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Editorial

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The year 2020 has been marked by a major outbreak of the novel coronavirus aka SARS-CoV-2 which has continued to spread its fangs globally and has already led to more than 3 lakh deaths across the world. It has disrupted modern society on a scale that most living people have never witnessed; from forcing countries to close borders to pushing businesses to follow work from home models. While the nations across the world continue to take stringent measures to contain the spread of this highly contagious virus, the flattening of the curve is yet to be seen, in places.

This edition of CBW Magazine focuses on COVID-19 crisis. Here we have attempted to collate views from global experts, to present the bigger picture of how countries, have had their own distinct operational experiences and institutional challenges in the dual effort of curbing the spread of the virus and effectively curing the infected population through colossal political and policy limitations. While some articles highlight the efforts of the countries to bring the current situation under control besides the economic crunch and geopolitical chaos, some are generic in nature highlighting the struggle and operating procedures during the peak of the infection. There are many lessons to be learned from the current crisis and the post-pandemic phase is likely to witness a new world order. Additionally, the issue also focuses on the need to build on two decades of work within the Biological and Toxin Weapons Convention (BTWC) and for States Parties to agree on a Biosecurity Code of Conduct under the Convention.

This issue also comprises other features like Kaleidoscope and Chemical and Biological News. With our readers' feedback, we wish to publish issues in the future that focus on a subject of particular concern. Contributions and feedback are welcome and can be addressed to: cbwmagazineeditor@gmail.com.

Disclaimer: It is important to note that since the pandemic situation is changing rapidly and many of the articles were submitted as early as April end, there is a possibility of the need for data updation.

Biological Security and Health in the Post-pandemic World:

The Infectious Disease Community's 'Mushroom Cloud'?

David R Franz

David R. Franz served in the US Army Medical Research and Materiel Command during his 27 years on active duty and served as Commander of the US Army Medical Research Institute of Infectious Diseases (USAMRIID).

Summary

Having served in the US Army at the interface of health and security for most of my career, I have often found myself on committees and boards in government where the topic was 'WMD' (Weapons of Mass Destruction). It was common in those settings for there to be one or two 'biologists' to every ten nuclear physicists or arms control experts. When we got to the infectious disease or 'biodefense' portion of the agenda, some—not all—of the physicists would be ready for a 'break'. The biology was either too squishy for a brilliant engineering mind or just not that interesting. I might lean over to a friend—if I had one in the meeting—and whisper, "Too bad WE don't have a 'mushroom cloud.'"

The Cold-War

During the cold war and for ten years thereafter, the United States of America (USA) and other countries developed physical and medical countermeasures to protect their military forces from what we loosely called the "dirty dozen" biological agents previously weaponized in the Soviet Union. Most of the threat agents for which we developed medical and physical countermeasures were similar to the weapons agents developed by the offensive programs of the US and its allies before 1972 when the biological weapons convention was signed.[1] Throughout this period, our defensive biological work was on a small scale, compared to our nuclear weapons programs, and probably little known or appreciated outside our service laboratories.

Some might find it interesting that the US and Soviet weapons agents were not highly contagious. For example, the list of characteristics sought by US weaponeers through the '60s read like this: pathogenic for humans or animals, causes disability or lethality, highly infectious but not contagious, medical countermeasures available, stable during logistical operations, stable in small particle aerosol, readily and rapidly producible, weaponized in munitions and delivery systems and produce desired effects on the target.[2] During this period, our defensive focus was on environmental detection, physical protection, vaccines and diagnostics. While we were attempting to protect our military force globally, we also 'practiced' by responding to emerging infectious diseases, mostly through collaborations in Africa or South-East Asia. The total science and technology budget for the US biodefense program was approximately $137M in 1997. The overall

biodefense budget would jump to $14.5 billion spent between 2001 and 2004 in response to the 'anthrax letters.'[3]

Post 9/11 and the 'Anthrax Letters'

After attacks on the World Trade Center and mailing of the 'anthrax letters' in September of 2001, the focus in biological defense turned toward protecting citizens from weapons produced by individuals or sub-state terrorist organizations. A self-proclaimed survival medicine expert—sounding like nature at its worst—listed the following as likely threat agent characteristics during that era: infectious and contagious, causing long-term debilitation or death, few available preventatives or therapies, easily deliverable to a target population and low likelihood of harming the perpetrators.[4] During this period, we quickly realized that it was significantly more difficult to protect citizens of any country than it had been to protect a hypothetical military force on a European battlefield. The threat agent list became more difficult to construct and necessary medical countermeasures and defensive practices more difficult to define. Who should be vaccinated; against what agents; when? Furthermore, environmental detectors could not be placed everywhere, and ordinary citizens could not, or would not, carry a protective mask or know when to don it. The problem became 'too hard' to solve with technical solutions. As Noble Laureate Joshua Lederberg told us, "There is no technical solution to the problem of biological weapons. It needs an ethical, human, and moral solution if it's going to happen at all. Don't ask me what the odds are for an ethical solution, but there is no other solution".[5] Less than a decade into this phase we turned much of our biosecurity focus toward naturally occurring emerging infectious disease. After all, we had seen essentially no more bioterrorism after the anthrax letters and the FBI's conclusion based on circumstantial evidence was that the letters were mailed by an 'insider' from one of our labs.[6] We began a system of heavy-handed regulation and micromanagement of our domestic infectious disease laboratories where scientists worked with high-hazard pathogens.[7] We also turned our focus toward surprises that might come from nature rather than from nations, sub-national forces or even individuals.

