

The Role of Safe Water in the control of COVID-19 Pandemic

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Abstract

Safe water constitutes major resources to meet the requirements of basic hygiene that are necessary in curtailing the spread of COVID-19. This study reviewed COVID-19 Pandemic and its attendant problems. The role of safe water in ameliorating the deadly effects of COVID-19 is discussed. Literature search was the major methodology to this review. Results revealed that devastating Pandemics including Bubonic plague and small pox, killing 200 million and 56 million people respectively have been reported in literature. Only 83,600 deaths were reported globally due to COVID-19 as at April 2, 2020. Two main possible sources of the Pandemic are natural source and transmission through bats and/or pangolins. Respiratory droplets are believed to be the most common mode of coronavirus transmission. No vaccine has been developed for COVID-19. To mitigate the Pandemic; maintain social distancing, avoid hands shake/hugging; constantly wash your hands under running taps and rub hands with sanitizer. There is no current evidence that corona viruses are present in surface/groundwater but controlling the spread of the virus is closely related to water and sanitation. COVID-19 has negatively impacted humans' health and the globe's economy. Preventing COVID-19 is feasible if the global humans' requirement for safe water is attained.

Keywords

Safe water; Basic hygiene; Coronavirus; Bubonic plague; Pandemics; Respiratory droplets; Social distancing.

Introduction

COVID-19, a contagious acute respiratory pandemic disease started at Wuhan, China on December 8, 2019 with an incubation period that spans from one day to fourteen days. The disease is contagious before incubation which makes it exceedingly dangerous to humans. COVID-19 belongs to the family of viruses including the common flu and SARS. The COVID-19 could be a new corona virus with symptoms of respiratory problems, fever and cough, and might cause pneumonia and death. The medium of spread like the SARS is through droplets from sneezes. On March 11, 2020, the Globe Health Organization announced that the COVID-19 virus was officially a virulent disease after it's spread to 114 countries in three months with over 118,000 people infected. The spread wasn't abated because it was expanding to other additional countries within the world. As at 12 March 2020, China had 80, 891 and 3,173 confirmed and deaths cases of coronavirus pandemic respectively. The entire world had recorded 125,260 confirmed and 4,613 deaths cases respectively [1]. These aerosols can penetrate the anatomy (lungs) via inhalation through the nose or mouth [2]. One in every of the colleges of thoughts believed the virus have been circulating harmlessly in human populations for quite a while before it became the pandemic that's now ravaging the entire world. There's the likelihood that a progenitor of SARS-CoV-2 jumped into humans, acquiring (new genomic features) through adaptation during undetected human-to-human transmission [3]. Once acquired, these adaptations would enable the pandemic to require off and produce a sufficiently large cluster of cases.

History has it that coronavirus is not unaccustomed the globe since it is related to animals. Additionally, there has been an identical outbreak of infectious epidemics (Ebola virus disease, Avian Influenza A (H7N9), geographical area respiratory syndrome corona virus (MER-COV, Pandemic (H1N1) 2009, Cholera, AIDS etc.) which are controlled thanks to timely intervention. Early research work of Chen and Yu (2020) on "First two months of the 2019 Coronavirus Disease (COVID-19) epidemic in China: Real-time surveillance and evaluation with a second derivative model" indicates that the coronavirus looks as if it would be nonlinear and chaotic and was responsive to effective interventions. Availability of data/information is key within the control, policy formulation and decision with regards to any epidemic. As at 31st March, 2020, vaccine has not been discovered for the COVI-19.

Water is a universal solvent and a part of the natural environment. For humans' health and well-being as well as for the continuity of

eco-system, availability of safe water is paramount. About 3.4 million people die every year from illnesses associated with contaminated water supplies and inadequate waste removal [4]. The diseases associated with water contamination are malaria, cholera, dysentery, hepatitis A, and schistosomiasis. Lack of safe drinking water is the major factor underlying the deaths of over 1.5 million infants and kids from diarrhea every year [4]. Safe drinking water is the water that does not represent any significant risk to health over a lifetime of consumption [5]. This review work therefore, is to compile available data on COVID-19 that is threaten the globe with a view to suggesting possible ways out of the pandemic disease. Emphasis is laid on the use of safe water in ameliorating the COVID-19 while the effects of corona virus (if any) on the safe water is discussed.

