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Review

Environmental perspective of COVID-19

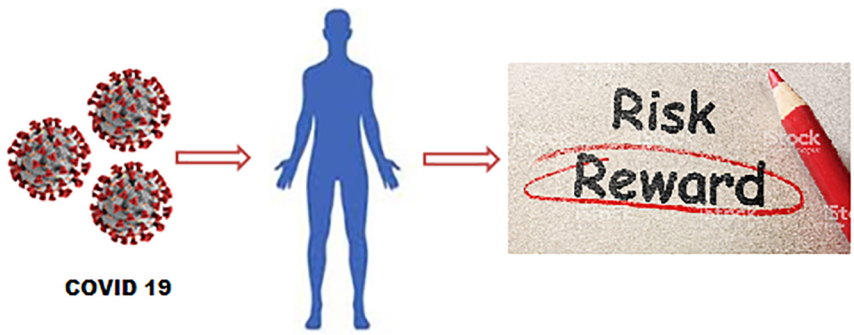
Saeida Saadat [a], Deepak Rawtani [a,*], Chaudhery Mustansar Hussain [b,*]

[a] Gujarat Forensic Sciences University, Nr. DFS Head Quarters, Sector 9, Gandhinagar 382007, Gujarat, India
[b] Department of Chemistry and Environmental Science, New Jersey Institute of Technology, Newark, N J 07102, USA

HIGHLIGHTS

- COVID-19 has been declared as a global health emergency due to spread of corona virus.
- To prevent the transmission mask, surgical gloves and sanitizer were used.
- It has led to generation of massive amount of medical wastes in the environment.
- Millions of people have been placed under lockdown to reduce the transmission.
- Reduction in economic activities and improved air and water quality across the globe.

GRAPHICAL ABSTRACT



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ABSTRACT

The outbreak of COVID-19 has caused concerns globally. On 30 January WHO has declared it as a global health emergency. The easy spread of this virus made people to wear a mask as precautionary route, use gloves and hand sanitizer on a daily basis that resulted in generation of a massive amount of medical wastes in the environment. Millions of people have been put on lockdown in order to reduce the transmission of the virus. This epidemic has also changed the people's life style; caused extensive job losses and threatened the sustenance of millions of people, as businesses have shut down to control the spread of virus. All over the world, flights have been canceled and transport systems have been closed. Overall, the economic activities have been stopped and stock markets dropped along with the falling carbon emission. However, the lock down of the COVID-19 pandemic caused the air quality in many cities across the globe to improve and drop in water pollutions in some parts of the world.

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* Corresponding authors.
E-mail address: rawtanid@gmail.com (D. Rawtani).

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1. COVID-19 global pandemic

On late December 2019 in a hospital in Wuhan city, in China an unusual pneumonia was noticed with a link to an animal market that sells poultry, fish and other animals to the public (Xu et al., 2020). This event was soon reported to the World Health Organization (WHO). In a month (26 January), the causal microorganism had been identified as a novel coronavirus that was named COVID-19**.** Genome sequencing and reverse transcription polymerase chain reactions tests of this virus had been done. WHO R&D had been started to quicken diagnostics, therapeutics and vaccine development and a candidate vaccine was prepared for initial laboratory testing (Wang et al., 2020).

The emergency committee of WHO declared a global health emergency on 30 January 2020 based of growing case notification rates at Chines and international locations. The case detection rate is changing on a daily basis and could be tracked in nearly real time on the developed website by Johns Hopkins University and other media. In the middle of February 2020, China suffered the huge burden of morbidity and mortality, whereas the incidence in other Asian countries, in Europe and North America remains low so far (Velavan and Meyer, 2020).

