IWMI International Water Management Institute

PROJECT BRIEF

Understanding chronic kidney disease: A socioeconomic approach in Sri Lanka

Introduction

Chronic kidney disease (CKD) is a serious health issue that affects approximately 10% of the global population, and has led to 5-10 million deaths annually (WHO 2016). Growing in importance is a distinctive form of this disease – chronic kidney disease of unknown etiology (CKDu) – that is not linked with factors normally associated with CKD. Although the cause of CKDu is unknown, groundwater use, dehydration, diets and pesticide exposure are important risk factors that have been implicated (Johnson et al. 2019). Responding to CKD and CKDu places a major burden on scarce public resources. In Sri Lanka, where CKDu has contributed to tens of thousands of deaths among rural, low-income populations since the 1990s (Rango et al. 2015), the government has devoted considerable resources to providing alternatives to the use of untreated groundwater (e.g., reverse osmosis [RO], rainwater harvesting) in an effort to prevent the disease.

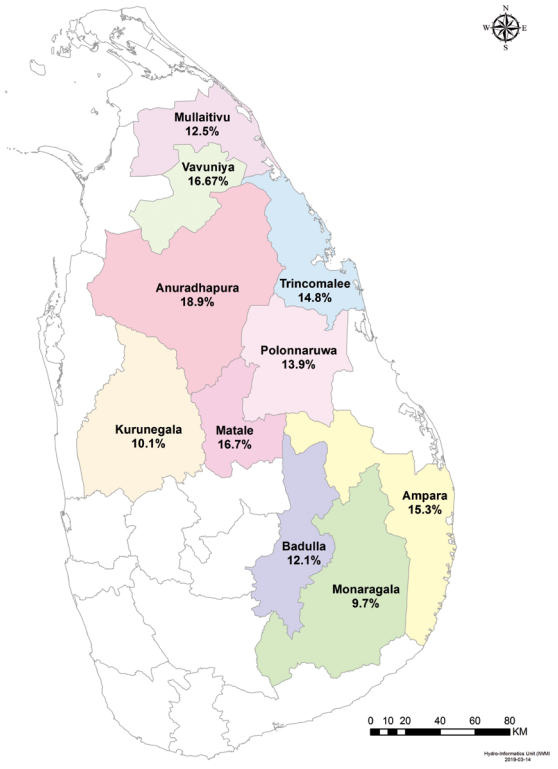
Given that CKD and CKDu are associated with chronic exposures to risk factors, it is important to have a historical perspective on these diseases. Thus, this project examines historical behaviors of groundwater-dependent households in Sri Lanka pertaining to their drinking water sources, water treatment practices and use of agrochemicals, all of which have been identified as potential risk factors. No prior studies have taken this type of historical approach to understanding the causes of CKD and CKDu in the country.

Research approach

This project has three study components. First, a brief study of 8,049 households was conducted across 40 *grama niladharis* in 10 districts of Sri Lanka to identify the incidence of CKD/CKDu at the household level (see Kafle et al. 2019 for more details). Given the challenge of distinguishing CKDu from CKD in the absence of invasive procedures, this project did not attempt to do so and thus groups them together under the generic term CKD. Second, a sample of 1,497 of these households was studied in detail, with 673 reporting that they had an adult individual in residence between 2009 and 2018 who was diagnosed with chronic kidney disease ("CKD households"), and 824 households that did not have any such individuals ("non-CKD households"). Recall methods were used to elicit historical drinking water source and treatment choices of households over the 18-year period from 2000 to 2017 (see Balasubramanya et al. 2019 for more details). Third, water testing was conducted for 240 paired wells: 120 that were historically used by CKD households, including many that are no longer operational, and 120 that had been used by otherwise-similar non-CKD households.