Emerging Infectious Disease

That refocusing made sense, as the rate of occurrence of highly-pathogenic emerging infectious diseases increased: SARS in China, 2002; chikungunya in numerous countries from 2007 to 2014; MERS in the Arabian Peninsula, 2012; Ebola in West Africa, 2014 and Zika in America in 2015.[8]

Almost in parallel with the Ebola outbreak in West Africa the Global Health Security Agenda[9] (GHSA) was endorsed by a group of, now more than 60, countries plus international organizations, NGOs and private sector companies to help make the world safe and secure from infectious disease threats. The GHSA would evaluate preparedness and even support improvements in a nation's capability to respond to an outbreak or epidemic caused by an emerging infectious disease. Then, even as the West African Ebola epidemic spread, the GHSA financial condition worsened; the program may have disappeared but for an infusion of 'left-over Ebola money'.

By 2018, the US CDC was threatened with budget cuts to programs that conducted infectious disease research and support for other nations internationally.[10] That same year, the Trump administration made clear the low priority of pandemic preparedness and the value of keeping a finger on the pulse

of emerging disease; it abolished the White House Office of Global Health Security and placed the responsibility under the Weapons of Mass Destruction Directorate. [Note that the same office had been abolished by the second Bush administration as well as the Obama administration, only to be reinstated after the anthrax letter attacks and Ebola '14 epidemic respectively.][11] Pandemic preparedness isn't easy when there is not a pandemic.

The Pandemic

And then in December of 2019, a handful of cases of SARS-like pneumonia were reported in a very large but little-known city in the middle of China: Wuhan. Almost overnight our world changed.[12] Now, we wish we had paid closer attention to medical epidemiologists and emerging disease experts who have been warning us for the last decade or more that a lethal pandemic was all but inevitable.[13],[14] One organization in the US has described our situation during the COVID-19 pandemic as "forewarned but not forearmed".[15] Will we all learn from this global experience that we must make pandemic preparedness a priority going forward?

The world has changed

As many of us sit in our homes we often feel helpless, attempting to maintain working relationships and activities electronically while helping to fight the war on COVID-19 as best we can. Many watch as their personal treasure and even livelihood slip away and most of us watch as our nations' economies come sliding to a near halt. We're told that a vaccine will be the best answer, but there are still so many unknowns. Yet, we are hopeful. There are some promising drugs in the pipeline. Diagnostics must get better and faster, both for the identification of virus-infected individuals and serology to see who is possibly protected by an antibody response. What about herd immunity? We are sorting through a swirling mass of new and old science to find relevant public health information to aid in halting the pandemic.

It is too early to know how individuals, populations, nations and global organizations and their policies will change after the COVID-19 experience. Nations will likely reconsider their supply chains for critical medical devices, clothing, personal protective equipment, drugs, vaccines and maybe even for the basics like food and fuel. Just-in-time supply, while efficient for both producer and consumer may not be feasible when we are cut off from global supplies for many months. Access to enough medical materiel through an international shifting of inventories may work for a local or regional crisis but may not be logistically or politically possible in a crisis that impacts globally. Modern medicine has allowed us to reduce hospital bed numbers *per capita*, but a number of countries in the COVID-19 crisis have had to improvise on the fly to house the massive number of humans needing intensive care. Will we change the way we build hospitals or even hotels and schools with the thought of quickly making them 'hospitals' in a crisis? So much has changed. Will infectious disease be discussed more seriously as a national security issue in the future? How long will we remember?

Impact on public thinking

Will our citizens change the way they think about the infectious disease after this most traumatic experience? Will there be stronger public support for vaccines? Will we be more attuned to the principles of preventive medicine, public health and 'one health'?[16] Will we alter our lifestyles to reduce comorbidities such as obesity, diabetes, heart and pulmonary disease? Will our young people be drawn to careers in medicine and the biological sciences more strongly after this experience?

Will we expect more from our governments, both local and national? Will we get more? In the US we have a National Strategy for Pandemic Influenza (2005) and a Pandemic Influenza Plan (2017 Update); now, in the bright light of the COVID-19 pandemic, is the time to see what difference they made, and adjust as necessary.[17] Strategies and plans can be nothing more than a stack of papers on a shelf unless recommendations are kept up to date, implemented and practiced regularly. Will our political leaders take pandemic planning more seriously? We have been warned so many times but it's difficult to find support for a once-in-a-century event in a political world that measures time in two and four-year increments. Or is the once-in-a-century rule still valid for pandemics? A big piece of this pandemic planning must be driven by our domestic departments and ministries with initial coordination that can only happen at the top strata of our respective governments. It requires funding, of course, but even more importantly, sound leadership. Much of this must occur within our nations, but with transportation what it is today, we can't afford to become isolationist in our thinking regarding the infectious disease. Remember, the 'bugs' know no borders. A highly contagious viral disease such as influenza or a coronavirus in my country today can be in your country tomorrow. We must work together.

