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The 2019 Novel Coronavirus Outbreak: Current Crises, Controversies and Global Strategies to Prevent a Pandemic

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The 2019 novel coronavirus (2019-nCov) has been implicated in the outbreak of an uncommon pneumonia in Chinese City of Wuhan, Hubei Province first reported in late December 2019. Since then, infection has spread to other Chinese cities, as well as internationally, threatening to trigger a pandemic. On January 30 2020, the World Health Organization (WHO) in an effort to slow down the global spread of the virus declared the outbreak, "A global public health emergency of international concern". As at the time of this review, there were more than 31 000 confirmed cases and 638 deaths reported globally. Controversies exist on the origin of the virus with diverse views. The swift rise in morbidity and mortality rate of the virus has caused widespread alarm in China and other parts of the world. This review is aimed at providing relevant information on the possible origin of the virus, its mode of transmission, associated risk factors, existing controversies, consequences of the current trend and control interventions required to halt the widespread of the new coronavirus outbreak.

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1. INTRODUCTION

Nothing threatens the world like the emergence of a deadly virus with pandemic potential. Right from time immemorial, man's existence has been threatened by one pandemic or the other which claimed the lives of thousands and even millions of people across the globe [1,2]. While Experts have continued to warn against an impending pandemic, just this late December 2019, the Chinese City of Wuhan, Hubei Province reported an outbreak of uncommon pneumonia caused by the 2019 novel coronavirus (2019-nCov). Cases have been exported to other Chinese cities since then, as well as internationally, threatening to trigger a pandemic in the face of seeming containment failure [3-9].

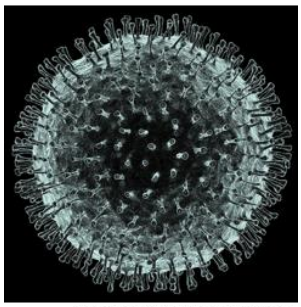
There is a theory that every 100 years, a pandemic happens. For instance: the 1720 Plague, 1820 Cholera outbreak, 1920 Spanish Flu and now the 2019-nCov outbreak [1,10]. Some people considered these events as mere accident. but the accuracy with which these events take place is scary and calls for global concern.

The first coronavirus outbreak was reported in the mid-1960s. Sub-types of the viruses include: alpha, beta, gamma, and delta, with only alpha and beta affecting humans. Today, a total of seven types are found in humans and they include: NL63 (alpha), 229E (alpha), HKU1 (beta), OC43 (beta), SARS-CoV - Severe Acute Respiratory Syndrome (beta), MERS-CoV - Middle East Respiratory Syndrome (beta), and now 2019 Novel Coronavirus (2019-nCoV). - temporary name [4,7].

While the first four types are common in humans and less virulent, the last three are rarer and more virulent in nature with high morbidity and mortality rates in humans. It is interesting to note that the SARS coronavirus originated in China and became a global outbreak in 2003. A total of 8, 098 people were infected, out of which 774 deaths were recorded [4].

2. WHAT ARE CORONAVIRUSES?

Coronaviruses are members of a large family, Coronaviridae, order Nidovirales, known to cause mild diseases ranging from the common cold to more severe diseases such as the MERS and SARS [11,12]. Morphologically, the Coronavirus appear like a crown under an election microscope (Fig. 1). The new coronavirus is an enveloped non-segmented positive sense single-stranded RNA beta-coronavirus. Like other coronaviruses, the 2019-nCoV genome encodes structural proteins (e.g spike glycoprotein and accessory proteins), as well as non-structural proteins such as RNA-dependent RNA polymerase, papain-like protease, 3-chymotrypsin-like protease and helicase (Fig. 2). The new coronavirus causes a respiratory disease with pneumonia-like characteristics. It is a new strain of coronavirus, never seen in the history of man. Infection was first reported among individuals who had either visited or had consumed food from the live animal market in the Hubei Province. Beyond animal to human transmission, the virus is now spreading from person-to-person without geographic restrictions [4,13].



