous materials with less- or non-hazardous alternatives and ensuring their proper disposal. A major obstacle to adopting such pragmatic sustainability solutions and practices appears to be hesitancy among scientists to include sustainability references in their grant applications, fearing that this may decrease the appeal of their research. Perhaps it is time to challenge this narrative and emphasize to scientists how sustainable practices can in fact enhance and not hinder their science. After all, widespread adoption of such practices amongst the international scientific community has the potential to lead to

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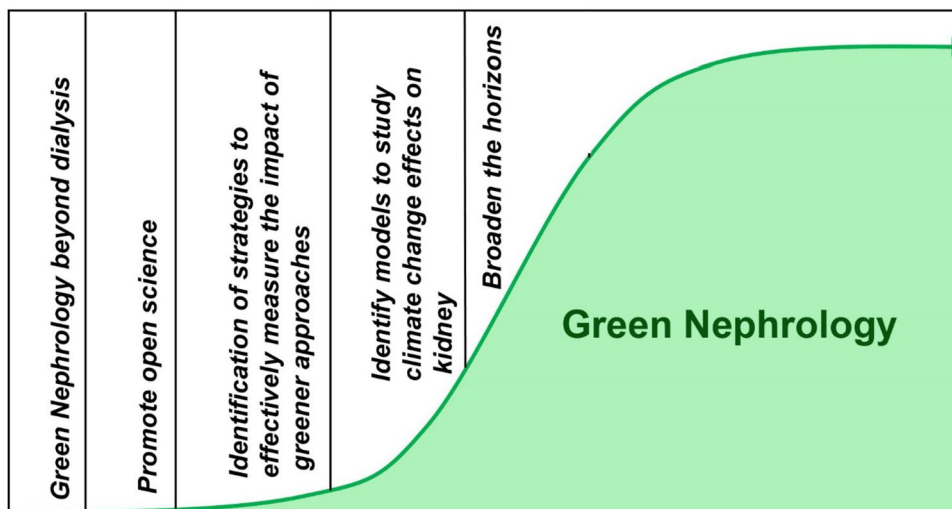
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**Fig. 1** Steps to achieve a greener Nephrology



domino effects of considerable importance. However, as scientists, we want/need to be able to quantify (and analyze) the effects of such changes. But how do you measure something that can be influenced by so many external factors (noise)? In the absence of clear benchmarks and standards of practice, quantifying and measuring the effect of alternative research practices becomes extremely challenging. Such hurdles mean studies on the topic are difficult to conduct and even when they are attempted, their overall quality tends to be below the average of the kidney field. Additionally, difficulties in generalizing the findings of these studies often decrease their impact, arguing for more studies and a nuanced approach to adopting sustainability practices.

## The vicious circle of kidney care and disease

Environmental change is not only the result of our efforts to treat and understand kidney diseases, but comes back to negatively impact the incidence, severity, and distribution of kidney diseases [4]. The kidneys are exceptionally susceptible to temperature extremes and are therefore directly threatened by the global warming caused by climate change [7]. Heat stress and dehydration can cause repeated occurrences of acute kidney injury (AKI) [8], a key risk factor for developing CKD [9]. Moreover, as the kidneys filter the blood they are also particularly exposed to the potential harms posed by microplastics ingested through food and water [10]. Presently, we do not have good models to study the effects that our changing climate has on kidney, and the existing literature is rather sparse [10]. This creates a vicious circle, wherein kidney care directly affects the environment thus feeding back to cause more kidney disease which then indirectly harms the environment even more when we try to deal with the new CKD. Can we break this circle? A starting point may be represented by favoring a multidirectional

approach in conjunction with the broadening of our horizons to promote collaboration among different centers in parallel with other disciplines for more sustainable healthcare solutions (Fig. 1).

In conclusion, stemming from a personal journey, this editorial is not intended to give a full perspective on such an important and complex subject. The overarching ambition is simply to spark discussion and reflection with the hope of encouraging researchers and clinicians to think carefully about their current research and medical practices and how they could and should adopt an agenda of sustainability. Most importantly, we would like to emphasize that the nephrology community as a whole must commit to profound changes in behavior if these sustainability goals are to be met.

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## Declarations

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