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COVID-19: What Lessons Learned in Anticipation of Future Pandemics in the Field of Water Resources

Noui Abderrahmane[1], Guesbaya Zineb[2]

[1]Center for Scientific and Technical Research on Arid Regions, Biskra, Algeria

[2]Faculty of Exact Sciences, Natural Sciences and Life, University of Biskra, Biskra, Algeria

Email address:
nouihyd1979@yahoo.fr (N. Abderrahmane)

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Abstract: According to the recommendations of the WHO, the most effective way to eliminate COVID-19 is the quarantine and always clean hands by rubbing them with an alcohol disinfectant or washing them with soap and water, but alcohol disinfectants are expensive compared to water, and billions of people in the world lack clean water. The aim of this study is to evaluate the amount of water needed to wash hands only during quarantine for a period of 75 days to eliminate the corona virus in the country's most affected by it, with a focus on countries with water shortages, to alert governments to mobilize sufficient water resources to eliminate this epidemic and future epidemics. By a rough calculation, we assessed the water requirements for hand washing for 75 days of quarantine in the 53 countries most affected by the epidemic, and we summarized them in (Table 1). The average increase in the water needs to face the Corona virus by hand washing only ranges between: 3.20% to 15.70%, at a global average rate of 9.68%. Among the 53 countries most affected by the Corona virus, 27 countries in five continents suffer from significant water stress, which means that 50% of these countries may be unable to provide water to their citizens to wash their hands only, without considering the quantities of water required to sterilize hospitals, administrations, shops and streets. To face the COVID-19 and various epidemics in the future, all governments must mobilize adequate water resources and expedite the completion of water networks.

Keywords: Corona Virus, Quarantine, Hand Washing, Global Water Deficit, Countries in Danger, Future Epidemics

1. Introduction

It is called COVID-19: a new form of corona virus appeared at the end of 2019 in the city of Wuhan in China. Quickly, the virus spread across the planet. At the beginning of March 2020, all continents are infected [1].

The total quarantine of the central province of Hubei, cradle of the COVID-19 pandemic, has shown that the total quarantine is still the best solution to prevent the spread of the new corona virus (SARS-CoV-2) [2].

The corona virus is spread when mucus or droplets containing the virus enter the body through the eyes, nose or throat. Most often, this contact takes place through the hands. The hands are also one of the most common ways of transmitting the virus from person to person [3].

During a pandemic, washing your hands frequently with soap and water is one of the most economical, easiest and most important measures to prevent the spread of a virus [3].

40% or three billion people - of the world's population live without basic facilities for washing hands with soap and water available at home [11, 14]. In addition, one in six health care establishments in the world does not have a hygiene service [4].

According to the UN, two billion people live in a country under severe water stress. As well as, Global water demand is expected to increase by 20-30% by 2050, which estimates that half of the population would be at risk [5].

The aim of this study is to evaluate the amount of water needed to wash hands only during a quarantine for a period of 75 days to eliminate the corona virus in the country's most affected by it, with a focus on countries with water shortages, to alert governments to mobilize sufficient water resources to eliminate this epidemic and future epidemics.

2. Materials and Methods

To find out the amount of water needed in quarantine to

wash hands only and for several times a day (per capita), we calculated the average amount of water used to wash hands 12 times a day and for 30 seconds [9, 12], at each wash (before and after eating, when getting out of the toilet, touching hard objects....), we are obtain on average 18 liters per day per capita (Figure 1).

Since all members of the same family are involved in washing hands to avoid the virus (men, women, elders and children), all citizens of the same country were taken into account in the evaluation of the quantities of water [10, 13].

For an ideal quarantine that lasts 75 days (the Chinese quarantine experience) [2]. We have evaluated the water needs of the 53 countries most affected by the Corona virus in the world (Figure 2) [6], by calculating the average per capita consumption for washing their hands each day times the population of each country times the number of quarantine days.