Nations and the International Community

Like never before in our lifetimes, we face a common enemy. This enemy does not respect the seal on the cover of our passports, political ideologies, economic power, military might, age or gender. Fortunately, to the degree that we had been working together internationally before the pandemic, we have been able to leverage relationships of friendship and trust between experts, scientists and clinicians during the crisis. Global networks of scientific and clinical subject matter experts are powerful tools before, during and after a pandemic.[18] We must work together internationally.

We have exceptional examples of science academies, academic centers, military-to-military programs and even industrial partners working synergistically across international borders. When we look closely, however, it is often individuals within these systems and organizations who find a colleague with common technical interests anywhere in the world. Common interests fuel conversation and communication which leads to sharing what I have long called "good news and bad news". This kind of frank exchange over time results in trust between the two parties. Where trust exists, the relationships are often both sustained and supercharged. These nodes of friendship and trust between technical experts are empowered, in some cases, by connecting with other similar nodes to contribute to an even broader network of likeminded individuals. National leadership is, of course, central to domestic and global preparation for the next pandemic, but politics so often get in the way. However, through relationships of trust grounded in common technical interests, each of us as individuals can contribute our small piece to the 'fight', technically and through effective communication. Both enlightened leadership and excellent subject matter experts are essential. And now, sadly, we do have our very own biological 'mushroom cloud'.

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A Summary of Effective Management of COVID-19 in Iran Collaboration of Civil and Defence Forces

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Summary

The emergence of novel coronavirus hereafter named COVID-19 first observed in the Wuhan province of China rapidly transferred to other countries and soon became a pandemic. The first cases were officially announced on February 19 in Qom city, Iran. COVID-19 is a highly contagious viral infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Pharmaceutical companies and research organizations are making efforts, to develop new treatments for this novel coronavirus. This review would discuss the management of the novel Coronavirus epidemic in Iran Collaboration of Civil and Defense forces from the beginning of the pandemic until 22 April 2020.

On 30 December 2019, a cluster of viral pneumonia cases of unknown origin emerged in Wuhan, Hubei Province of China which soon spread across the world. (1) From the first COVID-19 case in Iran, the Iranian President ordered health minister to set up a national committee for managing coronavirus epidemic. In his decree, President urged the Iranian Health Minister to use all his power to prevent the spread of coronavirus as well as uproot it from the country.

In response to the COVID-19 situation, Iran established a National Corona Virus Management Committee (NCVMC). The NCVMC consists of ministers of road and urban development, interior, education, science, tourism, and culture, as well as chief of staff of Iran's Armed Forces, head of budget and planning organization, IRIB chief, Iran's Attorney-General, head of pilgrimage and hajj organization, government spokesman and police chief. The committee is responsible to hold meetings, make policies in presenting services on health, treatment and pharmaceutical field, and inform people.

Understanding Biological Composition of COVID-19

A typical Coronavirus size is 65–125 nm in diameter and its genome pool contains a single-stranded RNA (Ribonucleic Acid) from 26 to 32kbs length. (2) Most coronaviruses contain three major proteins: the phosphorylated nucleocapsid protein (N); a small membrane-embedded glycoprotein (M); and a large club-shaped glycoprotein (S) which is projected spikes with 20 nm length. The M protein is synthesised on ribosomes bound to the endoplasmic reticulum and accumulates in the Golgi

apparatus. Researchers believed that the site of virus budding in the infected cell is affected by subcellular localisation of M protein to the Golgi. The S-protein involved in many of the biological processes of the virus, such as attachment to cell receptors, penetration, cell-fusion, is the major target for virus-neutralizing antibodies (3).

4 subgroups are reported for coronaviruses family including alpha (á), beta (â), gamma (ã) and delta (ä) coronavirus. (2).

The International Committee on Taxonomy of Viruses (ICTV) named the virus as SARS-CoV-2 and the disease as COVID-19(4). Middle East respiratory syndrome coronavirus (MERS-CoV) (5), SARS-CoV (6) like COVID-19 cause acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) which leads to pulmonary failure and subsequently in a fatality (4).

Two prominent genomic characteristics have been reported for COVID-19. First, structural studies revealed that SARS-CoV-2 seems to have a great affinity for binding to Angiotensin converting enzyme 2 (ACE2) human receptors (7). ACE2 is highly expressed on the luminal surface of intestinal epithelial cells, it acts as a co-receptor for nutrient uptake, in particular for amino acid resorption from food (8). The receptor binding domain (RBD) in the spike protein is the most variable part of the coronavirus genome. Six RBD amino acids have been shown to be critical for binding to ACE2 receptors and for determining the host range of SARS-CoV-like viruses (7). In summary, the SARS-CoV-2 spike protein directly binds with the host cell surface ACE2 receptor facilitating virus entry and replication.

Second, the spike protein of SARS-CoV-2 has a functional polybasic cleavage site at the junction of two spike subunit (the S1–S2 boundary) through the insertion of 12 nucleotides, which additionally led to the predicted acquisition of three O-linked glycans around the site. This allows effective cleavage by furin and other proteases and has a role in determining viral infectivity and host range. These sites have not been reported in although other human betacoronavirus (7).