History of Pandemic Worldwide

History helps in knowing our past pitfalls and achievements while molding the future for careful treading. Grasping of changes in the globe can be achieved through studying of history apart

from comprehending the factors that cause change. Additionally, elements of an institution or a society that persist despite change can be understood [6]. The summary of the globe history of pandemic is presented in (Table 1, Figure 1 and 2) . A critical overview of the word history revealed that Pandemics have been part of humans' existence since inception of the world. The world record revealed that SARS Pandemic (2002 – 2003) has the smallest death records of 770 while the bubonic plague had the highest of 200 million (Table 1, Figure 2). The ongoing COVID-19 according to John Hopkins University estimates (April 08, 2020) has recorded deaths of 83,600 (Table 1, Figure 2). Going by the records of Pandemic in the world, COVID-19 has not wrecked severe havoc on the world compared to bubonic plague or even Smallpox of 1520. However, considering the rate at which COVID-19 spread as reported in the research of [7] in which a doubling time of the number of infected persons of 6–7 days and a basic reproductive number (R0) of 2.2–2.7 was established with regards to the outbreak in Wuhan, China deserved world's attention. In addition, the rapid human to human transfer has been confirmed

Year	Disease	No of Deaths (Million years)
1347-1351	Bubonic Plague	200
1520	Smallpox	56
1918-1919	Spanish flu	40-50
541-542	Plague of Justinian	30-50
1981-2020	HIV/AIDS	25-35
1855	The Third Plague	12
165-180	Antonine Plague	5
1600	17th Century Great Plagues	3
1957-1958	Asian Flu	1.1
1889-1890	Russian Flu	1
1968-1970	Hong Kong Flu	1
1817-1923	Cholera 6 outbreak	1
735-737	Japanese Smallpox Epidemic	1
1700	18th Century Great Plagues	0.6
2009-2010	Swine Flu	0.2
1800	Yellow Fever	0.15
2019-2020	COVID-19	0.0836
2014-2016	Ebola	0.0113
2012-2020	MERS	0.00085
2002-2003	SARS	0.00077
	Min	0.00077
	Max	200
	Mean	16.597
	Stdev	49.141

Table 1: Statistics of Deaths from World Pandemic History.