Figure 1. *Wash hands with soap and water - Source: UNICEF 2020.*

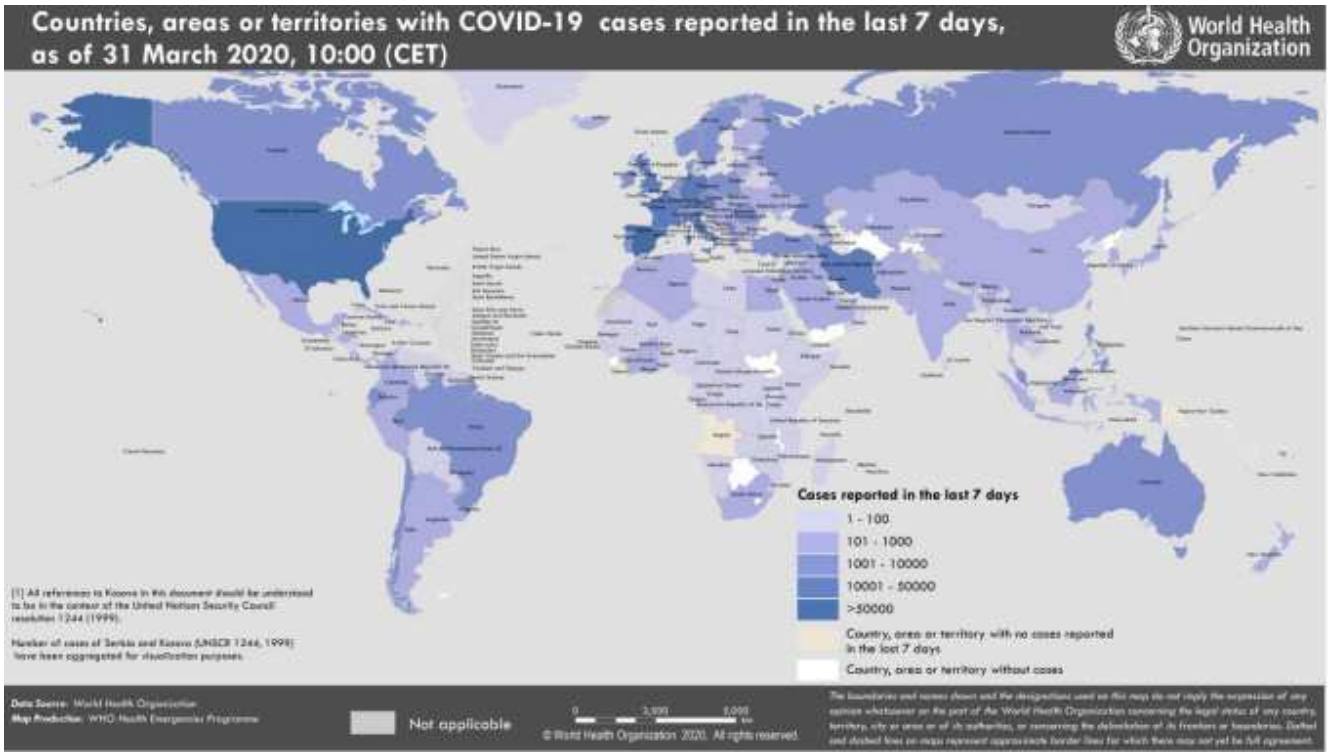

Figure 2. *Countries, territories or areas with reported confirmed cases of COVID-19, 31 March 2020 Source: WHO 2020.*

3. Results

Table 1. *The quantities of water needed to wash hands to face the Corona virus in countries most affected by it.*