Credit: Pasieka/Science Photo Library

Fig. 1. Coronavirus as seen under the electron microscope

3. WHERE DO CORONAVIRUSES COME FROM?

Bats are known to be reservoir hosts for viruses with pandemic capability. They can host and tolerate many different viruses at the same time without getting sick themselves. The horseshoe bats in particular have been reported as the source of SARS, Ebola and possibly the latest coronavirus outbreak that began in Wuhan. Their ability to cohabit with viruses that can escape to other animals, in particular humans, can have overwhelming consequences when people invade their territory, trade them in livestock markets, or consume them. Bats are found in every continent, except Antarctica, in close range to humans and farms. They can fly short and long distances; which helps them in spreading disease causing agents; especially through their feces. More worrisome is that some folks in

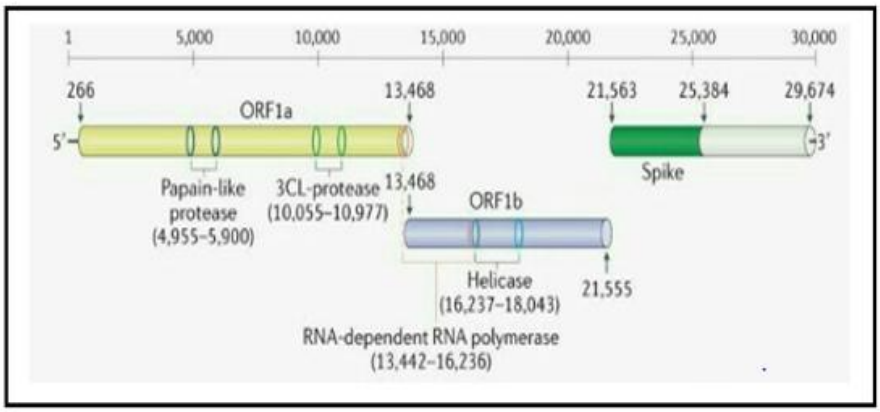


Fig. 2. Genomic organization of 2019-nCoV

many parts of the world sell bats in live animal markets or consume them as delicacies [14-17].

Scientists posited that the intermediate host in this case could be the Chinese cobra (Fig. 4) because of the close similarity in its genetic building blocks when compared to the new coronavirus. It is likely that a population of bats could have infected these snakes in the wild, which then passed the virus to humans as they were being sold at the Wholesale Seafood Market in Wuhan. However; recent report shows that 13 of the 41 coronavirus cases examined had no link to the Wuhan marketplace. The only way to then verify the origin of the virus is to take DNA samples from animals sold at that market and compare the same with those of the wild snakes and bats in the area [14,18].

Fig. 3. Horseshoe bat, suspected reservoir host of the new coronavirus
Credit: https://www.shutterstock.com-horseshoe-bat

4. HOW IS THE NEW CORONAVIRUS TRANSMITTED?

The coronavirus is transmitted through the respiratory droplets (among humans), body contact and through consumption of contaminated seafood animals, infected reservoir and intermediate hosts like bats and snakes which are sold and enjoyed as delicacies (Fig. 5 and 6) in many parts of the world including China [19-22].

According to the Blueprint list of priority diseases released by the World Health Organization, viruses such as SARS and MERS viruses have either a direct or indirect connection with bats. In fact, a likely future SARS- or MERS-like coronavirus outbreaks in China was forecasted in March 2019 by some researchers with bats incriminated. This is so because the majority of coronaviruses circulating in both humans and animals are found in bats living near humans in China, with animal-human transmission capability [4,15].

Fig. 4. Chinese cobra, intermediate host of the new coronavirus
Credit: https://www.thejakartapost.com

5. WHAT ARE THE CLINICAL MANIFESTATIONS OF THE CORONAVIRUS INFECTION?

The new coronavirus manifests itself just like the MERS virus. Incubation period for the virus ranges from 0-14 days (with an average of 4.1 days) post-exposure. Observed symptoms from confirmed infected patients include: Fever, cough

and dyspnea (i.e, shortness of breath) majorly. Other manifestations may include: Chest pain, sore throat, head ache, rapid heartbeat etc. While some people may be symptomless, infection may be severe in others with complications such as organ failure [23-25].

6. WHAT IS THE CURRENT SCENARIO OF THE CORONAVIRUS OUTBREAK?

Following the outbreak of Coronavirus in Wuhan-China, people are seen passing out on the streets, infected people been moved on stretchers and in containment vehicles. The hospitals becoming grossly overcrowded as people press on each other for medical attention. Suspected sick animals were evacuated from animal houses and destroyed. Live animal markets in Wuhan were shut down and neighborhoods disinfected. There are road blocks and Police mounting the Wuhan trans-stations preventing people from leaving the city. High speed trains and ferries in and out of the mainland have been stopped. Flights in and out of the City are been halved or even cancelled, with neighboring cities and countries closing their borders. The City with a population of more than 11 million people is currently under total lock down. In fact, report has it that the more than 60 million people in the Hubei province are currently under quarantine (Figs. 8 and 9). No doubt, the outbreak is impacting negatively on the socio-economic life of the people [3,4,11,26].