Districts most affected by CKD in Sri Lanka

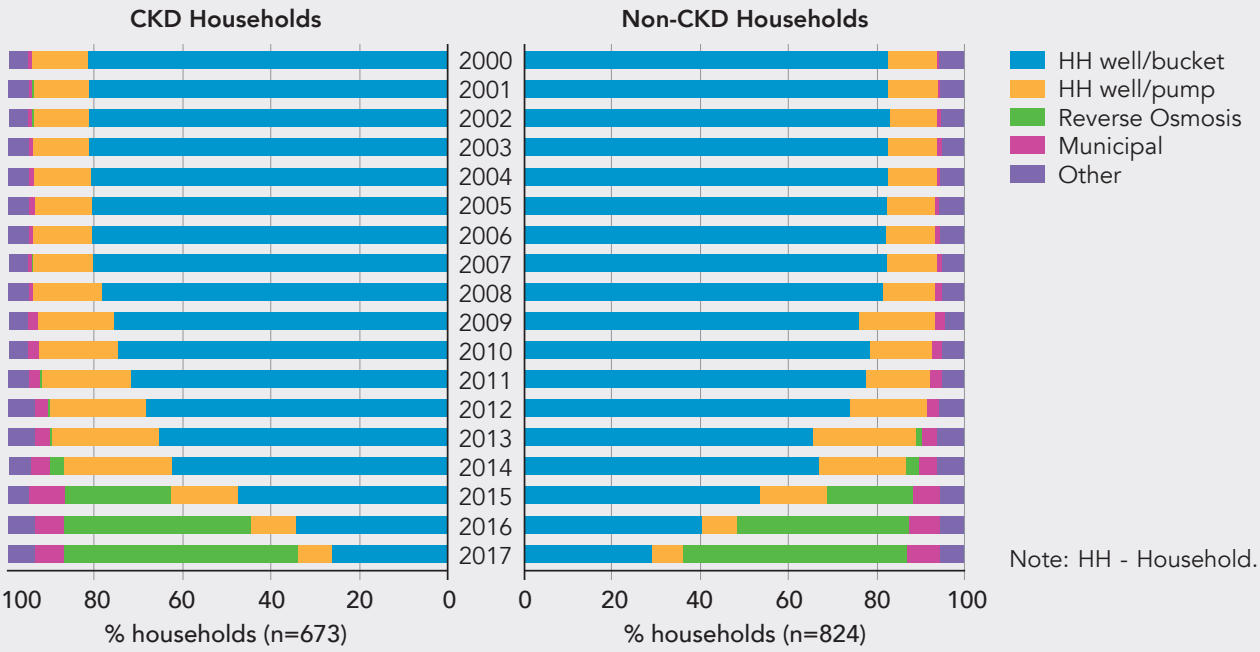
Percentage of households reporting at least one member diagnosed with CKD who resided in the household between 2009 and 2018



Key findings

1. **CKD is present across multiple districts in Sri Lanka, and a greater share of symptomatic individuals is women.**
   - Of the 8,049 surveyed households, 1,071 had at least one symptomatic individual. The percentage of affected households varied from 9.7% in Monaragala to 18.9% in Anuradhapura.
   - Of the 1,192 symptomatic individuals identified in the 1,071 households, 62% were female.
   - CKD with standard risk factors (e.g., hypertension) was more common among males.
   - CKD with neither diabetes nor hypertension was more common among females (39%) than males (24%).
2. **No particular water source stands out as the sole risk factor for CKD.**
   - Historical choices of primary water sources for drinking and cooking did not differ substantively for CKD and non-CKD households over the 18-year period from 2000 to 2017 (Figure 1).
   - Both CKD and non-CKD households mostly sourced their water from household wells until 2015. By 2017, however, more than half of both categories of household had turned to RO.
   - The absence of a systematic difference in the historical use of water sources for CKD and non-CKD households, coupled with the sharing of the same well by symptomatic and non-symptomatic individuals, suggests that the source of water itself may not be the sole risk factor for CKD.

