

Invisible and Unjust Impacts of Water Informality in Lebanon

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Lebanon suffers from water intermittence from its main piped infrastructure, which means that households do not receive water from their taps on a 24/7 basis. As a result, houses rely on alternative, informal water sources to satisfy their daily water needs, including drinking, using the bathroom, cleaning, and others.

Piped water supply for Beirut comes from two main sources: the main one is a northern water treatment plant in the Dbayeh area, 15 kilometers north from Beirut, which supplies around 80 percent of the capital's water use. A second source is a cluster of multiple wells in the Naameh area, 20 kilometers south from Beirut, which supplies the remaining 20 percent. Water from these locations is usually pumped to different reservoirs in Beirut for storage before final delivery. However, the reservoirs cannot supply water on a continuous basis. As a result, households in normal times receive water on average about three hours a day in the summer and around seven hours per day in the winter.

In Lebanon, the first informal water tankers appeared around the 1970s. After decades of mismanagement in the public sector, the Lebanese infrastructure suffers in present days from poor water quantity and quality. The grid loses up to 45 percent of water due to leakages, and faces water contamination from sea water intrusion and sewage seepage. The economic and financial crisis of the last few years has amplified the situation even more. For several weeks this summer, for instance, residents faced a total interruption of water supply from the main piped infrastructure mainly because of insufficient electricity in the grid to pump water to different areas. These years of negligence have resulted with Lebanese residents relying on different forms of informal sources including water tankers, wells, and bottled water. While these informal sources fill a gap in water provision and help communities access and secure their daily water needs, they come at additional socio-economic, health, and environmental costs. More worryingly they lead to social injustices as they burden disproportionately lower income communities.

Socio-economic impacts

Piped infrastructure water cost is based on the official subscription fees: Lebanese households pay a flat rate of \$200 per year for one cubic meter per day. However, because of water intermittence in the piped infrastructure, residents do not receive the promised amount of water per day, and need to pay for additional informal water sources. There is a general consensus among water planners that water affordability thresholds of cost-to-income ratios should range between 3 percent and 5 percent; this means that as long as residents are paying less than 5 percent of their income to water, they are accessing a rather affordable resource.

To assess the cost-to-income ratios in Beirut, I conducted in 2019 a survey of 100 Lebanese households, from two Lebanese communities of different socio-economic levels in two areas in Beirut—Verdun and Aicha Babbar. The survey shows that the cost-to-income ratio of total water sources—municipal and informal—was around 6 percent. In other words, overall, water sources were unaffordable in Beirut. In addition, when looking deeper into this ratio, there were stark disparities with lower income communities paying 2.2 times more for water than higher income communities: lower income communities paid around 10 percent of their income to water, whereas higher income communities paid only 4 percent. Lower wages and higher total costs for water explain these disparities between the two communities. As the survey was conducted just before the economic crisis hit in 2019, we can expect that unaffordability levels have increased tremendously today because of multiple factors including the depreciation of the Lebanese pound and overall inflation of prices.

Health impacts of informal water sources

The additional and higher costs have pushed communities to develop different coping behaviors that can also lead to invisible health disparities among communities. For example, higher income communities rely heavily on expensive reverse osmosis units that allow them to treat their well water before consumption. The survey shows that 17 percent households in the higher income community relied on those reverse osmosis units, whereas no evidence of it was recorded in the lower income community. These units are costly, approximately \$15,000 as initial investment cost, without taking into account operation and maintenance costs, which might explain the disparity. As a result, households that do not have those units are directly exposed to groundwater contamination from seawater intrusion and raw sewage leakage, which can lead to dangerous health implications including being exposed to coliform and E. coli, or even cholera infections, as we have recently seen in the news. Seawater intrusion can also indirectly impact lower income household's appliances that deteriorate rapidly from excessive salinity, leading to higher repair and replacement costs. Additionally, lower income communities compromise on the quality of their drinking water by purchasing cheaper unregistered bottles of dubious quality, which can lead to their exposure to drinking water contaminated with microbiological pollution.

Environmental impacts

Every liter of water is usually associated with an energy and carbon footprint because energy is needed to treat and pump water in order to deliver it to households. Informal water sources are no exception. Diesel engines are used by tankers, hence water delivered by those tankers uses energy and is associated with carbon emissions. Typically, tankers transport water from water-rich wells, located at the outskirts of Beirut, to different areas in Beirut and the Mount Lebanon region. Energy is also needed to pump, treat, and transport bottled water; the same goes for wells.

In Lebanon, informal sources have the highest energy use and carbon emissions compared to the formal piped infrastructure. They increase energy use by 83 percent and are responsible for 72 percent of total carbon emissions per person per year. From all the water sources, bottled water has the highest values because of higher energy needs for treatment and transportation. However, an imperceptible impact comes from transporting water through trucks, which contribute to additional harmful hidden emissions from nitrogen oxides, black carbon, and particulate matter. The main issue with that is that tankers usually operate inside cities, releasing these harmful emissions to populated areas, increasing the possibility of respiratory diseases among the population.

The continuous abstention of Lebanese public institutions and a changing climate will result in an increased reliance on informal water sources. These sources are a necessity as they help communities overcome their daily water shortages. However, they come at multiple costs and lead to disparities in access, affordability, and health. This shows that formal and informal water systems work in tandem: while informal sources can fill the gap in needed volume and quality, formal piped infrastructure generally provides an affordable service. We might consider hybrid strategies that address both formal and informal sources. We need a holistic plan that addresses the water system as a whole and at different hydraulic, environmental, economic, societal, legal, and political dimensions, to develop long range policies and viable solutions. However, developing such a plan might be politically challenging as the country's public institutions have not developed such a vision yet, and have been only investing in large scale infrastructures projects that are economically and environmentally unviable. Some examples include more than 35 non-operational wastewater treatment plants (inland and on the coast) that have been built without any connection to sewage networks, or networks that have been built without wastewater treatment plants. This shows that we should also think of other ways to solve water supply issues. For example, decentralized and bottom-up strategies can protect residents in the short term; this includes using water testing kits to test drinking and groundwater qualities, or solar pumps to reduce carbon emissions when pumping water. However, these solutions are not sustainable in the longer-term. They rely on the entrepreneurial spirit of end-users and can result in increased financial burdens, and higher unaffordability and unjust outcomes.

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