More worrisome is the morbidity and mortality rate being recorded on a daily basis. Real time global statistics by Johns Hopkins Center for Systems Science and Engineering (CSSE) as at February 7, 2020, indicates that a total of 31 523 people are already infected, with major occurrences in China mainland (31, 210), others (61), Singapore (30), Thailand (25), Hong Kong (25), Japan (25), South Korea (24), Taiwan (16), Australia (15), Germany (12), US (12), Malaysia (12), Vietnam (10), Macau (10), Canada (7), France (6), United Arab Emirates (5), India (3), Italy (2), Russia (2), Philippines (2), UK (2), Spain (1) Cambodia (1), Belgium (1), Finland (1), Nepal (1), Sweden (1) and Sri Lanka (1). So far, a total of 638 deaths has been recorded with 1 758 recovered (Fig. 10).

As the number of confirmed cases continues to grow, Wuhan City seems to run out of medical supplies, hospital spaces and medics. To therefore deescalate the mounting pressure, China began building of new medical centers from scratch (Fig. 11). Military and non-military medics in hundreds from other cities were urgently mobilized to salvage the situation in Wuhan (Fig. 12). Experts opined that the coronavirus outbreak in China could affect about 100,000 people or even more if no radical step is taken to contain the spread of the virus [4].

While China struggles to contain the virus, countries around the world have started to cut tie with China. The United State of America recorded her first 2019-nCoV travel-related case on January 21, 2020 and immediately placed travel ban on anyone with recent travel history to China from coming to US [3,27]. They have also evacuated their nationals from China and have them quarantined for a minimum of 2 weeks in military/special hospitals. Other Countries like Japan, Australia, Russia have also pull their citizens out of the crisis-hit Hubei Province and have stop giving visas to visitors from China. On January 30 2020, the World Health Organization (WHO) in an effort to curtail the global spread of the virus declared the outbreak, “A global public health emergency of international concern”, but did not recommend any restriction on international travel or trade based on the available current information [28-31].

While laboratories worldwide scramble to analyze live samples from confirmed cases for the purpose of gene sequencing of the Coronavirus [32-35], it is worthy to note that there is no vaccine for the new coronavirus at the moment, but researchers at the U.S. National Institutes of Health confirmed they were in preliminary stages of developing one. In a press brief on NBC News, Regeneron, a pharmaceutical company, announced that it is in the early stages of developing a treatment for this virus [36].

Coming to Africa, the Director of the African Centre for Disease Control and Prevention-ACDC (Dr. John Nkengasong) said that Africa is at high risk for the spread of the coronavirus because of the number of flights between China and the continent [37]. He said air traffic between the regions had risen by more than 600% in the past decade. This is so because Africa has become home to millions of Chinese business people and workers since Beijing began an aggressive push into the continent in search of raw materials for its industries and markets for its products. Students and tourists also travel regularly between the 2 regions.

Fig. 5. Wuhan market where live and dead wild animals are sold

Fig. 6. Bats and snakes are enjoyed as delicacies in China

As a prevention strategy, most African countries have commenced and intensified screening of passengers arriving from China. The first confirmed case of Coronavirus in Africa was recorded in Egypt on February 14, 2020 as a foreign national who had since been quarantined at a hospital in Egypt tested positive for the virus. Meanwhile, the cases in Botswana, Sudan, Angola, and Equatorial Guinea, Kenya and Ethiopia remain unconfirmed. Nigeria in particular, has already issued alerts with strong surveillances at the International airports including Lagos, Enugu, Kano, Abuja etc to prevent importation of the Coronavirus into the country. China returnees are disinfected on arrival, screened and quarantined (if warranted). A right step in the right direction as considered by many concerned stakeholders [37,38].