Country	Rank in infection COVID-19	Rank in the water deficit	Rate of water Network connection	Amount of water needed to wash hands 75 days of quarantine	Rate of increase in water needs
United States	1	Low-Medium	100%	446853578.85 m³	9.7%
Spain	2	High	100%	63118950.3 m³	8.6%
Italy	3	High	100%	81623465.1 m³	8.3%
France	4	Medium-High	100%	88119239.85 m³	11.2%
Germany	5	Medium-High	100%	113108321.7 m³	9.4%
United Kingdom	6	Low-Medium	100%	91646114.85 m³	8.6%
China	7	Medium-High	96%	1943087097.6 m³	13.5%
Iran	8	Extremely High	96.2%	113390481.15 m³	14.6%
Turkey	9	High	100%	113857740.45 m³	12.7%
Belgium	10	High	100%	15645991.05 m³	8.4%

Country	Rank in infection COVID-19	Rank in the water deficit	Rate of water Network connection	Amount of water needed to wash hands 75 days of quarantine	Rate of increase in water needs
Netherlands	11	Low-Medium	100%	23132077.2 m³	5.1%
Switzerland	12	Low	100%	11683739.7 m³	3.8%
Canada	13	Low	100%	50951907.9 m³	10.2%
Brazil	14	Low	98.1%	286955212.95 m³	14.3%
Portugal	15	High	100%	13765557.15 m³	6.9%
Russia	16	Low-Medium	96.9%	197011523.7 m³	12.3%
Austria	17	Low	100%	48634549.2 m³	5.2%
South Korea	18	Medium-High	97.6%	69213399.75 m³	11.5%
Sweden	19	Low	100%	13634007.75 m³	7.2%
Ireland	20	Low	97.9%	6666011.1 m³	8.2%
India	21	Extremely High	94.1%	1863005919.75 m³	15.7%
Peru	22	Medium-High	86.7%	44512002.9 m³	12.8%
Ecuador	23	Low	86.9%	23818122.9 m³	11.6%
Chile	24	High	99%	25806871.35 m³	14.2%
Japan	25	Low-Medium	100%	170743222.35 m³	9.4%
Poland	26	Low-Medium	98.3%	51092924.85 m³	6.8%
Norway	27	Low	100%	7318675.35 m³	7.9%
Denmark	28	Medium-High	100%	7819472.7 m³	5.8%
Australia	29	Medium-High	100%	34424843.4 m³	9.4%
Romania	30	Low-Medium	100%	25970882.85 m³	7.8%
Czech Republic	31	Low-Medium	100%	14457124.35 m³	8.5%
Pakistan	32	Extremely High	91.4%	298204659 m³	15.4%
Malaysia	33	Low	98.2%	43694098.65 m³	14.6%
Philippines	34	Low-Medium	91.8%	147934455.3 m³	13.4%
Saudi Arabia	35	Extremely High	97%	46998725.85 m³	12.6%
Indonesia	36	Medium-High	87.4%	369256880.25 m³	14.8%
Mexico	37	High	96.1%	174059216.55 m³	12.6%
United Arab Emirates	38	Extremely High	99.6%	13352042.7 m³	4.6%
Serbia	39	Low	99.2%	11795450.85 m³	4.9%
Luxembourg	40	Medium-High	100%	845070.3 m³	3.2%
Panama	41	Low	94.7%	5824935.45 m³	4.5%
Qatar	42	Extremely High	100%	3889421.55 m³	4.8%
Finland	43	Low	100%	7479972 m³	5.9%
Ukraine	44	Low-Medium	96.2%	59040578.7 m³	8.5%
Colombia	45	Low	91.4%	68691902.85 m³	12.6%
Belarus	46	Low	99.7%	12756586.05 m³	5.9%
Thailand	47	Medium-High	97.8%	94229970.3 m³	6.7%
Singapore	48	Low	100%	7897961.7 m³	8.1%
South Africa	49	Medium-High	93.2%	80066731.5 m³	12.4%
Argentina	50	Low-Medium	99.1%	61014294.9 m³	13.6%
Greece	51	High	100%	14071122.9 m³	11.4%
Egypt	52	High	99.4%	138151445.4 m³	12.7%
Algeria	53	High	95.6%	59198909.4 m³	10.5%

In Table 1, we have classified the country's most affected by the Corona virus (World Health Organization) [6]. And we have inserted the percentage of water deficit [7], and the percentage of connection of drinking water networks to citizens [8]. We calculated the quantities of water needed to clean hands during a quarantine that lasts 75 days for each country, as well as the rate of increase in the annual water needs of these countries.