Coronaviruses are single-stranded RNA viruses that can infect not only humans, but also a huge variety of animals as well (Kooraki et al., 2020). These viruses were first studied by Tyrell and Bynoe in 1966 who cultured them from patients with common cold. Due to their spherical virions morphology along with a shell and surface projections like a solar corona, these viruses were named coronaviruses. In Latin corona means crown and there are four different subfamilies including alpha, beta, gamma and delta coronaviruses identified so far. Alpha and beta- coronaviruses have been originated from mammalians, particularly from bats, gamma- and delta- coronaviruses originated from pigs and birds (Ather et al., 2020). The genome of these viruses differs between 26 kb and 32 kb. The beta- coronaviruses could cause severe disease and fatalities among the other seven subtypes of these viruses. Alpha-coronaviruses cause mildly symptomatic or even asymptomatic infections. SARSCoV-2 is a beta-coronavirus and is related to the SARS-CoV virus. There are four structural genes encoding the nucleocapsid protein (N), the spike protein (S), a small membrane protein (SM) and the membrane glycoprotein (M) with an extra membrane glycoprotein (HE) occurring in the HCoV-OC43 and HKU1 beta-coronaviruses. The whole genome of SARS-CoV-2 is 96% identical to that of a bat coronavirus (Kucharski et al., 2020; Cao et al., 2020). SARS-CoV-2 seemingly had made its transition from animals on an animal market in Wuhan city in China. Although, the efforts to identify potential intermediate hosts seem to have been neglected in Wuhan and the exact transmission route have to be clarified. The primary clinical symptoms of the SARS-CoV-2- linked disease COVID-19 which permitted the case detection as pneumonia. Recently literatures report the description of gastrointestinal symptoms and asymptomatic infections, especially among young children. The average incubation period is ranging from 0 to 24 days (Li et al., 2020; Zhou et al., 2020). As we are writing these lines, the pandemic affects 200 countries and territories, with around 1,357,382 infected subjects, more than 120, 438 deaths and 456.773 recovered patients, according to the Johns Hopkins University.

2. Unpredictable environmental aspects of COVID-19

As WHO has declared the fast spreading of COVID-19 as an epidemic, the citizens around the globe hastened to go home. For instance, in the case of Wuhan city in China which has been the epicenter of the pandemic with over than 11 million people, is shown to have produced 200 tons of clinical trash on a single day exactly 24 February/2020 which is four times the amount the city's only dedicated facility can incinerate per day. As coronavirus is spreading rapidly to other parts of the world, very soon the medical waste management could be a big issue. Medical health organizations waste management companies have already taken step in coronavirus decontamination services, it is becoming very crucial for governments to find solutions soon. At the meantime, it is every individual's duty to follow the regulations while discarding of their face masks and other medical wastes (Luan and Ching, 2020). To the end, it is possible only by mutual understanding and willingness and world will emerge stronger than this epidemic. Some people are at higher risk of adverse effects from contact to medical wastes as well, including cleaners, trash collectors and some other people who have to spend a great amount of time in public places. All over the world governments stopped students to go to schools and universities, and a lot of employees are being asked to work from home, only those who are maintaining the cleanliness of cities have to go to their jobs daily, that makes them among the most vulnerable groups and one that is highly susceptible to the virus from respiratory shed droplets on the masks. They may also be infected by other pathogens existing in the discarded pieces of garbage, for instance meningitis and Hepatitis B. The masks are made up of plastic based materials that are liquid- resistant and are long lasting after they are discarded, ending up in ocean or landfill. The surgical masks should not be worn longer than one day, discarding them and empty bottles of hand sanitizer along with solid tissue papers are ending up to a huge trail of medical waste in the environment. For instance, in Hong Kong, where COVID- 19 infection started in late January/2020 the medical wastes have already polluted the environment. Recently, an environmental NGO Ocean Asia in Soko islands took a survey, according to it, in Hong Kong a large amount of discarded single-use masks washed up to a 100-meter stretch of beach. Gary Stokes the director of the Ocean Asia NGO, who has been monitoring the ocean surface trash, his team has seen a few masks over the years, but now they were spotted all along the high tide line and seashore with new deposits coming with each current. While this recent COVID-19 outbreak, the general public have started wearing surgical masks in order to take precautionary measures. When 7 million people suddenly start wearing one or a couple of masks daily, single use gloves and hand sanitizers, the amount of trash created is going to be substantial. The contrary impacts of such medical wastes are far-reaching. When these are remained discarded in an animal's natural habitat in both land and ocean this could cause animals to mistakenly eat this as food and lead in their death (Hellewell et al., 2020). The diagram below illustrates the problems of polluting the environment by medical wastes while COVID-19 pandemic (Fig. 1).

