



Nephrologists should talk to their patients about climate change

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Climate change became more real, more observable, more palpable, in 2023, the warmest year in recorded history, and in the last hundreds of thousands of years. The health consequences of climate change are familiar to us all, and, in fact, we are likely to have personally experienced them in the past few summers as we inhaled the particulate matter (PM_{2.5}) sent to us by wildfires of unprecedented magnitude. In those months of worsened air quality, we had little choice but to observe the darkened, hazy skies, and passively suck into our alveoli the smoke and ash that surrounded us [1]. The effects on pulmonary function are well known and ominous, but recently, PM_{2.5} has been tied to progressive chronic kidney disease (CKD) [2]. While we previously considered each breath to be laden with pollutants targeting airways, we now recognize that our nephrons may also be a destination for the many products of combustion.

Knowing that there are several other renal effects of climate change, perhaps we can take a more proactive approach. Is there something nephrologists can do to alter the seemingly inevitable effects of increasing ambient temperature on nephrologic diseases? Most obvious is the link between ambient temperature and kidney stones [3]. Higher temperature increases transdermal water losses, reducing urine volume, and leading to increases in the supersaturation of the relatively insoluble salts, particularly calcium oxalate, responsible for most kidney stones. This effect is expected to be exacerbated by urban heat islands (UHI); cities are significantly hotter than more rural environments, as the result of lack of vegetation and unique characteristics of urban architecture [4]. With more people living in urban settings worldwide, we have hypothesized that UHIs are responsible for the continued increase in kidney stone prevalence in the United States and the rest of the world [5]. These effects are likely exacerbated in minority populations and people of lower socioeconomic status, as these populations often live in hotter neighborhoods as the result of historic, racist housing policies [6].

More alarmingly, excess deaths are also tied to heat exposure. One estimate is that almost half of

the global population and more than 1 billion workers are exposed to high heat episodes. One-third of workers with high heat exposures experience negative health effects, including heat-related deaths for those workers unable to work in temperature-regulated settings [7].

Citing this climate-related literature for you, the readers of *Current Opinion in Nephrology and Hypertension*, is the conventional way to delineate the effects of heat exposure. We may also consider the solution to be relatively simple, an approach that any lithologist brings to the kidney stone clinic: advise our patients to increase their fluid intake. The Prevention of Urinary Stones with Hydration (PUSH) Study is investigating ways to encourage fluid intake, such as smart bottle apps [8]. However, the solution is actually less straightforward. We need to explicitly deliver the message to our patients that climate change specifically affects them. In a survey completed in 2018, health professionals' awareness that climate change had adverse health effects was high. In contrast, among the North American public, few could list *any* health effects of climate change, but viewed climate change as harmful to health. Supportive of the proposed solution, Americans appeared receptive to information about health aspects of climate change [9]. Thus, nephrologists must present specific information about climate change and possible mitigation strategies to our patients in nephrology clinics and dialysis units, as these populations are most at risk.

Informal surveys of my colleagues, fellows, and residents suggest that essentially none of us has discussed climate change with our patients. The

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argument that heat effects are the most common cause of climate-related morbidity and mortality mandates that this omission be corrected. Thus, offering science-based advice about climate and its consequences, or at least stimulating such conversations, is an obligation to our patients that we all must share under the current circumstances.

The messages about climate change must come from trusted messengers [10]. While the COVID pandemic changed the public's view of who such messengers are, even in these contentious times, our patients still view us, their physicians, and scientists, as the most credible sources of reliable information and recommendations. The credibility of sources of information is based on their expertise, trustworthiness and benevolence, characteristics that primary care physicians (a role that nephrologists often play) reliably exhibit.

Maibach, of the Center for Climate Change Communication at George Mason University, and colleagues have recently promoted two strategies to make climate change a regular topic of conversation [10]. First, to improve public understanding, they recommend simple, clear messages, repeated often, by trusted and caring messengers. An example, developed by their climate communication team, now being used by many groups in the climate communication community, are shown in Fig. 1: 'Five key facts in ten words'. Second, to encourage uptake of useful behaviors, they recommend making the behaviors 'easy, fun, and popular'. To implement the second strategy, the authors address the time constraints that many 'trusted messengers', like physicians in clinical practice, must deal with.

