



Chronic Kidney Disease, End-Stage Renal Disease and Heat Providers

Individuals with chronic kidney disease (CKD) and end stage renal disease (ESRD) may be among the most vulnerable people to heat exposure.¹ They are far more likely to visit emergency departments, need hospitalization, and die during heatwaves than healthy individuals.² When CKD patients progress to dialysis dependence, risks of harm increase further.³

Heat Exposure Risks for People with Chronic Kidney Disease

Several studies have identified that emergency department (ED) visits, hospitalizations and deaths during heat waves often result from kidney diseases.⁴ A meta-analysis of more than 24 studies found a temperature increase of 1°C (~0.6°F) increased risks of kidney failure by 1.1% (95% CI: 0.9-1.3) and mortality from kidney disease, including kidney failure, urolithiasis, acute kidney injury (AKI), and urinary tract infection, by 3.1% (95% CI: 0.5-5.8).⁵

Hydration Status Dehydration has been associated with acute kidney injury (AKI) and chronic declines in renal function.⁶ Heat promotes dehydration which puts renal blood flow at risk. At the same time, in individuals with CKD, over-hydration may also worsen outcomes.

Age Renal function generally declines with age. About 45% of adults ≥70 years old have CKD, compared to only about 4% of adults between 20 and 39 years old,⁸ while 30% of adults over 65 never recover from an acute kidney injury.⁹ Older individuals may have less plasma volume,¹⁰ decreased thirst,¹¹ and reduced urine concentrating ability,¹² among other physiological changes that promote dehydration and increase risk for AKI. Age-related declines in hormonal control of diuresis and blood pressure also play a role in renal injury.^{13,14}

Comorbidities

CKD's most common comorbidities include cardiovascular disease, hypertension, and diabetes mellitus (both type 1 and 2) with as many as 3 in 10 Americans over 65 affected by one or more of these conditions.¹⁵ These comorbidities increase morbidity and mortality from heat exposure in patients with CKD and especially those with end stage renal disease (ESRD) on dialysis.³ In a review of heat-related deaths in the United States between 2004-2018, nearly half were attributable to underlying cardiovascular disease.¹⁶

Medication Considerations

Dehydration potentiates kidney injury from nephrotoxic medications, especially in patients with compromised renal function.

Medications to manage CKD comorbidities, including ACE inhibitors/ARBs and beta blockers for hypertension or other cardiovascular diseases, may substantially increase hospitalization during warmer months.¹⁷ While more research is needed, several studies have found the following classes of medications increase risk of hospitalization: ACEIs, ARBs, beta blockers, diuretics, antipsychotics, SSRIs.^{17,21,22} No trials have been conducted to guide clinical decision making in light of these increased risks.

Limited research has found that statins may be protective against heat exposure.²³

Temperatures of Concern

The temperatures that increase risk of harm for patients with CKD and ESRD may be far lower than those considered dangerous to many people. For most cities in the United States, the minimum mortality temperature (the temperature above which mortality rates increase) is often just below the 80th percentile of the annual temperature range for American cities.¹⁸ Temperatures tend to peak in mid to late afternoon. The time of day with highest temperatures can be found here.

The National Weather Service (NWS) issues heat advisories, excessive heat watches and excessive heat warnings. To see if a heat alert has been issued for your location, check the weather app on your smart phone, or go to weather.gov and click on your county or type in your zip code. For more details on how to access NWS alerts for heat (and other weather extremes), as well as the differences between heat watches and warnings, see the accompanying toolkit document titled “Accessing Weather Alerts from the National Weather Service”.

Built Environment

The forecast temperature available to patients may not accurately represent the temperature they are exposed to in their home or community. The upper levels of multi-story buildings, especially those without air conditioning, may be much warmer than lower levels.

Urban heat islands can result in temperatures more than 4°F higher than reported due to factors such as fewer trees and parks, more asphalt and concrete, and more traffic. Black American, Hispanic, and lower-wealth communities often live in neighborhoods with greater heat island effects.²⁰ Homeless individuals are at particularly high risk of heat exposure.

Heat Action Plans for Patients with CKD And ESRD

Appropriate guidance for people with CKD and ESRD should be based upon an assessment of the severity of their disease, comorbidities, occupation (especially if outdoors), access to air conditioning at home, and excess heat exposure from an urban heat island or the home environment.

Prior to a heat event, you can work with a patient’s primary nephrologist or care team to develop a plan. For guidance, see the accompanying toolkit documents titled “Establishing a Heat Action Plan for Patients”.

Anticipatory Guidance for Providers to Give to Patients

Anticipatory guidance for hot days may contribute to improved health outcomes. These points are covered in the accompanying toolkit document titled "Tip Sheet for Patients with CKD/ESRD: Staying Safe When It's Hot Outside", which we encourage you to review with patients.

1. Before going outside, check out the weather forecast on your phone, TV, radio, or internet (e.g., at weather.gov or weather.com).
2. If a patient does not have a thermostat or thermometer that measures room temperature in their home, they can be bought for a few dollars at hardware stores or online. Consider having inexpensive thermometers available in your clinic to distribute.
 - A. Indoor temperatures in the patient's home should remain <80°F. If they cannot keep the temperature below 80°F, they should consider moving to an air-conditioned space until the temperature cools.
3. When a heat advisory or heat alert has been announced by the National Weather Service (see "Accessing Weather Alerts from the National Weather Service" for more information) advise patients to:
 - A. Follow their heat action plan (see "Establishing a Heat Action Plan for Patients" for guidance)
 - B. If a heat advisory is issued, patients with CKD/ESRD should preferably stay indoors in an air-conditioned space. If going outside is necessary, limit outdoor activities especially during the hottest part of the day.
 - C. If an excessive heat warning is issued, patients with CKD/ESRD should remain in air-conditioned spaces until the warning expires.
4. For tips on how CKD/ESRD patients can stay safe in the heat see "Tip Sheet for Patients with CKD/ESRD: Staying Safe When It's Hot Outside"

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