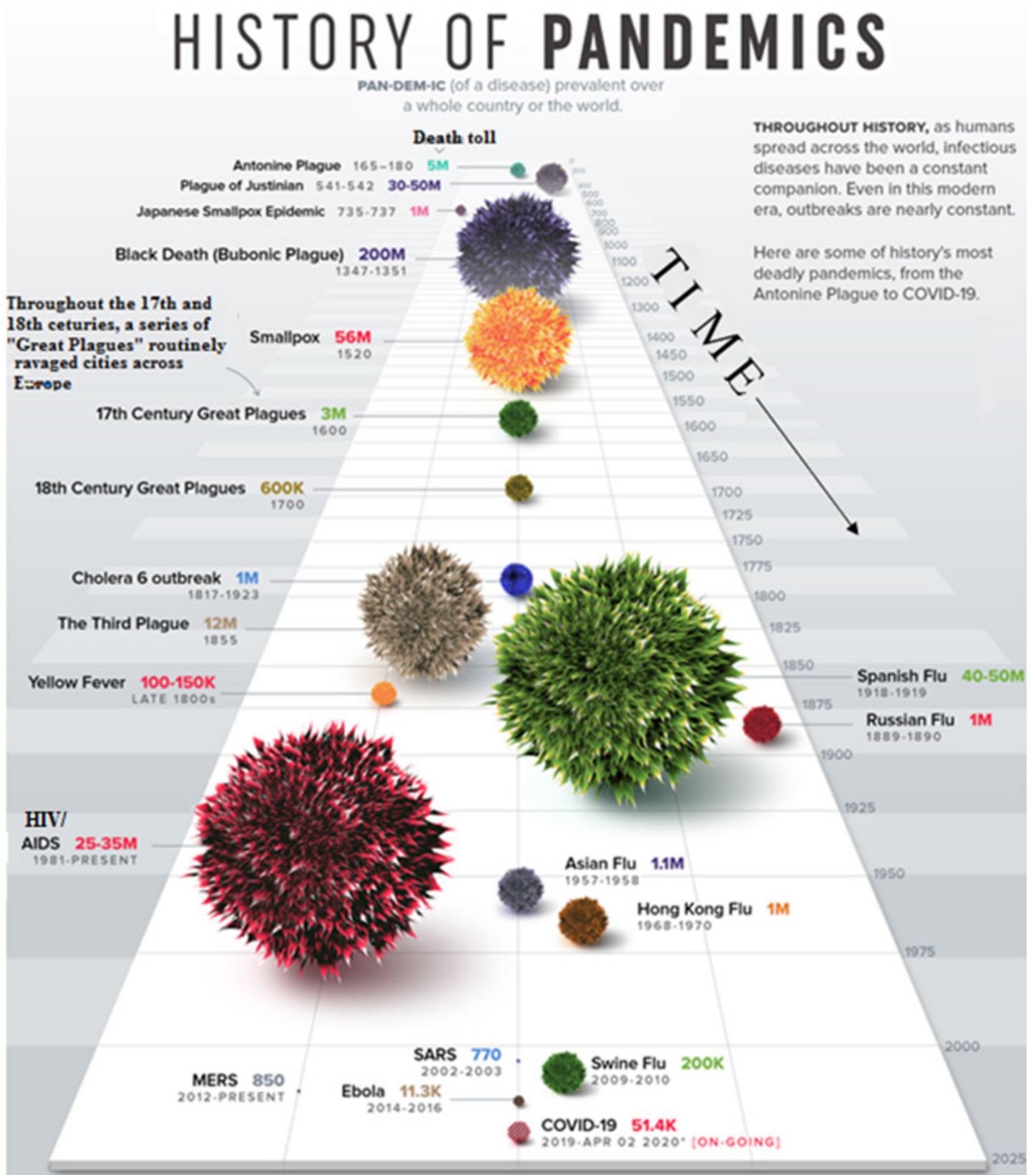


Figure 1: History of Pandemics.

