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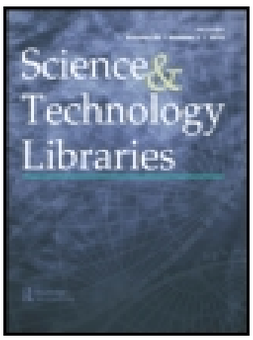

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Water Scarcity: A Big Challenge to Slums in Africa to Fight against COVID-19

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ABSTRACT
In the light of the current situation regarding the COVID-19 disease, a discussion is attempted on the need for focusing on water scarcity in Africa and the important considerations to conserving water to fight against SARS-CoV-2 virus.

KEYWORDS
Water; Africa; COVID-19

Water availability and scarcity

It is possible for many of us to have running water! A huge blessing we shouldn't take for granted. It is possible to help others have access to clean water! (Figure 1).

The water resource in Africa is necessary for the development of human societies. This development, mainly in the industrial and agricultural sectors, is being increasingly affected by the lack of water resources at many levels. Lack of water is considered as a limiting factor of socio-economic development of a country (Haddout et al. 2019). Water covers about two-thirds of the earth's surface. Rivers and lakes form ~0.3% of the world's freshwater and are considered to be the primary water source for human use and consumption (Karamouz, Szidarovszky, and Zahraie 2003). Human population growth is the main driver of rising global demand for water and food products. The population in the world is expected to increase to ~9.2 billion in 2050 (Figure 2). Rapid demographic growth, together with an anticipated increase in manufacturing and production of the agriculture, put more constraint on the environment, especially on the already strained water resources. The availability of renewable freshwater was around ~17,000 m^3/capita/year in 1950; and in 2000, this was reduced to ~7,000 m^3/capita/year, indicating a decline of about 60% from 1950 to 2000. By 2050, the availability of water is expected to decline further to ~5,000 m^3/capita/year, and successively to about ~70% compared to the availability of water in 1950 (Abdullah 2017).

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Figure 1. The joy of a child in Africa experiencing water. (Source: World Health Organization (2019d)).

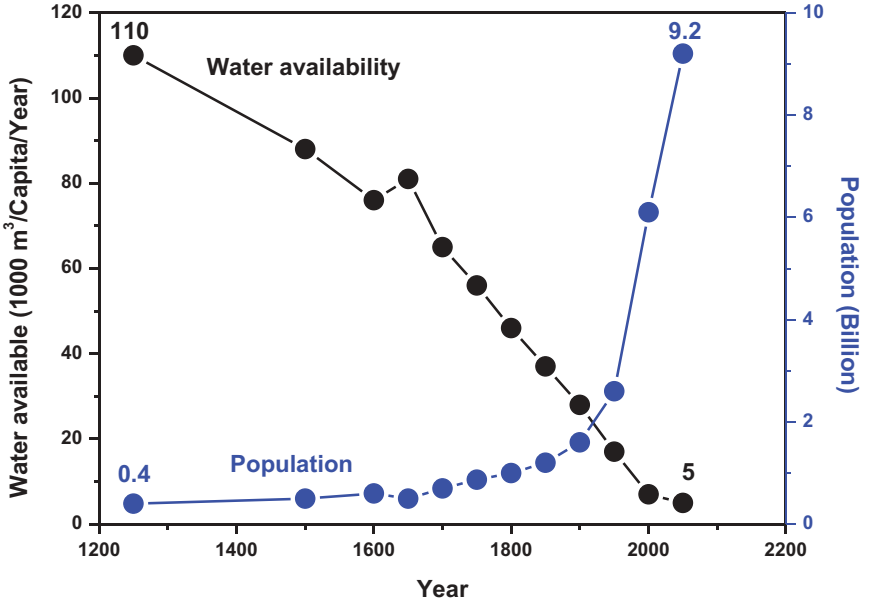

Figure 2. Water availability and world population (Source: Dolphin, 2007; UN Water and FAO (Food and Agricultural Organization of the United Nations) 2007).

