Drinking water

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Larger lessons from the Jackson Mississippi and Flint water crises

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Examination of boil water alerts (BWAs) in Jackson, Mississippi points to the breadth and diversity of impact from water contamination. We describe these impacts and the larger context and limitations of BWAs as ways of both informing the public and mitigating risk.

Writing in *Nature Water*, Myungjin Kim and colleagues explored the relationship between boil water alerts and public school unexcused absence rate in Jackson, Mississippi[1]. Their analysis, along with a growing body of evidence, demonstrates both the fragility of many urban water systems and the diversity of impacts on residents[2,3]. In many cases, these residents are more likely to be members of minority communities, poorer and often facing significant health disparities (Fig. 1).

The Jackson case, along with the Flint Water Crisis, were both driven by years of disinvestment in water infrastructure in disadvantaged communities that lacked political influence. Major shifts in the sociodemographic composition of residents, ageing infrastructure, failed warnings and fundamental failures in the management of the water system are characteristics of the Flint Water Crisis[4] that also characterize the Jackson case. Both cases involved questions of environmental justice, defined by the Environmental Protection Agency (EPA) as "the fair treatment and meaningful involvement of all people regardless of race, colour, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies"[5]. In both cases, the history of discrimination extended to the very pipes that brought water to residents' homes.

Kim and colleagues explore an under-examined impact of failing urban infrastructure — that is, environmental justice and BWAs. Although the impact of BWAs on the unexcused absence rate is not surprising, it demonstrates the diversity and range of impact of unsafe water. Property values, economic growth and gastrointestinal disease rates are all logically related to the frequency of BWAs. BWAs impose additional challenges on communities that already face disproportional burdens. Thus, the harm is compounded, is both short and long term and is diverse.

Adherence to BWAs, however, is the primary way residents can mitigate risk of possible and confirmed microbial contamination in potable water. The Safe Drinking Water Act mandated creation of the EPA's Public Notification Rule 65 FR 25982. The rule requires that public water systems notify customers of drinking water violations or situations that may pose risks to public health[6]. This includes any time a water system violates a primary drinking water regulation. The public notification rule specifies that BWAs include a description of any violation and potential adverse health effects, identify the population(s) at risk, describe efforts to correct the problem, and include sources of additional information and any recommended actions the public should take, such as boiling water before consumption. The EPA classifies violations by their severity. Tier 1 notices are situations with significant potential for serious health effects as a result of short-term exposure and are most likely to include a BWA.

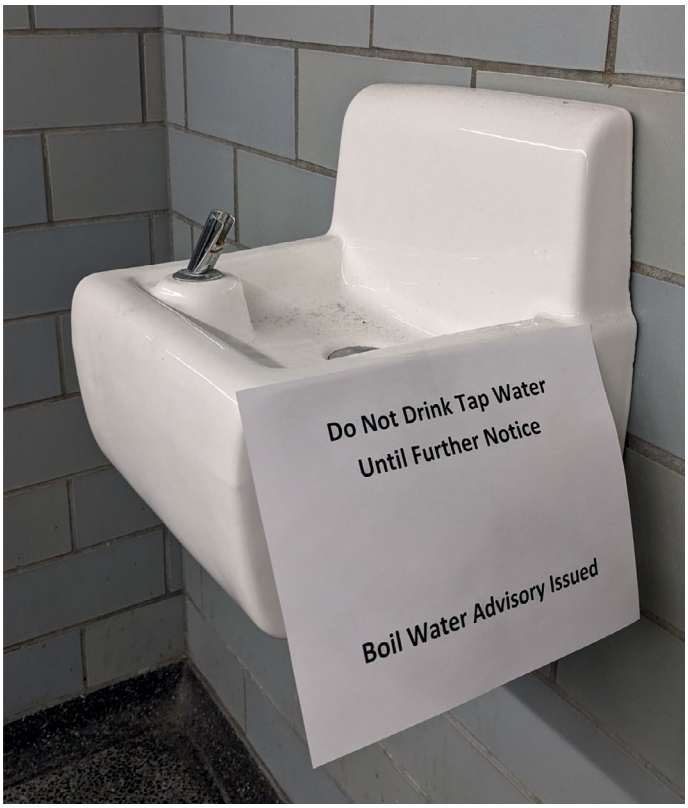

Fig. 1 | Boil water alerts. BWAs impact communities in many ways and are the primary way residents mitigate risk of microbial contamination in potable water.

Although BWAs are considered a standard mitigation tool, they are inefficient and their effectiveness in mitigating harm is not clear. Most BWAs are issued for events that are not violations of the Safe Drinking Water Act. These events include water main breaks and low-pressure events in public water systems. While the National Academy recommends maintaining a minimum pressure of 20 psi under all operating conditions and all locations[7], the minimum pressure threshold at which a BWA is issued varies. These low-pressure events are often the result of decaying infrastructure, freeze–thaw cycles, construction, fires, power outages, equipment failures, and events such as tornadoes and hurricanes. In some cases, low-pressure events may change typical flow

patterns in distribution systems, which can induce water quality problems (for example, water discolouration). Low-pressure events increase the possibility of untreated groundwater, possibly contaminated, entering the distribution system. There are limited studies linking low-pressure events to public health[8]. However, during a low-pressure event or associated BWA, it is not clear when precautions are needed and there is a real risk to the health of consumers.

Most evidence suggests that the public generally complies with BWAs when they receive them. The public, however, may also become fatigued with repeated risk messages, especially if the risks do not materialize. BWAs may be seen as false alarms and fall victim to the cry wolf phenomenon, where subsequent BWAs are discounted or even ignored. In some cases of natural disasters, power outages may limit the ability of residents to boil their water[9]. In addition, repeated BWAs may undermine the basic trust in the public water system encouraging residents to permanently turn to bottled water. Damaged water systems are much easier to repair than damaged trust in safety of water.

Kim and colleagues call for the development of "accessible, consistent, and reliable information systems for water-related issues". The EPA's public notification rule was last updated in 2000 and has yet to accommodate significant changes in the media ecosystem driven by the growth of social media. BWAs are most often communicated through a press release to local media outlets, despite the fact that the general public increasingly receives news from social media outlets. Moreover, the general public may have little understanding of the larger issues about water safety and may not understand the specific methods for boiling water to make it safe. This lack of knowledge also extends to the installation and maintenance of point-of-use treatment devices, which are often recommended for some forms of chemical contamination, such as lead. Kim and colleagues call for better data management systems and methods to inform consumers. Making real-time data available to residents about the quality of their water may be one way to enhance trust and empower residents.

As Kim and colleagues note, the great strides that have been made in creating systems that provide safe water to the public may be undone by ageing and poorly maintained infrastructure, new and re-emerging contaminates, and the multiple risks imposed by climate change. Both better understanding and updated methods of monitoring, treatment and communication with the public will be necessary to ensure that water is safe to drink and to address the legacy of inequity found in our public water systems.

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Competing interests

The authors declare no competing interests.