3. Socio economic environmental aspects of COVID-19

COVID-19 does not affect everyone in the same way. There are several reasons that's why different socioeconomic groups are affected by this pandemic in different ways. To understand the consequences, and to predict how this pandemic affects differently with various socioeconomic groups is not easy and good data is the key to it. These socioeconomic factors include population density, urban and rural settings, education level, lifestyle, the size of household and homeowners & tenants. Sometimes only a single block distance neighborhood household within the socioeconomic spectrum can make a huge difference in

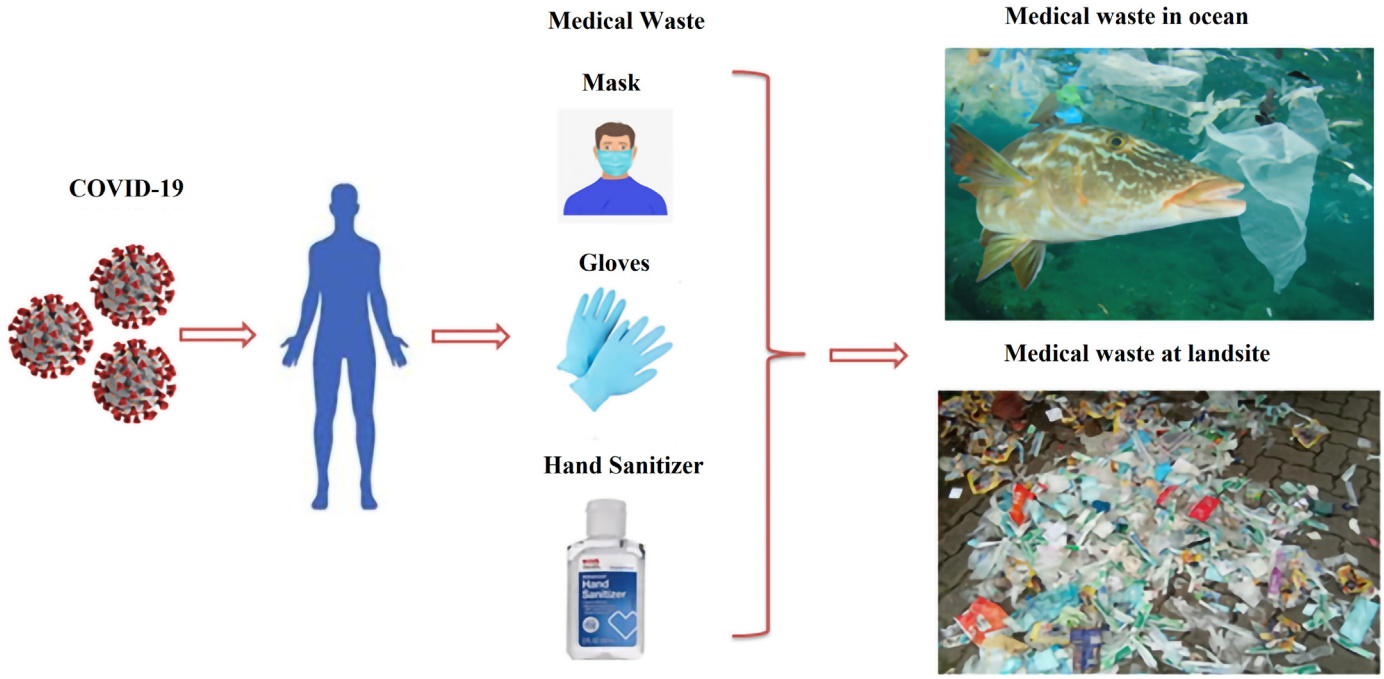

Fig. 1. Medical wastes generated during COVID-19 pandemic in the environment.

one's life (demonstrate form the US in Club Vita's US longevity map). Therefore, sometimes it is very unfortunate that people who are feeling the effects of COVID-19 very severely, are probably in your neighbors (Messner, 2020). Majority of the countries are now trying different tactics to stop the spreading of the disease and trying to limit only a subset of the people would catch the disease. It has been indicated that groups with lower socioeconomic status could be more at danger from the spread of the COVID-19, based on the analysis of New York showing that poor neighborhoods have been affected highly. COVID-19 spreads by droplets shed of the respiratory system by someone with the virus, which means it would spread with higher proximity of people, larger contact networks and lower levels of hygiene. There are some factors, which increase the risk of catching the virus.