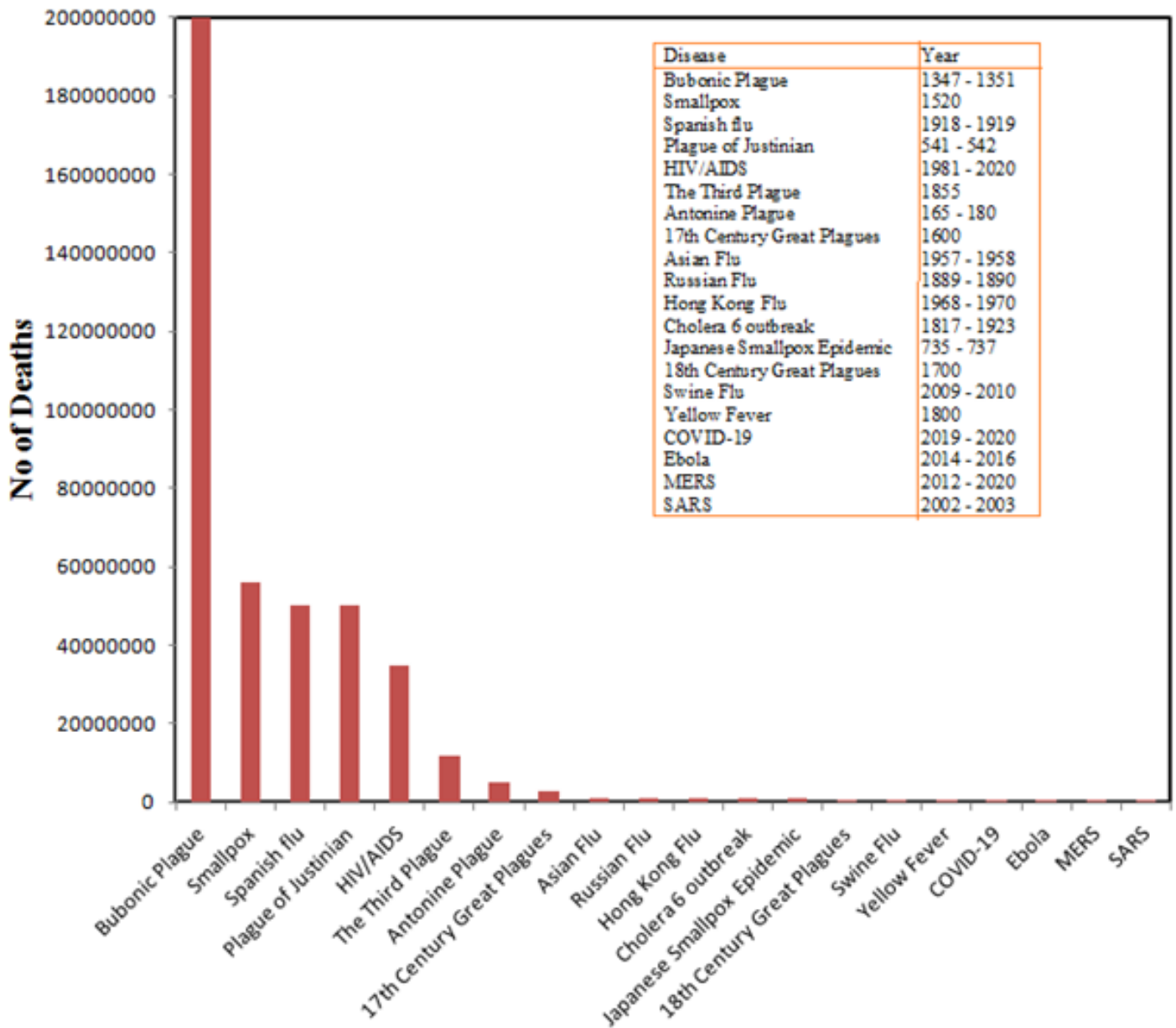


Figure 2: Deaths in the History of World Pandemics.

widely [8]

Origin of COVID-19 Pandemic

Leaping of wild animal virus species gap to ravage humans has been reported in literature. The Chinese has animal markets in existence for decades. The animal markets in China posed serious treats to humans’ health in view of the transmittable diseases from the animals to humans. However, the exact origin of the SARS-CoV-2 is still unclear. The belief that it was a lab-invented disease has been dispelled based on new research analysis [9]. Genomic analysis revealed that SARS-CoV-2 is phylogenetically related to severe acute respiratory syndrome-like (SARS-like) bat viruses; therefore bats could be the possible primary reservoir [8]. (Figure 3) is a diagrammatic representation of the school of thought that bats could be the primary source of COVID-19. The animal source could be that the patients infected with Wuhan coronavirus induced pneumonia in China may have contacted the disease during visits made to the seafood market or may have eaten infected animals or birds bought from the market

as food. Subsequently, further spread was a human to a human infection. The human to human spreading of the virus occurs due to close contact with an infected person, exposed to coughing, sneezing, respiratory droplets or aerosols.

The virus in form of suspended fine solid particles or liquid droplets in air can pierce into anatomy (lungs) through the nose or mouth by inhalation [2,10]. One of the hypotheses on the origin of COVID-19 stipulates the existence of the virus within humans’ community for quite some time before it degenerated to a pandemic that cut across the entire globe. This college of thought further indicates that COVID-19 possibly originated from SARS-CoV-2 precursor which subsequently acquires new genomic features for adaptation in human – human transmission [3]. Sequel to adaptation in human-human transmission, large clusters of the virus are produced which continue to spread across the globe.

The second hypothesis about the origin of COVID-19 stipulated natural source. The hypothesis is that the natural selection happened in humans-after the virus was transmitted from an animal host. This

natural source of COVID-19 was supported by the analysis of genomic data from SARS-CoV-2 and other similar coronavirus.