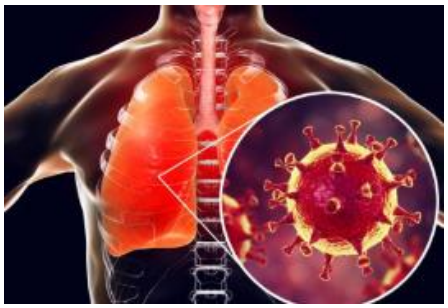


Fig. 7. Coronavirus infects the respiratory tract causing pneumonia-like symptoms

The Nigerian President, Muhammadu Buhari had reiterated the country's solidarity support for the people of the Republic of China amidst the crises. Recalling that China has been of immense help to Nigeria and Africa in general both in recent times and in the past. The president commended China for doing its best, through global collaboration, to contain the economic and sociopolitical effects of the epidemic both nationally and internationally [39]. While China is making effort to produce more protective wears for her medics, a Nigeria based company has been reported to export over 100 million face masks to China to augment the shortage of face marks in China, a development some individuals considered unpatriotic profiteering as it has led to hike in the price of the item in some parts of Nigeria [40].

Furthermore, the Nigerian Minister of Health, Dr. Osagie Ehanire, as well as the Chinese Ambassador to Nigeria, Zhou Pingjian, in a press conference held in the Federal Capital City (Abuja) February 2 debunked the rumor of importation of the coronavirus into the country. Though, China has gone through great winds and waves, the Chinese Ambassador assured the Nigerian people that mechanisms are already in place to ensure that the virus is not only curbed and controlled, but also eliminated. He particularly requested Nigerians living in China to adhere to public health instructions to avoid contracting the virus. He also noted that China is starting tests on an antiviral drug called Remdesivir (an approved HIV reverse transcriptase inhibitor) in the search for cure [41].

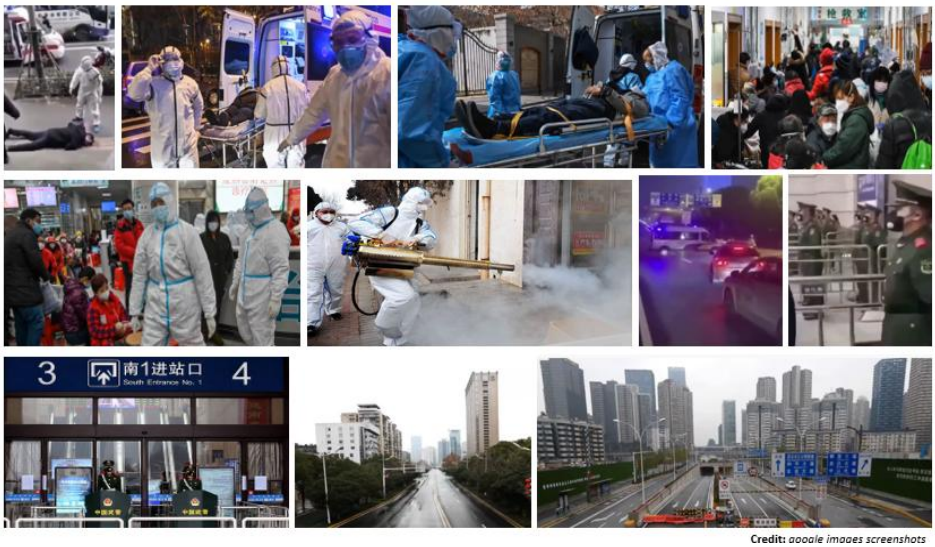
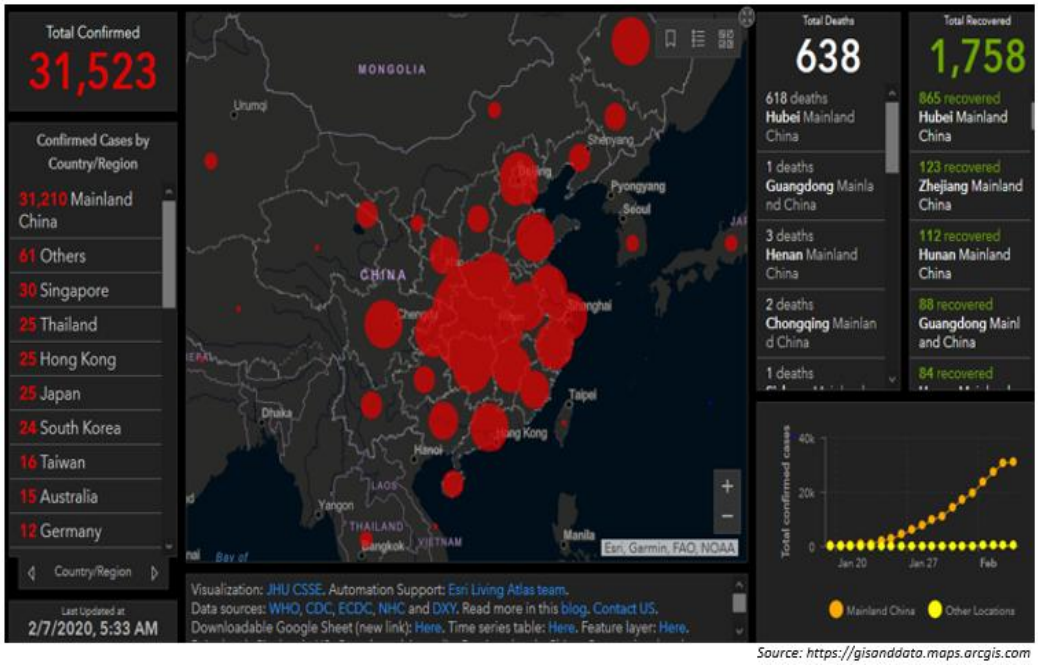