1- Population density: Close contact among people is very high in urban areas rather than rural areas.
2- Household size: A big household will have a higher chance to bring the virus home, while in household where one person lives alone; he/she will have to catch the virus outside the household. In Sweden, social-distancing regulations are not taken very strictly due to the high proportion of single person household. Whereas in Italy based on the multi-generational homes apparently contributed to the multiplication of the coronavirus.
3- Social distancing level: social distancing is very effective to stop the spread of the disease, but several reasons that various groups might show dissimilar levels of social distancing:

- Official advice might be dependable between regions, for instance, guidance in the US has varied even between neighboring towns. Access to local guidance might be different between socioeconomic groups, for instance guidance might be provided online or in particular languages.
- Working from home might reduce social contact, but can only be available to some people focused in jobs linked to higher socioeconomic status.
- Stay at home regulations would be more than a challenge for those who live in smaller and crowded houses or without outside space.
- Some groups would be obedient to social distancing regulations not all.
- Not all who are infected by the COVID-19 will react severely to it. There are some factors that contribute to the risk of COVID-19 but they are probably felt differently by different socioeconomic groups (Lipsitch et al., 2020)
- People who have had medical problems of diabetes, chronic respiratory disease, cardiovascular disease, or even high blood pressure and cancer are at higher risk from coronavirus (Giannis et al., 2020; Fang et al., 2020; Zheng et al., 2020).
- WHO has warned the smokers that they might be highly at risk because to the obvious effects of smoking on the lungs and smoking is common in lower socioeconomic groups.
- Different socioeconomic groups do not have access to the same level of healthcare services. This would particularly common in countries like US where the huge number of uninsured population is concentrated in certain industries not to universal health care system.

Therefore, some socioeconomic groups are more likely at risk compared to others. So, logically higher numbers of deaths can be expected from certain parts of society. This can be highly related for pension plans using analysis of this experience of the population to predict future mortality rates. The post pandemic population may look more different compared to the start point of this outbreak. The annual percentage change in Gross domestic products is shown in Table.1.

The short-term scenarios of the COVID-19 environmental aspects raise many questions. China is struggling to rebound from the epidemic and has to limit the re-entry of COVID-19 to its region by put a check on travelers coming from abroad (Bogoch et al., 2020). In a country with such a high population, where the majority of its population has not yet experienced COVID-19, and has no immunological contact with this virus, the possibility of second wave is a big risk. European and North American countries has not yet reached to the peak of the epidemiological curve. One crucial aspect seems obvious: the fast control of the outbreak done by China could not be implemented to democratic countries where rights of individuals are very high. Therefore, outside china no leader has the capability to enforce these measures at the level of China (Bai et al., 2020). The question is: what will happen in countries of Indian sub-continent, the Middle-East and South America, where they live in crowded forms traditionally, big gatherings are

Table 1
Latest world economic outlook growth projections (Real GDP, Annual percent changes).

	2019	Projections	
		2020	2021
World output	2.9	−3.0	5.8
US	2.3	−5.9	4.7
Germany	0.6	−7.0	5.2
France	1.3	−7.2	4.5
Italy	0.3	−9.1	4.8
Spain	2.0	−8.0	4.3
Japan	0.7	−5.2	3.0
United Kingdom	1.4	−6.5	4.0
China	6.1	1.2	9.2
India	4.2	1.9	7.4
Russia	1.3	−5.5	3.5
South Africa	0.2	−5.8	4.0

Source: IMF, World Economic Outlook, April 2020 (IMF.org).

common, and the public health systems are insufficient. The possibility of secondary peak appearance could not be estimated. In the mid-term, the scenario in the southern Hemisphere should be considered. Not almost all South American and African countries have access to national health systems and sufficient health care services. Many of these nations decided to close the borders, however very late, when they already had patients of COVID-19 inside. All these indications show that the Southern Hemisphere would not escape from this pandemic. The outbreak is widening in the southern Hemisphere now, and this is happening while the higher income nations are struggling over their own problems in (i) applying control actions (ii) trying to recuperate from the massive social and economic impacts, and (iii) focusing in preventing re-entry of COVID-19 by foreign travelers (Chinazzi et al., 2020). The long-term scenario of probable secondary waves of outbreak is concerning as well. A second wave might be devastating more than the first one, based on other pandemics in history. Economists have shown serious concerns about the economic effects of control measures taken during this crisis (Hemida and Abduallah, 2020). However, there are many models that show the economic impacts of the disease and majority of the economists are challenged by the social and economic depth of the pandemic. They are trying to understand the control as soon as possible. Although the economic losses are obvious, but still economists are not able to grasped the extending nature of the outbreak that is causing far more economic damage compared to drastic measures taken to end the pandemic globally as soon as possible (Meo et al., 2020; Anderson et al., 2020. The COVID-19 pandemic will have severe impact on socioeconomic growth across the globe as shown in Table.2.