The result of the analysis revealed that the receptor-binding domain (RBD) sections of SARS-CoV-2 spike proteins were so effective at binding to human cells, which is caused by natural selection [3]. The virus eventually gained the ability to spread from human-to-human causing serious and life-threatening disease as a result of gradual evolution with time.

Transmission of COVID-19

The principal modes of transmitting COVID-19 are human – human contact and through respiratory droplets. However, the human – human transmission is most prevalent. Research of [11]. (2020) revealed that coronavirus can be isolated from respiratory droplets, faces and fomites. The virus can be contacted at a close proximity of two meters from infected persons and there is increase tendency of contacting the virus once in closer proximity to infected person. The pathways of entry into human system are through touching the eyes, mouth and nose after picking the virus by touching a surface, object or hand already contaminated by infected person. Thus, the hand is a principal agent of conveying COVID-19 to the human body (Figure 4).

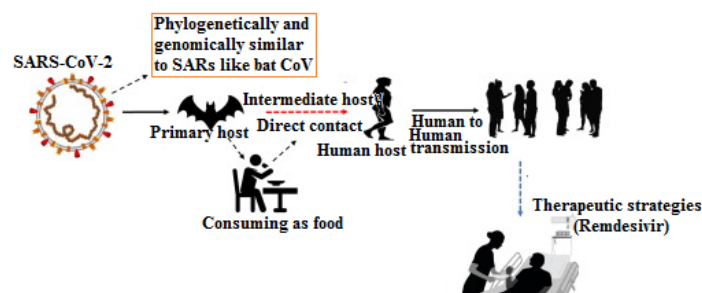


Figure 3: Diagram illustrating bats as the possible primary reservoir Mitigations of COVID-19 (Non Pharmaceutical approach).



Figure 4: Hand’s activities through which COVID-19 can be contacted & Preventive Measures.

Effects of COVID-19

COVID-19 has rapidly spread across the globe. It is profoundly disrupting fundamental activities including agriculture and food

systems, thereby endangering all those who depend on it as their livelihood. The lock-down orders across the entire world, asking people not to move at all, shutting borders in many countries in the world will obviously be all sorts of problems and issues.

Health Effects

Effects of COVID-19 are manifested in the health of humans as well as the economic down turn of the globe as a result of the Pandemic. There is continuous increase in the suffering of poor people as their health receives little to no attention arising from the coronavirus outbreak. Catastrophe may engulf the globe if deepening global health and economic crisis from COVID-19 are not addressed shortly. The COVID-19 pandemic could have serious consequences for women’s health, according to the UN Population Fund. The pandemic has disrupted access to sexual and reproductive health and gender-based violence services. It could also exacerbate existing financial inequality between men and women. Women generally are more susceptible to psychological defects arising from the COVID-19 outbreak. Access to vital health facilities and services are being denied which can spike up domestic violence and maternal mortality. Out of mere ignorance, misconceptions about virus transmission and fear of being quarantined, pregnant women stayed away from medical facilities and were forced instead into riskier home births. COVID-19 has negatively impacted sexual and reproductive health globally [12]. Functioning, well-resourced health systems are undoubtedly needed to manage the current Pandemic. The outbreak is already placing health services in developed countries under considerable strain. The recommendations for maternity services alone, to limit pregnant women’s exposure to ill persons, while ensuring that women receive essential care, means identifying potential cases before entry at health service points, delaying routine appointments and using strict isolation and infection control measures to limit transmission to other patients and staff [12]. Imbalance is created in health care provision routine, essential services are disrupted. The insufficient health workers are made to work beyond their breaking limits to combat the coronavirus. Severe hardships are meted to humans as a result of this outbreak. Few health advantages recorded during this coronavirus Pandemic include drop in pollution as revealed by NASA space images. Nitrogen oxide (NO₂) is commonly produced by car engines, power plants and other industrial processes. The lockdown order has led to reduced vehicular movement while many vital industrial plants were closed down leading to reduced pollution.