Currently, there are more than 11,346 full genome sequences of viruses from clinical samples around the World in https://www.epicov.org and Gene Bank with one full genome from Iran Accession ID: EPI_ISL_424349.

Coronavirus Cases in Iran

As noted till 23 April 2020, the country has set up 87000 laboratories. There have been 16,702 infected patients, of which 13,597 (81%) are in mild condition and 3,105 (19%) are in serious or critical condition. In terms of closed cases, out of 70,324 Cases — 64,843 (92%) have recovered / discharged and 5,481 (8%) have died.

Diagnostic

There are various methods to diagnose a COVID-19 infection. Diagnosis through CT imaging of the chest and counting white blood cell and or, preparation of a laboratory sample for definitive diagnosis by molecular methods.

Low-dose CT-scan, that is a widely available and almost inexpensive imaging test in Iran, is beneficial for the diagnosis of COVID-19 suspicious cases (9).

Sharif University of Technology engineers have provided a new diagnostic system by utilizing artificial intelligence algorithms via CT scans, this COVID-19 diagnostic system can be used when there is a large number of patients in hospitals or

there is no access to a radiologist. Such a system can double up as a doctor too (10).

Fig1. Mobile Biological lab of the Iranian Army

Islamic Revolutionary Guards Corps (IRGC) also unveiled Biodetection kits and Mobile Labs which is designed and manufactured in Iran and is capable of detecting the coronavirus named "MOSTA'AN" that is currently on evaluation process (11).

Fig 2. Mobile Lab Made By Basij.

The diagnosis of COVID-19 should be confirmed by molecular examinations the most usual one, reverse-transcription polymerase chain reaction (RT-PCR), or by gene sequencing of respiratory or blood specimens. Although these methods are crucial standard tools for COVID-19 detecting, they are time-consuming as well as may not be accessible widely (12).This delay in diagnosis and treatment subsequently results in a higher risk of infecting a larger population.

Several knowledge-based companies like Pishtaz Teb Company were successful to design and manufacture COVID-19 diagnostic kits (13).

Iran's Defense Ministry has begun the mass production of rapid coronavirus test kits (RT-PCR and serologic test). In late February, the Pasteur Institute of Iran approved the ministry's testing kit after examining them and comparing the result with foreign ones (14).

Anti COVID-19 Measures Assessments

a) Vaccine

The development of a safe and effective vaccine for this highly transmittable respiratory virus is an important epidemic control. To date, no efficient vaccine has been developed against COVID-19. Recombinant protein, mRNA, DNA and inactivated whole virus vaccines are being developed and some are now entering the clinical trial stage. The first COVID-19 vaccine in China is expected to be ready for clinical trials by the end of April, according to Xu Nanping, China's vice-minister of science and technology. Invio Pharmaceuticals plans to begin clinical trials on a coronavirus vaccine in April 2020. The most advanced candidates have recently moved into clinical development, including mRNA-1273 from Moderna, Ad5-nCoV from CanSino Biologicals, INO-4800 from Inovio, LV-SMENP-DC and pathogen-specific aAPC from Shenzhen Geno-Immune Medical Institute(4, 15-17).

Three independent groups are conducting research to produce a vaccine for COVID-19 in Iran and this country's health ministry concluded six contracts with knowledge-based companies for this purpose (18, 19).

The Head of IRGC's Baqiyatallah University of Medical Sciences, Brigadier General Alireza Jalali said that Baqiyatallah University focused the research on virus behavior that was the latest scientific material to be observed. Baqiyatallah University also focused on developing the Coronavirus vaccine, diagnostic kits and drugs which are complex and complicated processes.

b) Antibody

The first treatment for COVID-19 that anyone receives, is from their own immune system. Monoclonal antibodies are the major class of bio-therapeutics for passive immunotherapy to come up against viral infection. Monoclonal antibodies are a versatile class of pharmaceuticals that have been successfully used by the pharmaceutical industry. The Monoclonal antibody can perform efficient therapeutic intermediation with a highly specific treatment against a particular disease or agent (20).

Cytokine storm or inflammatory storm occurs by COVID-19 infection as a result of the release of proinflammatory cytokine including interleukins (IL) -6(21). In the biopsy samples at dissection from a patient who died from the severe infection with COVID-19, histological examination showed bilateral diffuse alveolar damage with cellular fibromyxoid exudates. Mononuclear inflammatory lymphocytes were seen in both lungs (22) that suggested the occurrence of such a phenomenon. Further, investigation on the immune characteristics of patients with COVID-19, showed that pathogenic T cells and inflammatory monocytes quick activation leads to a large number of cytokines production and ultimately inflammatory storm occur. Among them, IL-6 is the key cytokines, that cause inflammatory storm which may lead to increased alveolar-capillary blood-gas exchange dysfunction, notably impaired oxygen diffusion, and finally, result in pulmonary fibrosis and organ failure (23). Therefore, IL-6 might play a crucial role in the inflammatory storm and interfering with IL-6 by Immunomodulating drugs such as IL-6 inhibitors might be a potential therapeutic agent for severe and critical COVID-19.