4. Need for new rules and regulations for COVID-19

General actions to decrease person to person transmission of coronavirus are needed to control the present outbreak**.** Special restrictions strategies and efforts should be applied to protect the highly vulnerable populations such as children, health care workers, and older aged people (Kucharski et al., 2020). A guideline has been already published for the medical employees, health care providers, and public health individuals and researchers who are interested in working in the coronavirus (Mossa-Basha et al., 2020). The major death cases of coronavirus outbreak are happening mainly in old people probably because of a poor immune system that allows rapid growth of viral infections. The public services must provide in decontaminating reagents for sanitizing hands multiple times on a daily basis (Luan and Ching, 2020). Physical contact with contaminated and wet things must be counted in dealing with the coronavirus, particularly agents which could be a possible rout of transmission. China and some other countries such as the US applied travel screening that could control and prevent the spread of the virus. Epidemiological alterations in coronavirus infections must be observed. The probable routes of transmission and subclinical infections, adaptation, progression must be taken into consideration and spreading of virus among people and potential intermediate animals and reservoirs should perceived. Moreover, still there are significant numbers of questions that need to ponder. These are, but not limited to, details about how many people have been tested, how many of them turned positive and whether this range stays constant or fluctuating. Additionally, only fewer pediatric cases have been reported to date; that could be due to lack of testing and not due to true infection (Rothan and Byrareddy, 2020).

Table 2
Merchandise Trade Volume and Real Gross domestic products (GDP) 2018–2021 Annual percent change (Trade Set to Plunge as COVID-19 Pandemic Upends Global Economy).

	Historical		Optimistic scenario		Pessimistic scenario	
	2018	2019	2020	2021	2020	2021
Volume of world merchandise trade	2.9	−0.1	−12.9	21.3	−31.9	24.0
	Exports					
North America	3.8	1.0	−17.1	23.7	−40.9	19.3
South and Central America	0.1	−2.2	−12.9	18.6	−31.3	14.3
Europe	2.0	0.1	−12.2	20.5	−32.8	22.7
Asia	3.7	0.9	−13.5	24.9	−36.2	36.1
Other regions	0.7	−2.9	8.0	8.6	−8.0	9.3
Imports						
North America	5.2	−0.4	−14.5	27.3	−33.8	29.5
South and Central America	5.3	−2.1	−22.2	23.2	−43.8	19.5
Europe	1.5	0.5	−10.3	19.9	−28.9	24.5
Asia	4.9	−0.6	−11.8	23.1	−31.5	25.1
Other regions	0.3	1.5	−10	13.6	−22.6	18.0
Real GDP at market exchange rate	2.9	2.3	−2.5	7.4	−8.8	5.9
North America	2.8	2.2	−3.3	7.2	−9.0	5.1
South and Central America	0.6	0.1	−4.3	6.5	−11	4.8
Europe	2.1	1.3	−3.5	6.6	−10.8	5.4
Asia	4.2	3.9	0.7	8.7	−7.1	7.4
Other regions	2.1	1.7	−1.5	6.0	−6.7	5.2

Source: WTO Secretariat for trade and consensus estimates for historical GDP. Projections for GDP based on scenarios simulated with WTO Global Trade Model.