Economic Effects

The global economy has being in a state of uncertainty since the outbreak of COVID-19 apart from the growing humans’ sufferings. Disruption of the world economy came up as a result of COVID-19 with the existing financial inequality between men and women widening as most domestic responsibilities during this coronavirus pandemic outbreak fall on women. Additionally, single parents that may work and earn money are prevented from doing so to comply with the social distancing measures.

Additional economic consequences due to the outbreak of COVID-19 include massive reduction in international trade, dropping in the global demand for both consumption and investments. Tourism and construction industries are worst affected by coronavirus. To ameliorate the devastating consequences of globe economic crunch due to outbreak of COVID-19, Central banks worldwide introduced money into the economy and slashed down the interest rate. This economic strategy may not have any impact on USA and Europe economy as base interest rates are already approaching zero. There

is serious disruption in supply of goods as manufacturing sectors shut down due to lockdown order and quarantine measures spread across the globe. Unemployment is on the increasing lather while financial burden on humans are being ameliorated by policy makers through the implementation of fiscal and monetary measures. The International Monetary Fund on April 9, 2020 remarked that the COVID-19 pandemic has caused unprecedented world economic downturn the type that has never happened since the Great Depression.

Role of safe water

Water is required in all aspects of life especially for domestic and agricultural activities. Safe water represents water that is affordable, available at required quantity as drinking water, for food preparation and personal hygiene and washing [13]. It also signifies water that does not represent any significant health risk. Though safe water is fundamental to human existence, unfortunately, its availability is limited [14]. Fresh water represents 2.7% of the entire globe water. The availability and distribution of the world freshwater worldwide is lopsided. The chunk of the water is not available for use as it is locked up in icecaps and glaciers. Even, the available fresh water in form of surface water and groundwater has associated problems that make them not to be readily available as safe water. Though, the right to safe water is fundamental to human existence as well as continuity of ecosystem [15], it's availability and affordability worldwide amidst continual increase in world population and industrialization is still a mirage and deserve special attention.

the most prevalent way of contacting COVID-19 is through human-human contact, avoiding human-human contact by maintaining social distancing of not less than two meters is one of the most successful ways to mitigate contacting the virus. Another most useful agent of transmitting the virus is the human hand. Therefore, avoiding hand shake and hugging one another are pertinent to mitigating coronavirus (**Figure 4**). Up till the time of this review work, no vaccine has been discovered for COVID-19. However, appropriate utilization of human's hand as illustrated in (**Figure 4**) will go a long way to curtail the menace of COVID-19. Thus to control/prevent coronavirus, compliance with simple hygiene rules of constantly washing of hands and rubbing with sanitizer become imperative [1]. Currently, there is no research work to indicate presence of coronavirus in either surface water or groundwater and the virus is not transmitted through contaminated water. However, the complimentary requirements of safe water in maintain the simple hygiene rules to put coronavirus in abeyance is noteworthy. Constant washing of hands with soap can substantially reduced COVID-19 transmission and assist people to stay healthy. Worldwide, about 1.1 billions of people do not have access to safe water [16] and are prevented from taking precautionary hygiene measures required of safety from coronavirus attack. Many developing countries of the world are worst hit of lack of sufficient safe water [17]. More exacerbating, is uncontrolled open waste dump and open defecation in some instances. Such unhygienic activities constitute precursors to most diseases and should be addressed promptly to curtail the spread of COVID-19. Presently, about 89% of the people in the world have access to safe water. This indicates that one person amongst six people lack access to potable water and is susceptible to poor health [18]. The evil effects of COVID-19 can be curtailed if simple hygiene rules are maintained. However, developing a vaccine to cure the virus is the ultimate as it is obvious that availability of safe water to meet the hygiene requirements is an illusion for now. It is advisable to strictly follow the most critical preventive measures of washing and sanitizing hands to prevent infection by coronavirus.

Continual attitudinal change (no shaking of hands, no hugging of one another, civilized coughing etc.) may also assist in this regards.