One of the effective IL-6 inhibitors is Tocilizumab. It was effectively tested for the patients diagnosed as severe or critical COVID-19 in The First Affiliated Hospital of the University of Science and Technology of China (Anhui Provincial Hospital) and Anhui Fuyang Second People's Hospital. As a recombinant humanized anti-human IL-6 receptor monoclonal antibody, Tocilizumab can specifically bind IL-6 receptors and inhibit signal transduction (24). Tocilizumab rapidly resolved some of the clinical symptoms of COVID-19, such as fever and oxygen saturation while may decline the severity of the pulmonary complications of COVID-19, including respiratory failure, but there is no evidence that it has anti-viral potential (25). By Mach 11, the Iranian version of the Swiss-made "Actemra" has been used at one of Isfahan's hospitals (on **500** patients in different centers) and a relative improvement after 48 hours in the patient's symptoms has been observed. The mass production of this medicine was marketed in about three weeks (26, 27).

c) Antivirals

Antiviral treatments are crucially needed to diminish the burden on health-care systems worldwide. Effective therapeutics are expected to decrease fatality and hospitalizations. In the absence of a vaccine, antiviral agents could also be given to protect vulnerable populations.

Remdesivir (RDV, formerly GS-5734) is an investigational broad-spectrum small-molecule antiviral drug that its activity against RNA viruses in several families, including *Coronaviridae* has been determined (28). RDV is a phosphoramidate pro-drug of a 1'-cyano-substituted nucleotide analogue. Its triphosphate form (RDV-TP) resembles adenosine triphosphate (ATP) and is a substrate for viral RNA-dependent RNA polymerase (RdRp) enzymes (29). RDV showed a positive effect on 14 Americans who had severe acute COVID19. The first two of the five clinical trials testing have been done and RDV has completion dates in early April. Both phase trials are being run by Chinese groups (15).

One of the four drugs that Iran has joined with WHO (World Health Organisation) to complete the clinical phase is RDV. Iran has one of the biggest medical research capacities in the Middle East region and also among the Islamic countries has joined WHO clinical trials with 12 research teams in 100 patients (27, 30).

d) Convalescent Plasma

Apart from supportive care such as oxygen supply, no specific effective drug or vaccines for COVID-19 are available. Several agents, like RDV, are under research moreover, the antiviral efficacy of these drugs is not known yet (31).

Immunotherapy by transferring the convalescent plasma (CP) from recovered patients to patients suffered from COVID-19 may be effective in humans to overcome the virus infection (32). The use of CP was recommended as an experimental strategy during outbreaks of the Ebola virus in 2014 (33). In another study, 80 patients with SARS who were given CP have been associated with a higher rate of hospital discharge at day 22 from symptom onset compared with patients who did not receive the same (34). The early administration of CP from recovered patients that contains significant antibody titers may cause a reduction in viral load and disease fertility. Based on current findings a hypothesis raised that, utilizing a transfusion of the recovered patient could be profitable in cases infected with SARS-CoV-2. However, some crucial challenges need to be considered before using CP as a therapeutic option such as the availability of sufficient donors, clinical condition, viral kinetics, and host interactions of SARS-CoV-2 (32).

Two independent studies in china (245 patients in Xinhua and 10 patients in Wuhan) showed CP as a therapeutic option could potentially enhance the clinical issue through overcoming severe COVID-19 cases (35, 36). Some countries like Iran, Italy and the US are also using CP in clinical phase (37).

Masih Daneshvari Hospital in Tehran is the first medical center in Iran to collect plasma from recovered coronavirus patients to use as a possible treatment for the disease. 300 persons have donated their blood plasma, and the result was a 40 percent decline in the number of deaths due to COVID-19 (38). Now the trial phase continues in Baqiyatallah, Jondyshpoor, Mazandaran, Shiraz and Mashhad medical universities (27).

e) Cell-based treatment

Severe respiratory consequences of the COVID-19 pandemic have inspired a potential need for novel therapies (39). The most critical phase of COVID-19 is severe acute respiratory, thereby preventing this phase can be advantageous for the treatment and reduction of mortality rate (40).

Cell-based approaches, primarily using Mesenchymal stem (stromal) cells (MSCs), have determined as secure and efficient

options in cases that have acute respiratory distress syndrome (ARDS) (39).

There are many advantages for preforming MSC therapy in comparison with other treatments, such as: a) They are accessible and can be isolated from various tissues such as bone marrow and adipose tissues, including in umbilical cord, dental pulp, menstrual-blood, fetal liver, etc.; b) MSC are multipotent stem cells; c) They can be easily developed to the clinical volume within an appropriate period of time; d) MSCs can be saved for repeated therapeutic utilization; e) Clinical trials of MSCs so far haven't shown harmful reactions to allogeneic MSC; f) several clinical trials have reported that MSCs therapy is safe and effective. However, the cost-effective and speed of therapeutic preparation are capable topics for discussion regarding MSC-based therapy for COVID-19.