How to make disseminating these messages 'easy, fun, and popular' is not obvious.

My own personal implementation of this plan has indeed been 'easy, fun and popular'. At the end of every clinic visit with my patients with kidney stones or CKD, I ask 'Have you thought about the effects of global warming on your kidney stones or kidney function'? The replies of my patients do not necessarily require a long conversation that sabotages my clinic schedule. It is usually just an opportunity for me to deliver my simple messages: 'It's hot out there; stay hydrated! Keep track of your urine output; have you pee'd today?' Urine output is an easy and understandable marker of fluid intake and hydration status that my patients, friends, family, and fellow bike riders can informally monitor and self-report. People are comfortable discussing this otherwise less socially acceptable topic with their kidney doctors. Keeping it simple, my kidney stone clinic handout now includes Fig. 1.

In the dialysis unit, we also have other opportunities to address global warming. The message in hurricane season especially is 'Bad weather is now a fact of life, and it's coming soon: do you have a dialysis plan? What will you do if your schedule is disrupted by flooding, electrical outages, or snow'. This sort of injunctive norm aims to get people to think about the future and make a plan and be prepared. Dialysis units today are obligated to develop such disaster plans as disruptions in transportation and facilities' operations may occur due to more frequent storms. Framing these disaster plans for dialysis units and for individual patients as

Five key facts about global warming (in 10 words)	
IT'S REAL	Global warming is happening.
IT'S US	Human activity is the main cause.
EXPERTS AGREE	More than 97% of the world's climate experts are convinced, based on data, that human activity is warming the planet.
IT'S BAD	The impacts are serious, and they affect us (especially our children and grandchildren).
THERE'S HOPE	There are actions we can take that will make a difference.

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FIGURE 1. Five simple messages about global warming [10].

climate-related preparations may further highlight the relationship of climate to health.

Getting people with kidney disease to consider maintaining hydration, eliciting work-place accommodations, ensuring access to work breaks and bathroom facilities, and hemodialysis patients to have plans in case of missed treatments, would all be the result of enhancing health professionals' knowledge and consideration of the effects of climate change. We may have to write letters to employers, supervisors, teachers, and principals in support of our patients.

Other intersections of kidney disease with temperature and climate change have recently been thoroughly reviewed [11]. While the effects of reduced urine volume on stone disease are intuitively clear, ambient heat is likely to have more insidious effects on CKD as well [12]. A dramatic example of these effects is what was previously known as Meso-American nephropathy, now known as CKD of unclear cause, or CKDu [13]. The associated epidemic of CKDu and kidney failure, especially in young men working in agricultural settings near-equatorial locations, is not completely explained by heat exposure. Heavy metals, herbicides, and other chemicals may be concomitant exposures that contribute to this frequent disorder, which, with lack of access to dialysis, is often lethal [14]. Here in New York State, one week of high-temperature exposure was shown to be a risk factor for acute kidney injury and volume depletion, as well as kidney stones [15].

Such communications to our patients must include recognition of their vulnerabilities, education, and limitations and vary in different geographic locations. The messages also present logistical and economic challenges. While the concept of 'hydration' is simple, it can be challenging for older people, less mobile and disabled people, and poor people to get adequate, consistent fluids. Addressing these circumstances may require prospective community-based or social-worker-based solutions.

The health effects of climate change are overwhelming. We are all liable to feel that mitigating them or adapting to them are beyond our capabilities and beyond the responsibilities of physicians and nephrologists. While we may find it intimidating to even begin to address these monumental issues, we can start with one initiative at a time, one patient at a time. In delivering this message, I have been soliciting feedback, via a short, anonymous survey that is accessible using the QR code in Fig. 2. I would appreciate if you could take 2 minutes to offer your impressions. Change will come when we have more of us talking about one of history's



FIGURE 2. The QR code leads to a 2 minute, anonymous survey about your thoughts about climate change.

most foreboding issues. Our patients are being seriously affected by climate change and though it's late, we can make them aware of what's coming.

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