Besieged on all sides: the future burden of high-temperature-related kidney disease

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With the record-breaking hot summer in 2023, growing attention has been drawn to the heat-related disease burdens. While abundant epidemiological studies have focused on major non-communicable diseases such as cardiovascular diseases and respiratory diseases, there is a burgeoning body of observational research examining the associations between high temperature and risk for kidney diseases.[1] However, less is known about the future burden of kidney diseases. A few studies projected a marked increase in the prevalence of chronic kidney disease in decades,[2,3] while existing evidence predominantly relies on disease progression models that consider individual characteristics such as age and medical histories, neglecting climate-related risk factors, including ambient high temperature. Findings from existing projection studies are therefore far from comprehensive and conclusive.

In a recent study published on *The Lancet Regional Health—Western Pacific*, Liu and colleagues[4] projected high-temperature-related kidney disease burden across Australia, including not only fatal burdens (i.e., indicated by the years of life lost [YLL]) but also non-fatal burdens (i.e., indicated by the years lived with disability [YLD]). When conducting the projections, they took into consideration three elements: climate change, shifts in population size and age structure, and different scenarios of human adaptation to high temperature. This study suggests that in the context of climate change, Australia will be facing an increasing burden of kidney disease attributed to high temperature (increase by 18–67% from the baseline with no shifts in population and no adaptation). Furthermore, changes in population size and age structure will amplify such increase to 100–291%, while human adaptation to high temperature could substantially reduce such increase (e.g., reduction from 291% to 133% when assuming no adaptation versus full adaptation under the scenario of RCP8.5 and changes of population in the 2050s).

Serving as the first comprehensive evaluation of future high-temperature-related burden of kidney disease on the national level, Liu and colleagues' work has a thorough consideration of climate change, human adaptation, and population change.[4] The considerable contributions from all the three aspects to the future temperature-related disease burden underscore the three pillars of opportunities in the face of global warming—mitigation, adaptation, and health equity.

To date, despite various mitigation practices and ambitious emission targets proposed by the governments, it is far insufficient to meet the two-degree goal by 2100.[5] However, the COVID-19 recovery period could be an unprecedented opportunity to meet the climate goals, once it is a green and healthy recovery.[5] In order to promote timely and effective mitigation practices, future research should quantify the benefits of mitigation practices across the full spectrum of health outcomes, including kidney diseases. Moreover, when projecting health impacts of specific mitigation practices, researchers should spare additional attention to the complexity of the unknown future environment and the consequent complexity of the future patterns of temperature-health associations. Potential influencing factors include other weather factors that could affect heat stress, such as humidity, wind speed, and solar radiation.[6,7]

In the aspect of adaptation, Liu and colleagues reveal the critical role of human adaptation by comparing scenarios of no adaptation, partial adaptation, and full adaptation based on changes in the temperature level with the theoretical minimum risk.[4] To incorporate adaptation in projecting health impacts of climate change, there are a few approaches in research practices: (a) translations of the exposure-response curve along the temperature levels (e.g., Liu and colleagues' work); (b) changes in the slopes of the exposure-response curve; (c) combinations of (a) and (b); and (d) use of analogue cities where the current climate characteristics are similar to the future projections of interest.[8,9] Liu and colleagues' work is important by drawing attention to the role of adaptation when conducting projections on high-temperature-related kidney disease burden. As recognized in Liu and colleagues' work, the complexity in adaptation is noteworthy, and further research should seek to determine the contributions from physiological adaptation versus socioeconomic adaptation (e.g., use of air conditioning and adaptation of health systems), which will have essential policy implications.[9,10]

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When considering health equity in kidney diseases, aging is a critical aspect, same with that older adults are amongst the most vulnerable in the face of climate change.[5] However, future studies should also consider other demographic characteristics from which vulnerability could arise, including sex (e.g., due to potential physiological differences), occupation (e.g., due to occupational exposure to high temperature), income (e.g., due to accessibility to behavior adaptation practices), and race-ethnicity (e.g., due to structural racism and historical residential segregation policies). Equity in health benefits of climate mitigation and adaptation practices is imperative to promote targeted prevention and intervention against increased disease burdens in the most vulnerable communities and populations. Further research, especially in the low- and middle-income countries, is warranted to provide a more comprehensive perspective of the health equity of kidney disease burdens under climate and population changes.

Contributors

Dr. Chu wrote the original draft of the manuscript. Dr. Chen revised the manuscript. Both authors have approved the final version of the manuscript and agree to be jointly responsible for the work.

Declaration of interests

The authors have nothing to disclose.

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