Fig. 8. Emerging Images from China amidst the Coronavirus crises

Fig. 9. Emerging Images showing mass evacuation and destruction of infected swine in China



Source: https://gisanddata.maps.arcgis.com

Fig. 10. 2019-n Coronavirus global cases by Johns Hopkins CSSE as at Feb. 07 2020

Credit: Google images screen shots

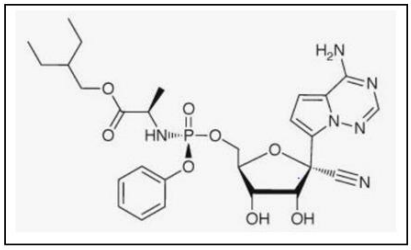
Fig. 11. New medical centers under construction in China

Credit: google images screen shots

Fig. 12. Medics mobilized to save the lives of the Coronavirus dying patients

It is interesting to also note that the Nigeria Center for Disease Control (NCDC) did not only dismiss the rumour of coronavirus importation into the country [42], but also release surveillance case definitions for the new coronavirus disease. According to the Director-

General, Dr. Chikwe Ihekweazu, a "*Suspected case*" is defined as any person with acute respiratory illness (including severe patients who have been hospitalized) presenting with fever, cough, difficulty breathing and who within 14 days before inception of clinical manifestation has any one of the following exposure: (1) History of travel to China 14 days prior to symptoms onset, or (2) Close contact with a confirmed case of 2019n-CoV infection, or (3) Exposure to healthcare facility in a country where hospital associated nCoV infections have been reported. A "*Probable Case*" is defined as a suspect case for whom testing for 2019-nCoV is inclusive or for whom testing was positive on a pan-coronavirus assay. Meanwhile a "Confirmed case" is any person with laboratory confirmation of 2019-nCoV infection with or without signs and symptoms [43].



Credit: Li and De Clercq

Fig. 13. Chemical structure of Remdesivir

Meanwhile on the international scene, the World Health Organization on Thursday 06 of February, 2020 announced the death of Dr. Li Wenliang (Fig. 14), a 34 years Chinese physician (Ophthalmologist) who first raised alarm on the emergence of the Wuhan Coronavirus last year December. Dr. Li Wenliang called the attention of the Chinese authority to the deadly disease, however was accused of rumour-mongering and reprimanded by the Wuhan police. Dr. Li Wenliang was hospitalized on January 12, 2020 having contracted the virus from one of his seven patients from a local seafood market, with an established case of SARS-like ailment and quarantined in his hospital. He was confirmed to be infected with the new coronavirus on February 1 and died 5 days later (February 6). This has sparked several negative reactions on the Chinese social media [44-48]. For the time being, several other health workers have also lost their lives following the death of Dr. Li Wenliang due to the deadly virus, most remarkable was the death of Dr. Liu Zhiming (Fig. 15), a neurosurgeon and the Director of hospital at the epicenter of the coronavirus outbreak. His death which was announced on February 18 2020 has left a devastating memory on the minds of most people of the Republic of China [49-51].