Recently, published reports have shown that some countries like China, the USA, Jordon, and Iran have put cell therapy in clinical trial phase. A case study reported in China on a female with an acute COVID19 syndrome. 21 days after the treatment with umbilical cord MSCs, results of laboratory tests and CT images indicate a significant improvement in her health condition (41). By clearing phase one of the clinical study, phase II started in China on 6 February 2020 with 10 cases between the ages 18-75 years. This phase is expected to be completed by September 30, 2020 (42). In Iran, the clinical trial phase of MSC therapy on COVID-19 infected patients has begun (27).

f) Other drugs

Research thus far has revealed more than 30 agents including natural products that may have potential efficacy against COVID-19. Some of these agents have been rapidly tested in the clinical phase and determined primary efficacy against COVID-19. Antivirals including interferon á (IFN-á), lopinavir/ritonavir, chloroquine phosphate, ribavirin, and arbidol have been suggested by the National Health Commission (NHC) of China for experimental treatment of COVID-19 (43).

The sulfate and phosphate salts of chloroquine have both been commercialized as antimalarial drugs. Hydroxychloroquine has also been used as an antimalaria but is now being widely utilized to overcome autoimmune diseases such as rheumatoid arthritis. Notably, chloroquine and hydroxychloroquine are known to have side-effects. Lots of care must be taken while considering the effective dosage of this drug because chloroquine poisoning has been reported with cardiovascular disorders that can be life-threatening. Chloroquine and hydroxychloroquine use should be controlled with strict rules, and self-treatment must be forbidden (44). On February 17, 2020, the State Council of China revealed that chloroquine phosphate, an old drug for the treatment of malaria, had remarkable efficacy and suitable safety in treating COVID-19 associated pneumonia (45). This drug now is in phase IV of clinical trial and is being tested on 50 patients with confirmed severe COVID-19 conditions. The final result is expected by April-June 2020 (46).

As per the reports of Health ministry, Iran joined WHO for clinical trials of this drug on 24 March (30). On the other hand, Shahid Beheshti researchers have shown that rheumatologic patients who take 200 mg per day hydroxychloroquine, as well as the medical workers who received the same dose for prophylaxis against COVID-19, revealed that hydroxychloroquine with a 200 mg/day dose can have a relative prophylactic effect on COVID-19 (47).

Volunteers played a significant role

Even in Iran, the fear of COVID-19 led to mass hoarding of anti-corona products and masks. However, the country was quick to make up for those shortages. Almost all of the people reached out to volunteer in doing whatever could help to fail the disease. Volunteers offered services to the patients and medical staff, as well as aided in producing face masks, scrubs, and disinfectants. Many of these volunteers were housewives who sewed face masks and distributed them among the public and health workers. Furthermore, Iranian youth started producing disinfectants in universities, knowledge-based companies or religious places like a mosque. Many anti-corona products have been distributed among the financially weaker sections of the societies.

Many students and volunteers have also been working in hospitals and helping the medical staff. They help in feeding patients and sometimes encourage the patients and medical staff by reciting poems and songs. The medical staff has become so popular in Iran that they are being called "heroes of health." (48-53).

Knowledge-based companies, researchers come to the scene

Since Iran has been imposed with sanctions, obtaining drugs and equipment from other countries is costly and time-consuming. Therefore, Iranian researchers and companies have come together to make an effort to overcome these conditions.

Iran soon achieved the technology to produce kits for COVID-19 diagnoses that hit the market. Two types of diagnostic kits are now mass-produced by knowledge-based companies and defense ministry, the RT-PCR kits, 8 million of this kit are being produced per month; the other is serology-based kits — a total of 400,000 are being manufactured monthly and may reach up to 2 million (54). In addition, 40 advanced ventilators are manufactured daily in the medical equipment sector. This device is designed at a low-cost and easy-to-build technique by engineers in Tehran University Iran (55).

Some companies like Pars Nano are capable to produce high-tech Nanofiber masks. Other companies which produce Nano filters are altering their production lines to produce Nano masks and increase the capacity to manufacture from 100,000 masks each day to 300,000 in a few days. Iran is also planning to export masks to some countries soon (56, 57). Iran is also producing ozone generator (produce Ozone to replace carcinogenic disinfectants) and disinfection gate (58).

The Islamic Revolution Guards Corps (IRGC) and army

Soon after the spread of pneumonia secondary to COVID-19 in Iran, Armed forces mobile hospitals prepared for emergency admission of COVID-19 patients on February 26. Iran's two defense arm (army and IRGC) managed a national great biological defense exercise. The operation ran after the Iranian Supreme Leader Ayatollah Ali Khamenei, without evidence, which Iran had been subject to a "biological attack" following the outbreak of the virus (52).

All medical centers of the IRGC Ground Force were used at full capacity during the exercise and the disinfectant operations took place in 3,000 locations across the country, including 100 in the capital of Tehran. The exercise also involved 100 units of the IRGC Ground Force across 10 bases to carry out the cleaning operations (59).

On the other hand, Iran's Army established 300 medical centers in order to increase the

capacity of COVID-19 infected cases identification and prevent the spread of the disease (60). Army has transformed the Tehran exhibition center to a mobile hospital with 2000 beds in only two days (52).

Besides, these operations, dedicated attention was put towards manufacturing a great mass of diagnostic kit as mention before. They also started mass production of face masks, disinfectants, and protective clothes from the early days that the coronavirus pneumonia in Iran. They also unveiled advanced thermal cameras used for screening infected cases in crowded places (61).