5. Green & clean environment-COVID-19

Only in a period of few months, the world has changed. Thousands of people have been deceased, and hundreds of thousands have been infected by COVID-19. And the rest of people who are not infected, their entire life has been changed by this virus. In Italy, the most massive travel restrictions are being placed since Second World War. In London, the normal busy bars, theatres, and other public places have been closed and people are asked to stay in their homes. The flights are being canceled in all over the world. Majority of people are staying at home, practicing social distancing and working remotely (Harapan et al., 2020). It is all happening to control the spread of coronavirus, and to decrease the death rate. However, all these changes have led some unexpected consequences. As industries, transportation systems and all other bossiness have shut down; it has caused a sudden drop in carbon emission. Compared to this time last year, levels of air pollution in New York have dropped at almost 50% due to measures that have been to restrict the spread of virus. In China, emissions data shows a 25% decrease at the starting point of the year as people were told to stay at home, factories closed and coal use feel by 40% at china's largest power plants since the last three months of 2019. According to the ministry of Ecology and Environment, the amount of good quality air was around 11.4% compared with the same time last year in more than 330 cities all over China. In Europe, nitrogen dioxide (NO_2) emission dropped over northern Italy, Spain and UK, as shown in satellite images (Ficetola and Rubolini, 2020).

This epidemic has also caused extensive job losses and threatened the sustenance of millions of people as businesses are struggling and are shut down to control the spread of virus. Economic activities have been stopped and stock markets dropped along with the falling carbon

Fig. 2. Comparison of air quality in some of the biggest cities around the world before the COVID-19 pandemic and while the lockdown.

emission. On contrary, it is definitely a decarbonized, maintainable economy that many have been supporting for decades. An epidemic of this type that is taking people's lives definitely should not be seen as a route of bringing about environmental change either. First of all, it is not certain for how long this dip in emission will be. When the epidemic finally subside carbon and pollutant emissions get back then it would be as if this clear skied interlude never happened and the changes we see today will not have lasting impact (McCloskey and Heymann, 2020).

Another unexpected environmental impact of coronavirus has been observed in Venice, Italy. As the tourist's numbers culled due to the coronavirus, the waters in Venice's canals are cleaner compared to the past. While motorboats, sediment churning and other water pollutants have been dropped efficiently, residents got amazed by seeing the clear water and the fish could be seen once again in the canals.

One of the other effects of coronavirus on environment is the noticeable drop in coal consumption. This contributed in a large scale drop in air pollutants in China. The number of airborne pollutants like CO_2, CO and nitrous oxides has fallen too. As millions of people are holding on lockdown across the globe, energy consumption profiles in buildings are being disturbed. As many people working from home nowadays, domestic energy consumption is predicted to rise very quickly. The predictions data showed that this has risen around 6 to 8% in the US. This pandemic would ultimately save energy and also might have an effect on reducing the consumption of polluting fuels in power stations as the demand has been dropped (Lau et al., 2020). The COVID-19 pandemic has changed the air quality in many cities across the world as shown in the Fig. 2.

6. Conclusions

The COVID-19 pandemic is spreading very quickly every day, and the number of people putting on lockdown is increasing, to date more than 120, 438 people have died across the globe and there is a direct loss to the world economy. However, many think that there is a good side; that the spread of virus has been decreasing air and water pollution and probably even saved lives in this process. Nevertheless, this epidemic which is taking people's lives certainly should not be seen as a way of bringing about positive environmental change. First of all, it is not certain for how long this dip in emission will be. When the epidemic finally subside, then carbon and other pollutant emissions get back then it would be as if this clear sky view never happened and the changes we see today will not have lasting impact. General actions to reduce person to person transmission of COVID-19 are required to control the current outbreak. Special attention and labors should be applied to save the highly vulnerable populations including children, health care workers, and old people. There is already published guideline available for the medial employees, health care providers, and public health individuals and researchers who are interested in working in the coronavirus. Most of death cases of coronavirus outbreak are happening largely in old people possibly due to a weak immune system that permits rapid growth of viral infections. The public services must provide decontaminating reagents for sanitizing hands multiple times on a routine basis. Physical contact with contaminated and wet things must be taken into count while dealing with coronavirus, particularly agents that could be a possible route of transmission. Epidemiological alterations in coronavirus infections must be observed taking into consideration the probable routes of transmission and subclinical infections, furthermore to the adaptation, progression, and spreading of virus among people and potential intermediate animals and reservoirs. There are still some remaining doubts that have to be considered. The most important thing is about the details of how many people have been tested, how much of them turned positive and whether this range stays constant or variable. A less number of pediatric cases have been reported to date; that could be due to lack of testing and not due to true infection.

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