The international average of available freshwater does not reflect the real distribution of available water across the globe. It does not show the regions with

abundant water or the ones that experience scarcity. Uneven distribution of water resources exacerbates water scarcity (Abdullah 2017). The spatial and temporal distribution of water availability varies in different regions. There is often too much or too little water. These fluctuations result in floods and droughts. Water is not always in the right place at the right time to meet the demands. By the year 2025, around 3 billion people could be living in water stress. Further, around 1.8 billion people will live in 14 water-scarce countries (UNDP (United Nations Development Programs) 2006).

Water scarcity is a growing threat to humanity and the environment. Four main drivers will increase water scarcity (UN Water and FAO (Food and Agricultural Organization of the United Nations) 2007). The first driver is the sufficient food production required for sustaining the population growth (UNDP (United Nations Development Programs) 2006). The second is the expansion of existing urban areas and the creation of new cities. In 2010, urban areas were home to 3.5 billion people, which is expected to rise to 6.3 billion by 2050. Developing countries, where most projected urbanization growth will occur, are expected to double the population from 2.6 billion in 2010 to 5.2 billion in 2050 (Varis, Kummu, and Salmivaara 2012). Freshwater courses have limited capacity to respond to increased demand, and to process the pollutant charges of the effluents from expanding activities. Third, life-style and increased human development will increase per person domestic water requirements. Fourth, climate change will induce considerable changes in water resources. Freshwater availability will change at a regional scale, even with uncertain magnitudes. Arid and semi-arid regions will probably face frequent intensified drought periods as a result of increases in the variability of precipitation (Bates et al. 2008).

Figure 3 shows the distribution of water scarcity in the globe. Absence of sufficient institutional and financial resources will exacerbate the situation. Societies will not be able to maintain the health of these ecosystems and manage the available water resources sustainably without increasing the efficiency of infrastructure and developing capacity.

Water scarcity leads to poor sanitation, which in turn results to increase the vulnerability to water-borne diseases such as diarrhea, cholera and malaria, where children and old age people are the most vulnerable groups (Metwally et al. 2006). Diarrhea is said to be responsible for causing 502,000 deaths every year in Africa (World Health Organization 2019a). In 2018, tree countries in Africa reported outbreaks of cholera: The Democratic Republic of Congo reported 1,065 cases and 43 deaths, corresponding to a fatality rate of 4%; Mozambique registered 1,799 cases and one death, corresponding to fatality rate of 0.06%; and the United Republic of Tanzania reported 33,421 cases and 542 deaths, which corresponded to a fatality rate of 1.62% (World Health Organization 2019b). In 2018, Africa registered 213 million cases of

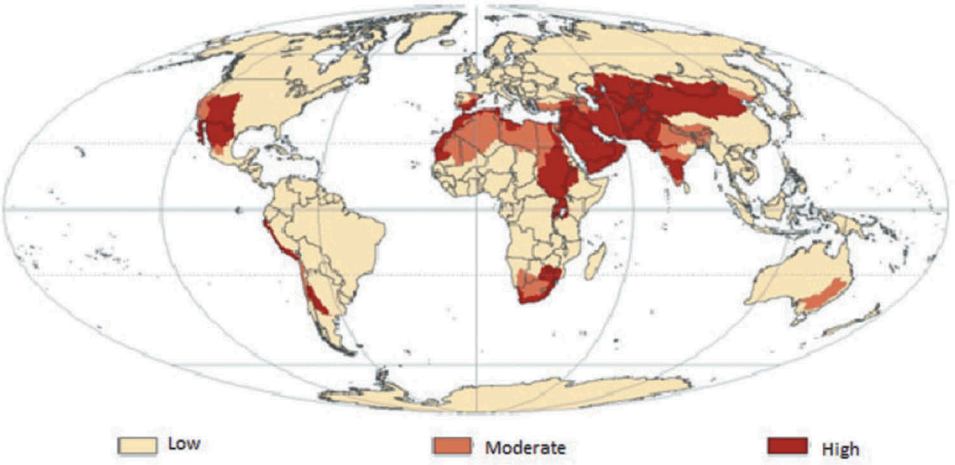

Figure 3. Global Distribution of Physical Water Scarcity by Major River Basin (Source: FAO (Food and Agricultural Organization of the United Nations) 2012).

malaria and 380,700 deaths, which corresponded to 93% and 94% of the global registered cases, respectively (World Health Organization 2019c).