Figure 1. *Water source by year (share of households).*

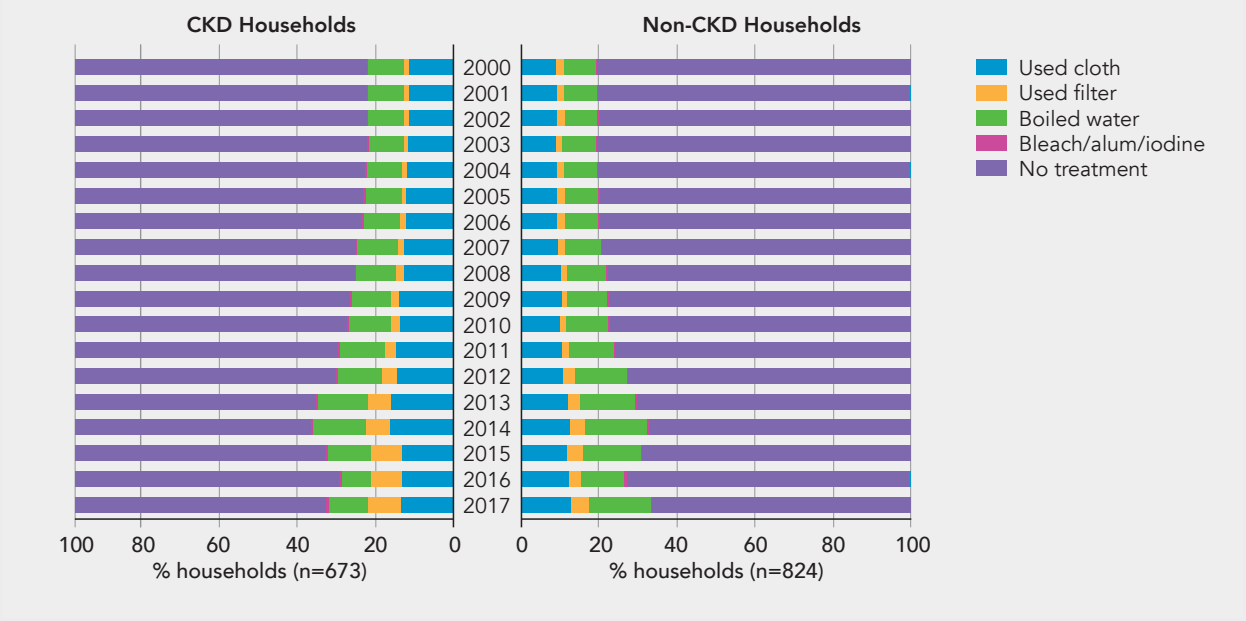


Note: HH - Household.

3. **Most households continue to consume untreated water. However, this has changed some in recent years.**
   - Although the share fell by approximately 10 percentage points between 2000 and 2017, over 70% of CKD and non-CKD households continue to consume untreated water (Figure 2).
   - More non-CKD households currently boil their water (17%) compared to CKD households (12%). Among the households that boiled their water, CKD households have done so 1.8 years longer.
4. **The historical wells regularly used by CKD households have lower water quality than those used by non-CKD households.**
   - Tests reveal that the current water quality of previously used wells meets most of the Sri Lankan standards for inorganic contaminants; however, the wells used by CKD households have relatively higher levels of inorganic contaminants.

- Average levels of total dissolved solids (TDS) found in wells used by CKD households were higher than the Sri Lankan standard.

Figure 2. *Water treatment by year (share of households).*



5. **CKD and non-CKD households are also different in other ways. Historically, CKD households are more likely to have:**
   - used agrochemicals (7% more have used glyphosate, and 5% more have used paraquat). This is particularly pertinent given that few households reported ever using protective equipment for agricultural activities (only 11% have used masks and gloves, and only 27% wore boots);
   - used a well that is located far from surface water sources (7%); and
   - been poorer. Using housing quality as a proxy for wealth, CKD households were less likely to have relatively more expensive clay-tile roofs (5%), and more likely to have cheaper asbestos roofs (8%).

Implications for research and policy Intervention

The project raises a number of research questions that, when addressed, can inform policy.

1. How do current and past agrochemical use practices differ for CKD and non-CKD households? Given that both categories of household report different exposures to agrochemicals, a better, more detailed understanding of these practices in affected areas is crucial to assessing agrochemical use as a risk factor.
2. Are there other alternative water sources or water treatments that are as/more effective at addressing CKD, and are more cost-effective than RO? Given that RO has only been widely available in recent years in Sri Lanka, and that the uptake of RO has been similar for CKD and non-CKD households, the association between RO and CKD prevention is unclear. It is worth considering alternatives while the jury is still out.
3. Aside from having an impact on CKD, do the alternatives to using groundwater deployed by the Sri Lankan government (e.g., RO, rainwater harvesting, water deliveries and piped water) have other benefits that improve household well-being? Even if these alternatives end up having little, if any, impact on CKD, they could be worthwhile investments nonetheless if they have sufficiently positive impacts on the lives of community members.
4. How sustainable are these alternatives to groundwater? What are households willing to pay to maintain these alternatives?
5. Why are poorer households at greater risk of developing CKD?

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The International Water Management Institute (IWMI) is a non-profit, scientific research organization focusing on the sustainable use of water and land resources in developing countries. IWMI works in partnership with governments, civil society and the private sector to develop scalable agricultural water management solutions that have a real impact on poverty reduction, food security and ecosystem health. Headquartered in Colombo, Sri Lanka, with regional offices across Asia and Africa, IWMI is a CGIAR Research Center and leads the CGIAR Research Program on Water, Land and Ecosystems (WLE).

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