Social and Media role for COVID-19 prevention

To decrease the rate of infection, Social Distancing Plan including not holding gatherings and prohibiting unnecessary travels was implemented (as early as 27 March and continue until April 3). According to the plan, inter-city trips will be prevented and only locals would be allowed to enter cities. Also, all parks, tour centers as well as any sites that might have large crowds, including pools, promenades, etc, was closed, even religious places like holy shires and mosques were closed (62).

Informing media from the first day of COVID-19 pneumonia, put lots of its attention on training people about the Coronavirus confrontation approach. In fact, national TV and the Media are in charge of increasing public awareness for all people and teams involved in the campaign against COVID-19 (52).

Response to Iran's coronavirus outbreak in late February, one of the government's first actions was to close schools and universities on March 5. The prolonged closure was a major challenge for students, parents and teachers. To decrease the effect of the school closures on the education system, Iran's Education Ministry introduced an online app, the Social Network of Students (Shad in Persian), and presents daily lessons for different grades on state TV. Two state TV channels in Iran are broadcasting educational programs. These two channels supported distance learning for mathematics, history, and social sciences that are taught by teachers (63, 64).

Conclusion

The global spread of coronavirus has caused many casualties, financial and social losses. However, Iran has used all its capacity, experience and knowledge of different sectors to combat the spread of the virus. Researchers, managers and the public have made a collective effort to combat the disease.

They have tried to turn the Corona crisis into a status for their scientific and social advancement. Due to long combat xperiences of defense forces consisting, the Army, Revolutionary Guards Corps (IRGC) and Basij or Mobilization Resistance and law enforcement police, Civil societies, volunteers, Red Crescent Movement against weapons of Mass Destruction especially Chemical and Biological warfare. All stages from surveillance to decontamination played an important part along with Medical and health staff to control the epidemic. After 41 years of various difficulties and crises from, 8 years of war, sanctions and hardships, Iran emerged as the most resilient nation in the world to fight any natural or man-made disasters or crisis.

Our knowledge and practical Experiences of Fighting WMD especially Chemical and Biological Weapons and Biological incidents due to more than 100,000 chemically injured military and Civilians and continuous threats

from enemies made nations defense forces to investigate and train to develop capabilities to fight against Biological incidents or crisis.

As Iranian leader said at the beginning of the epidemic we will turn this threat into an opportunity and as commander of the chief ordered the armed forces to use this environment as an example of Biological attack maneuver and try to manage the crisis and evaluate your capabilities and weakness and work hard to develop and expand Biodefense capabilities for future threats. Fortunately, effective collaboration between civilians and defense forces with the help of public Iran has been able to control the coronavirus.

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Italy's COVID-19 Crisis and Response

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Summary

Italy was the first European country to experience an overwhelming outbreak. Nonetheless, Italians have demonstrated a remarkable degree of endurance, solidarity, sense of duty, and responsibility. This paper sheds light on Italy's response to the Covid-19 crisis and what went wrong for the country and the way forward. As the country works towards recovery, the paper underscores the need for the country to reckon its mistakes and shortcomings, while deliberating on the social, political, and economic consequences, as well as the pre-existing systemic weaknesses exacerbated by the crisis.

After eight weeks of lockdown, Italy has gradually started to reopen. Positive cases and death numbers have begun to decline, albeit slowly, and caution, social-distancing, patience, and perseverance will still need to guide Italians for the upcoming weeks (at least) to avoid a new wave of contagion.

COVID-19 has indiscriminately affected the whole country (some more, some less) requiring national effort and sacrifice. With some exceptions, Italians have demonstrated a remarkable degree of endurance, solidarity, sense of duty, and responsibility. But as people start populating the streets again, uncertainty looms. As the country works towards recovery, it will have to reckon with its mistakes and shortcomings, the social, political, and economic consequences, as well as the pre-existing systemic weaknesses exacerbated by the crisis.

How Italy handled the coronavirus and what went wrong

Italy's response to COVID-19 has been shaped by several elements: how authority and responsibility are divided between the Italian government and regions; the Italian civil security system headed by the National Civil Protection Department that, during states of emergency, directs and coordinates activities nationally; a set of institutions such as the national health system and the Italian law enforcement and armed forces; and Italy's political landscape.

The Italian government declared the state of emergency[1] on 31 January 2020, one day after the World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern and two days after a Chinese couple visiting Italy was

hospitalized for COVID-19 in Rome.[2] However, it was only three weeks later that the outbreak manifested itself, initially in a way that seemed could be contained within a few towns, and then rapidly taking over Italy's northern regions (Lombardy, Veneto, Piedmont, and Emilia-Romagna), before spreading across the rest of the country. On 21 February, the first case of COVID-19 not directly linked to China was discovered in Italy, in the region of Lombardy. In the following days and weeks, the number of positive cases grew dramatically, and with that the number of individuals needing hospitalization and intensive care, rapidly stressing health care structures in the affected areas. At the time of writing, there have been 31.610 COVID-19 deaths in the country, one of the highest figures worldwide.[3]