Credit: cogwriter.com

Fig. 14. Dr. Li Wenliang,
The Coronavirus whistle blower & Martyr

Credit: gstatic.com

Fig. 15. Dr. Liu Zhiming,
The director of hospital at the epicenter of Coronavirus outbreak

7. ARE THERE UNRESOLVED CONTROVERSIES SURROUNDING THE CORONAVIRUS OUTBREAK?

Yes, there are unresolved controversies regarding the origin of the new coronavirus. As the new Coronavirus continue its onslaught in China and beyond, some very disturbing articles emerged online. The writers alleged that humans, rather than mother nature (i.e., bats, snakes, seafood, etc.) should be blamed for the outbreak. They believed the virus is either a bioweapon or a failed Chinese vaccine

experiment as the new virus genes was noted to contain "pShuttle-SN" sequences. This weird sequence is the remnant of a genetic engineering sequence that is used to insert genes into microbes, viruses inclusive. Experts opined that the new coronavirus must have been engineered with the "key structural proteins" of HIV (HIV-1 gp120 and Gag) and thus provides irrefutable "open source" proof that the emerging coronavirus now spreading among the people was genetically engineered in the laboratory, and not coming from bats and snakes as earlier reported. However, other researchers, opined that this molecular evidence does not explain whether the new coronavirus is a product of bioweapon mastery or a failed vaccine experiment. As a matter of concern, when this sequence was compared to other proteins, researchers found that it was a SARS protein inserted into a coronavirus with the aim of producing a more reactogenic vaccine [52]. According to Adam [53], when these SARS insertions in the coronavirus were inoculated into animal as a vaccine component, they created heightened fatalities when patients were challenged with less virulent coronavirus strains in circulation.

Whether the current outbreak was as a result of vaccination experiment or just a laboratory escaped vaccine; the predicted health outcome for the world calls for global concerns. If it is a candidate vaccine strain that escaped from the laboratory, the whole world (not just China) is now at risk of the SARS-coronavirus gene insertion which was previously found to cause serious fatality in experimental animals, for which reason the researchers abruptly terminated the SARS vaccine research program as they considered clinical trial of the candidate vaccine in humans too risky with catastrophic potential. In the words of Lyons-Weiler, "if China sensitized their population via a SARS vaccine, and this escaped from a lab, the rest of world has a serious humanitarian urgency to help China, but may not expect as serious an epidemic as might otherwise be expected. In the worst-case scenario, if the vaccination strain is more highly contagious and lethal, 2019-nCoV could become the worst example of vaccine-derived contagious disease in human history" [53, 54].

Furthermore, the emerging strain of Coronavirus was alleged to have been recovered from a 60 years old Saudi man diagnosed with SARS in June 2012. Due to treatment failure, his Physician, Dr. Ali Mohamed Zaki, an Egyptian Virologist decided to send biopsy of the man's lung tissues to a Colleague, Dr. Ron Fouchier in Rotterdam, Holland, for genetic sequencing of the virus, which was later acquired by Dr. Frank Plummer, the Scientific Director of the Canada National Microbiology Laboratory in Winnipeg, Canada in May 2013. The sent viral sample was propagated at the Dutch laboratory using appropriate cell lines. Animal inoculation was also carried out to determine which animal species is susceptible to the new coronavirus. It was later alleged that an unexplained delivery of deadly viruses was made to China in march 2019. Though the allegation was not substantiated, Researchers at Canadian National Microbiology Laboratory warned that the smuggled viruses were highly deadly with a potential of causing a pandemic [54-57].

A high-powered enquiry later traced the smuggled viruses to some Chinese Scientists (one Dr. Xiangguo, along with her husband, Dr. Keding Cheng and some members of her research team) who were formerly working at the Canadian National Microbiology Laboratory, but later dismissed. These people were alleged to have smuggled the deadly viruses from the Canadian Research Facility to China's Research institute of Virology particularly in Changchun, Hubei and Beijing. These China's research institutes are well known for their biological warfare program [54,57].

The reported militarization of Wuhan's P4 Laboratory has raised new questions about the origin of the 2019-nCoV and the seeming cover-up that has occurred since it was first made public. Following the removal of the most senior health officials in Wuhan, Chinese State Media has just reported that Chen Wei, China's chief biochemical weapon defense expert, is now to be stationed in Wuhan to lead the efforts to overcome the deadly virus [58].

Meanwhile, the Thailand Scientists were puzzled by the new coronavirus RNA segments that have no genetic resemblance with other coronaviruses like SARS and MERS, but instead resemble those of HIV. According to the Jewish Press reports, the new coronavirus was reported to have responded to treatment by cocktail of HIV medications (Oseltamivir, Lopinavir and Ritonavir). The laboratory results of the 71-year-old Coronavirus infected Chinese woman was turned negative 12 hours post-treatment [59].