Role of food

Apart from observing personnel hygiene and respiratory etiquette, food is essential for the upkeep of humans against any form of diseases. There has not been any report indicating that food constitutes risk to instituting corona virus. However, washing of hands and/or using sanitizer after handling food packages is essential to prevent contacting COVID-19 through surfaces of the food packages. Food is not a living host and is therefore remote for virus development [19]. Notwithstanding, food should be cooked to required temperature to forestall food borne diseases. COVID-19 however, had untold negative impact on food supply especially during the total lock down of the globe.

Combating COVID-19 through Artificial Intelligence (AI) and Media-Information Literacy (MIL)

Arising from the COVID-19 outbreak, there was serious down turn in the worlds' economy, schools were closed economic activities were paralyzed with the whole globe in high levels of uncertainty. Combating COVID-19 through Artificial Intelligence and Media-Information Literacy was globally accepted during this period. Since contacting COVID-19 is mainly through making contact with humans and objects, using remote technologies to control its spread has become inevitable. The AI has facilitated exchanges of views and information between the scientific communities. National calls for tenders companies were executed in neighboring countries. The use of AI is good but it has some short comings because a sizeable group of people are not digital literate making its application difficult. MIL covers all competencies related to information literacy and media literacy that also include digital or technological literacy. It focuses on different and intersecting competencies to transform people's interaction with information and learning environments online and offline [20]. COVID-19 is the first pandemic in human history where technology and social media are being used on a massive scale to keep people safe, productive and connected while being physically apart. MIL is an online and/or offline arrangement for people to interact and disseminate information across the globe. The media works employing understandable languages, images, colors etc. However, some fake news is occasionally circulated giving misleading information that could breed acrimony among countries. Despite this short comings MIL has assisted in educating the globe on the COVID-19 epidemic, thereby curtailing its spread.

The survivability of COVID-19 in water

Some research works have been carried out with respect to COVID-19 in water while others are ongoing. Epidemic of severe acute respiratory syndrome has been reported in literature [21]. Research has it that other coronavirus strains (SARS) can survive for 12 days in tap water at room temperature while in waste water; it will only survive for 2 to 3 days. The virus can stay longer in both water at a cooler temperature [22]. As for sewage water, research revealed that infectious droplets may contaminate water and the virus has been detected in waste water. However, no record indicated that the virus has been contacted in treated drinking water due to the dilution effects. Even in swimming pool and large body of water, the risk of contacting the virus is low. Thus, the pools of water, hot tubes and other chlorinated water are not sources of COVID-19 because the virus is rendered inactive as its water layer is disrupted.

Though, research is currently on going with respect to contacting COVID-19 through wastewater and from pathogens exposure. For now, it is the general acceptance of experts that exposure to waste water is not a significant transmission route for COVID-19 [23]. Additionally, drinking water is disinfected before consumption while wastewater is equally disinfected prior to its being returned to the environment. However, cautions must be exercised especially in some developing countries where wastewater is disposed to open pools of water without treatment. Corona virus has not been detected in treated drinking water because the treatment plants use filters and disinfectants to remove or kill virus that can cause COVID-19. Drinking water being served to humans may not have problems related to COVID-19 because government agencies [24] always regulate water treatment plants to ensure that treated water is safe for drinking. However, caution must be exercised in the application of disinfectants because not all disinfectants are effective against the corona virus [25]. No perfect disinfectant or product for healthcare disinfection, however, some array of excellent disinfectant products for COVID-19 are available with Environmental Protection Agency [24] that has qualified under the EPA's emerging viral pathogens program for use against SARS-CoV-2 [26].

Conclusion

COVID-19 broke out at Wuhan, China on December 8, 2019 and subsequently spread to almost all the countries of the world. Research reported two possible sources of the Pandemic; natural source and transmission through animals (bats and/or pangolins). Respiratory droplets are still believed to be the most common mode of coronavirus transmission. No vaccine has been developed for COVID-19. Mitigation of the Pandemic involves maintaining social distancing as this reduces transmission of the virus through direct exposure, touching a surface or aerosolized particles. Also, constantly wash your hands under running taps and dry off your hands using a clean towel or paper towel. COVID-19 has negatively impacted humans' health and the economy of the world. Basic hygiene could drastically reduce/eliminate COVID-19, but meeting the humans' worldwide requirements for safe water is an illusion

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