COVID-19 and water

In late 2019, an acute respiratory disease emerged, known as novel coronavirus disease 2019. The pathogen responsible for COVID-19 is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2, also referred to as the COVID-19 virus), a member of the coronavirus family (World Health Organization 2020). In response to the growing spread of COVID-19, WHO has published some technical guidance documents on specific topics, including infection prevention and control (IPC).

The COVID-19 virus has not been detected in drinking water. Conventional water treatment methods that use filtration and disinfection, such as those in most municipal drinking water systems, should remove or inactivate the virus that causes COVID-19 (World Health Organization 2020).The COVID-19 virus has not been detected in drinking-water supplies, and based on current evidence, the risk to water supplies is low (World Health Organization 2017). Laboratory studies of surrogate coronavirus that took place in well-controlled environments indicated that the virus could remain infectious in water contaminated with faces for days to weeks (Casanova et al. 2009).

Several measures can be adopted to improve water safety, starting with protecting the source water; treating water at the point of distribution, collection or consumption; and ensuring that treated water is safely stored at home in regularly cleaned and covered containers. Conventional,

centralized water treatment methods that utilize filtration and disinfection should inactivate the COVID-19 virus. Other human coronavirus are to be sensitive to chlorination and disinfection with ultraviolet (UV) light (SARS-CoV-2-water and sanitation 2020). As enveloped viruses are surrounded by a lipid host cell membrane, which is not robust, the COVID-19 virus is likely to be more sensitive to chlorine and other oxidant disinfection processes than many other viruses, such as coxsackie viruses, which have a protein coat (World Health Organization 2020). For effective centralized disinfection, there should be a residual concentration of free chlorine of ≥0.5 mg/L after at least 30 minutes of contact time at pH < 8.0 (World Health Organization 2017). Chlorine residual should be maintained throughout the distribution system.

It is not surprising why one of the most advocated measures to prevent infection by COVID-19 is a frequent washing of hands, preferably with running water. The technique instructs to applying enough soap to cover the wet hands, scrub all surfaces of the hands including the back of hands, between fingers and under nails for at least 20 seconds, and rinse thoroughly with running water. This implies farther expenditure of water, bearing in mind that in rural areas of the many developing countries, often people use buckets or small containers for washing dishes and hands, using as less as 1 L per person for washing hands, and further, hands are washed in few occasions during a day, which include prior to meals or after dirty work. Furthermore, in those areas water is often fetched at long distances, hence, in shortage. Therefore, the sanitation requirements of COVID-19 would require additional effort toward saving water in developing countries. It is interesting to note that the Mozambique government has ordered for the reestablishment of the supply of water to those consumers, whose supply had been interrupted due to debts.

To prevent the spread of COVID-19 in slums and informal settlements, the UN family under the leadership of UN-Water, national and local governments, civil society organizations, women and youth groups and community leaders are proposing some solutions (https://www.worldwaterday.org/). The countries, territories or areas with reported confirmed cases of COVID-19 as of March 2020 are shown in Figure 4.