Furthermore; amidst the coronavirus crises and controversies, there were allegations on the

social media that China was seeking for court approval for the mass killing of the coronavirus victims as a sure way of halting the further spread of the deadly virus. The state was alleged to tell the court that the China is on the verge of losing its health force due to the coronavirus, as at least 20 health professionals contract the virus daily. The state argued that the coronavirus patients admitted at the hospitals only have their deaths delayed and infect many others while receiving treatment at the hospitals. The state was reported to have mentioned to the Supreme People's court in a document that it might lose its entire citizens, if the few infected patients do not sacrifice their lives to save the health workers and millions of others, as the country appear to be losing the war against the coronavirus [60]. Consequent upon the alleged mass killing of coronavirus patients, China has been under criticism for human rights violations and international human rights organizations have questioned China's approach in dealing with the coronavirus outbreak and it is believed that the country has already killed many of its coronavirus patients. The above allegations and narratives, however have been debunked by the Chinese governments, health authorities and media [61].

8. WHAT ARE THE GLOBAL STRATEGIES NEEDED FOR THE CONTROL OF THE CORONAVIRUS OUTBREAK?

Going forward, beyond the prevailing controversies surrounding the 2019-nCoV outbreak, a global coordinated response is needed to forestall the emergence of a pandemic. Accurate diagnosis in a timely fashion is critical to the control of any outbreak including that of 2019-nCoV. China have developed rapid diagnostic tests which can detect the virus in less than two hours (vaccine development is underway) to allow for rapid screening of suspected cases [62,63] to prevent unnecessary spread of the virus. In addition, shipping of 2019-nCov Real-Time Reverse Transcriptase PCR diagnostic Kit by the Centers for Disease Control and Prevention (CDC) began on February 6, 2020, to selected qualified U.S. and international laboratories. Distribution of the 2019-nCoV laboratory test kits will no doubt, help improve the global capacity to detect and respond to the 2019-nCoV outbreak. The diagnostic test kit is intended for use with upper and lower respiratory specimens collected from people with suspected cases of 2019-nCoV [64].

Earlier in the year, the World Health Organization (WHO) senior leadership team, led by the Director-General (Dr. Tedros Adhanom Ghebreyesu) met with President Xi Jinping of the People's Republic of China in Beijing to share the latest information on the outbreak and reiterated their commitment to bring it under control. The discussions focused on continued collaboration to improve containment measures at the epicenter (Wuhan), to strengthen public health measures in other cities and provinces, conduct further studies to understand the virus's mode of transmission, ensure continuous data sharing, and for China to make biological materials available for WHO coordinated investigation [3, 65].

Since 28 January 2020, the Director-General of the WHO has been convening a bi-weekly call with clinical experts around the globe, to better understand the clinical presentation and treatment interventions for the 2019-nCoV in real time. Provisional clinical care guidance for hospitalized patients and for mildly ill patients at home has been published on the WHO website. The Director-General also announced that WHO will need $1 billion to fight the coronavirus outside China and requested for timely and energetic donations from well-meaning individuals, organizations and countries [65].

The WHO on 11 February 2020, came up with a new name for the disease outbreak. After several consultations among important stakeholders including the WHO's partner agencies, World Organization for Animal Health, as well as the Food and Agriculture Organization; the 2019-nCoV acute respiratory disease was officially named as "COVID-19", while the virus is called "COVID-19 virus". The new name conforms with the current WHO's guidelines for naming of new human infectious diseases: a name which must be bias-free, with no link to a people or geographical location. The International Committee on Taxonomy of Viruses (ICTV) have also named the same virus as "Severe acute respiratory syndrome coronavirus 2 – SARS-CoV-2". This other name was given because of the genetic relatedness of the virus to the strain of coronavirus responsible for the 2003 SARS outbreak [66].

According to the Emergence committee on the novel virus (now known as COVID-19 virus), strong measures for containment should include early disease detection mechanism, effective

Credit: EPA-EFE/Shutterstock

Fig. 16. Scientists working on clinical samples for detection of Coronavirus

treatment of cases, intensive contact tracing, and promotion of social distancing measures proportionate with the risk [3,30]. Specific advises provided by the Emergency Committee to the People's Republic of China and to all countries of the world on important measures to control the outbreak are summarized below:

The China health authority were advised to: (1) Intensify public health measures for halting the current outbreak. (2) Strengthen the health system and safeguard the health workforce. (3) periodically inform the population on the evolution of the outbreak, necessary prevention and protection measures, as well as the response measures taken for its containment. (4) Enhance active surveillance and case finding across China. (5) Team up with WHO and its partners to carry out research to understand the pathogenicity of the virus, epidemiology and the evolution of the outbreak and measures to contain it. (6) share relevant information on human cases and continue to identify the zoonotic source of the outbreak. (7) conduct exit screening at international airports and seaports, for the purpose of early detection of clinically sick travelers for further confirmation and treatment, without interfering with international traffic or trade [30,65].