4. Discussion

From (Table 1), one can conclude that:

The average increase in the water needs to face the Corona virus by hand washing only ranges between: 3.20% to 15.70%, at a global average rate of 9.68%.

The quantities of water required to wash hands only for a quarantine for a period of 75 days ranges from 845070.3 cubic meters to 1943087097.6 cubic meters at a rate of 144336447.05 cubic meters and for a total of 7794168140.70 cubic meters for 53 countries affected by COVID-19, which are very large quantities that cannot be mobilized in some countries that suffer from a deficit water.

Among the 53 countries most affected by the Corona virus, 27 countries in five continents suffer from significant water stress, which means that 50% of these countries may be unable to provide water to their citizens to wash their hands

only, without considering the quantities of water required to sterilize hospitals, administrations, shops and streets.

Mexico ranks second in the North American continent in terms of corona virus infections and ranks 24th globally in terms of water scarcity and 3.9% of its citizens are not supplied with clean water, but it is required to mobilize 174059216.55 cubic meters of water for a quarantine period of 75 days, an increase of 12.6% In their annual water needs.

In the continent of South America, Chile is ranked third in terms of infection with the Corona virus, it is one of the most water deficit countries, where it is in the rank 18 globally, and 1% of its population is not supplied with potable water, but it is required to mobilize 25806871.35 cubic meters of water for a quarantine 75 days, an increase of 14.2% in their annual water needs.

The Fifth place of infection with the Corona virus in Africa is occupied by Algeria. It is also 29th in the world in terms of water scarcity. 59198909.4 cubic meters of water that Algeria must mobilize for its citizens during 75 days quarantine, with an increase in its annual water needs of 10.5%, knowing that 4.4% of its population is not supplied with potable water.

Corona virus infection in India made it ranked first in Asia, and it is also ranked 13th globally in terms of water scarcity, while it is also required to mobilize 1863005919.75 cubic meters of water for a quarantine period of 75 days, an increase of 15.7% in its annual water needs, 5.9% of its population is not supplied with potable water.

Spain is one of the first European countries to have an outbreak of Corona virus. It is also ranked 28th in the world in terms of water scarcity and is required to mobilize 63118950.3 cubic meters of water for a quarantine period of 75 days, which equals an increase in its annual water requirement of 8.6%.

Australia ranks first in terms of corona virus infections on the continent of Australia and ranks 50th in the world in terms of water scarcity, while it is required to mobilize 34424843.4 cubic meters of water for a quarantine period of 75 days with an increase in its annual water needs 9.4%.

The (Table 1) also shows that there are several countries that do not suffer from a shortage of water resources or from a potable water network, but they are at the forefront of Corona virus infections such as: Russia, the United States of America, China and France, but they are required to take their future water reserves to face this epidemic and possible future epidemics.

5. Conclusions

The assessment of water consumption for washing hands for each person during quarantine to avoid the infection with the corona virus is approximately 18 liters per day.

Among the 53 countries most affected by the Corona virus, 27 countries in five continents suffer from significant water stress, which means that 50% of these countries may be unable to provide water to their citizens to wash their hands only, without considering the quantities of water required to sterilize hospitals, administrations, shops and streets.

The average increase in the water needs to face the Corona virus by hand washing only ranges between: 3.20% to 15.70%, at a global average rate of 9.68%.

Quarantine and hand washing are the best way to avoid infection with the Corona virus, but they cannot be applied in some countries that suffer from a water deficit.

To face the COVID-19 and various epidemics in the future, all governments must mobilize adequate water resources, as well as expedite the completion of water networks for all citizens.

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