Saving water against COVID-19

It is ascertained that ~214 L of water are needed to produce one kg of tomatoes, ~2,500 L for a kg of rice, ~3,180 L for a kg of cheese, and ~15,400 L for a kg of beef. It is then easy to understand the risks of price increases for food in contexts of water scarcity. Do we know how much water we consume every single day? The World Health Organization (2017) defines the concept of water scarcity based on the assumption that each person needs

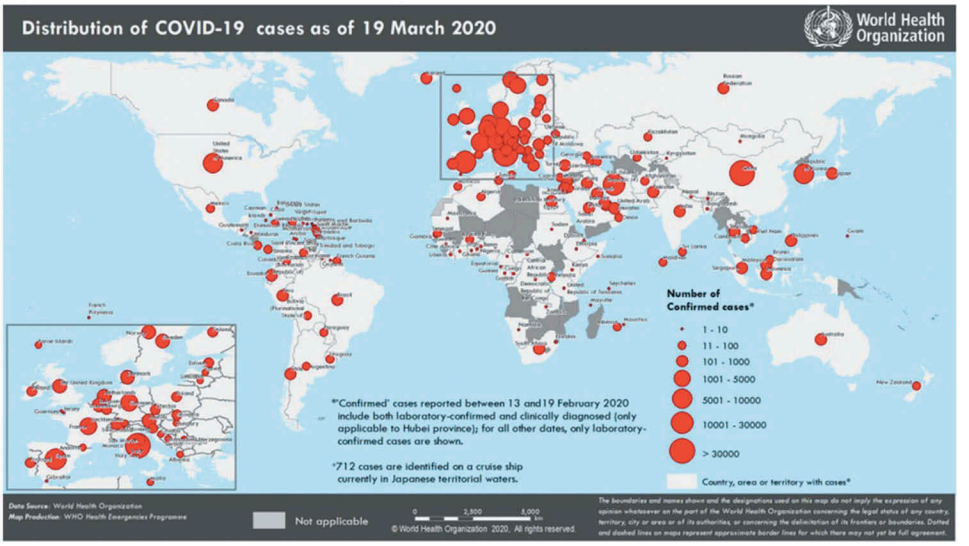

Figure 4. Countries, territories or areas with reported confirmed cases of COVID-19 as of 19 March 2020 (Source: World Health Organization).

between ~50 and ~100 L of water per day to meet their primary needs. Saving and conserving water reduces the energy required to deliver and process water. This reduces pollution and saves fuel resources. If we conserve water now; we will have a brighter and happier future! We must start thinking about how we can be smarters, better stewards of water abundance against COVID-19. More than a third of the world's drinking water supply is lost in urban distribution systems before it even reaches consumers. It is everyone's responsibility to conserve and not waste water and fight against COVID-19. Some of the simple strategies that can be adopted to have a healthier relationship with water and the environment in the future are furnished below.

Short term

- Don't let the tap or shower run when it is not being used.
- Run the dishwasher and clothes washer only when they are fully loaded.
- Fix leaks: conserves water and saves repair costs.
- Education (public awareness).
- Setting up awareness programs through social media for sharing information and for providing advice, training and capacity building support.
- Allocating adequate resources of water for drinking and hand washing in each community at important locations where public gathering and crowds are noticed.

- Adopting social distancing to reduce community spread.
- Promoting public participation with the help of community leaders and volunteers for managing water utilization for hand washing.
- Ensuring alternate measures to hand washing such as the use of hand sanitizers, in case of extreme lack of water resources.

Long term

- Development of policies for sustainable management of water resources.
- Exploration of alternate sources of water that are not yet explored.
- Preparation of a management action plan for the wise-use of water resources.
- Establishment of a water purification system in each community thereby promoting recycling.
- Optimization in the utilization of water resources by practising 4 R's i.e., Reduce, Reuse, Recharge, Recycle and Respect water.

These measures address mainly urban areas and each resident, in order to contribute to the more rational use of water. However, the use of water at a regional or global level requires a much more complex and comprehensive approach that goes beyond the personal level. It requires a smart water development, use and protection policy. Successful fight against the virus from both the medical and water management levels seems to need and require global as well as local measures. Thus, each individual, through his actions, by protecting himself and his environment (such us rational water use), contributes to the suppression of this pandemic.

Declaration of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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