On the other hand, the remaining countries of the world were advised to: (1) Expected that further international exportation of cases may appear in any country and therefore must be prepared for containment, including active surveillance, early detection, isolation and case management, contact tracing, and prevention of onward spread of COVID-19, and to share full data with WHO. (2) Countries are reminded that they are legally bound to share information with WHO under the IHR agreement. (3) Any detection of COVID-19 in an animal (including information about the species, diagnostic tests, and relevant epidemiological information) should be reported to World Organization for Animal Health (OIE) as an emerging disease. (4) Countries should place specific emphasis on reducing human-to-human transmission, prevention of secondary transmission and international importation. (5) contribute to the international response through multi-sectoral communication and collaboration and active participation in increasing knowledge on the virus and the disease, as well as advancing research. (6) Continue to demonstrate solidarity and cooperation, in compliance with Article 44 of the IHR (2005) and (7) Provide support to resource-limited countries to enable early response to this event, as well as to aid access to diagnostics, potential vaccines, and therapeutics [30].

Finally, this review is not complete without a remark on the $100 million donation made by the Bill and Melinda Gates Foundation on February 6, 2020, in support of the relief efforts to contain the Coronavirus outbreak and its attending challenges. This is in addition of the $10 million earlier pledged in a press release. The fund is being used basically for the purpose of vaccine research, epidemiological studies, diagnostics, technical assistance and development of prevention systems. Beneficiaries of these funds include the World Health Organization, US Centers for Disease Control and Prevention, Public Health Agencies in China and other countries in South Asia and Africa with higher risks of importation due to lack of access to good health care. [67]. Bill Gates has been warning about the risk of a pandemic disease for years, however the WHO is yet to consider the Coronavirus outbreak a pandemic. And Experts hope it does not become one.

9. CONCLUSION

Pandemic is one of the three greatest threats to humanity and the world needs to be prepare for it

in the same serious way it prepares for nuclear war and climate change. While the COVID-19 outbreak is real and the virus is on the loose, health workers in particular are advised to protect themselves and adhere to standard safety precautions while attending to sick patients. In addition to hand hygiene practice, members of the public are advised to seek for medical advice and care when ill, instead of indulging in the practice of self-medication, report any suspected case of COVID-19, avoid eating wild-life delicacies, ensure safe food handling practices, as well as avoid contact with body fluids of sick people amongst other measures. The current outbreak underscores the need for renewed efforts to develop broad-spectrum antiviral drugs to stem the menace of emerging and remerging coronaviruses. Testing of candidate antiviral drugs and vaccines for safety and efficacy must be done by certified facilities with the required biocontainment capability to prevent any potential laboratory fall-out or escape. Research facilities currently working on the COVID-19 virus and similar pathogens must obtain appropriate authorization and transportation of pathological specimens from one facility to another must follow global best practices. Furthermore, the security of such research facilities should be reviewed periodically, including proper documentation and continuous profiling of all the research personnel working on highly infectious agents like the COVID-19 virus to prevent infiltration of such research facilities by potential or known terrorists who seek to have access to bioweapon to perpetuate their act of terrorism on the innocents. We also suggest that the WHO should meet with the leaders of the world-powers to review “The Biological weapon anti-terrorism Act of 1989” with a view of identifying and addressing existing lapses in the Law. This law which prohibit development, production, stockpiling, selling and buying of deadly biological materials must be enforced without fear or favor. Defaulters (Individuals or Organizations) must be made to face the wrath of the law. Still, Global campaigns on nonproliferation of biological weapons must be ensured and sustained. Scientists working on highly infectious agents must take the issue of bioethics, biosafety, biosecurity and biodefence very seriously in their daily professional practice. Finally, to deescalate the controversies surrounding the source of the COVID-19 outbreak, there is an urgent need for a thorough verification by all stakeholders, including an unbiased WHO’s led investigations on a representative samples of different colonies of the suspected reservoir and intermediate hosts (bats, snakes, etc.) for the presence of COVID-19 virus.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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