On 21 February, the regional president of Lombardy issued the first coronavirus-related ordinance[4] (in Italy, regional presidents have authority in case of health emergencies, and they are equipped with powers to issue emergency ordinances). Initially aimed at the small towns where the outbreaks occurred, the cautionary and restrictive measures were then extended to the whole region. As the situation in Lombardy and elsewhere worsened, the Italian government began issuing decrees, first establishing circumscribed red zones and then progressively implementing stricter measures nationwide: schools of all levels[5] moved to online teaching on 4 March, "stay at home" orders were issued on 9 March,[6] non-essential commercial activities closed on 11 March,[7] and all non-essential production was halted on 21 March.[8] Legally, decrees supersede regional ordinances, but regions had the power to tighten local rules if needed [9]– many in fact established red zones[10] in several towns that became local hotbeds.

A 26 March governmental decree described a gradual reopening of the country in multiple phases.[11] From 4 May, factories and construction sites got up and running again, take-away from bars and restaurants are now allowed, and parks have been reopened for the public.[12] The next opening wave will be on 18 May and will entail the opening of stores and museums and, according to the decree, bars and restaurants will be able to fully reopen on 1 June, as well as personal care activities like hairdressers.[13] While at the height of the crisis the measures implemented by the government were generally accepted by the regions, the reopening phase has seen tensions mount due to economic concerns: some regional presidents, especially in the south, have been pushing for an early reopening of commercial activities. COVID-19 was not a homogenous experience for the whole country: 70% of the total registered cases are concentrated in the aforementioned northern regions, while the south was largely spared the unmanageable figures that stressed the north's healthcare system (which was, nationally, the best equipped to face such an emergency).[14] With this in mind and data at hand, the government is evaluating whether regional differentiation can and will guide the next reopening phases. In the meantime, facemasks[15] are still hard to come by; testing capabilities haven't increased, and the national testing strategy is unclear, leaving regions to deal with local screening; and the contact-tracing app deemed crucial to restart is nowhere to be seen.[16]

While the government has been responsible for the legislative aspects of crisis management, the National Civil Protection Department – still acting through the Council of Ministers, Italy's executive organ – has directed and coordinated national efforts. The Civil Protection Department ensures

joint management and coordination of emergency activities, including monitoring activities, information and data gathering.[17] It works closely with different bodies as law enforcement and military forces, voluntary forces as the Italian Red Cross, as well as its own force, local administrations and authorities (from regions, provinces, and municipalities), and all entities whose participation is required to manage a given emergency.[18] During the COVID-19 crisis, the Civil Protection Department (and its network of local offices) has been responsible for holding daily press conferences with updates on the national situation, collecting and publicly sharing numbers and data. It has also served as the hub for the collection and national distribution of medical supplies, its volunteers have manned regional hotlines to keep emergency lines free, it has supported the *Servizio Sanitario Nazionale* – Italy's national health system – by setting up field hospitals and triage areas, and coordinating the transportation of patients in need of intensive care to available hospitals. These, however, are just some examples of the range of activities it has carried out.

COVID-19 has tested Italy's regionally based national health system, highlighting its weaknesses – including personnel shortage,[19] the general decline in the number of hospital beds during the past decade,[20] and the lack of coordination between the regional governments and the local medical nodes, namely family doctors, local clinics and nursing homes.[21] To front the emergency, retired doctors were called back, young graduates were speedily habilitated as doctors and nurses, and makeshift hospitals were set up. But these weaknesses also meant that those doctors on the frontlines, the ones who had the first contact with positive patients – family doctors – were initially left without direction or the protection to carry out their work due to a nationwide shortage of supplies.[22] Additionally, nursing homes – hosting the most vulnerable section of Italy's society (over 70% of COVID-19 victims were over 70 years old)[23] – became hotbeds of contagion.[24] Over 200 doctors (family and hospital doctors), nurses, pharmacists, and care-workers have lost their lives in the fight against COVID-19, and investigations are shedding light on nursing home deaths.[25]

Italian law enforcement forces have also been playing an active role during the emergency: from manning checkpoints around the red zones, patrolling cities and enforcing the measures contained in the decrees, to engaging in spontaneous acts in service of the population. The Italian military has also been crucial in repatriating citizens from China, making its medical personnel, hospitals, and structures available to support the national health care system, supporting public safety activities and offering logistical support as the transfer of patients and equipment nationwide.[26]

In a country where fractious politics has been a constant feature for decades, the government was able to muster general support from political opponents for the sake of national unity at the height of the crisis but was not immune to criticism. As the health emergency gives way to what will likely be Italy's next economic crisis, criticism is evolving into threats of new elections from opponents, and from within the fragile coalition government. The government has been accused of initially underestimating the threat and for its slow adoption of more restrictive measures. It has also been under pressure for the delivery of the promised social and economic safety nets[27] and during its negotiations with the European Union and was criticized for mismanaging communication efforts throughout the crisis.[28]

Because Italy was the first European country to experience an overwhelming outbreak, the Italian government was faced with making decisions entailing short-term and long-term consequences, especially economic ones, requiring both caution and proportionality: an example was the decision to halt non-essential and non-strategic production which was taken on 22 March, four weeks after the first measures were implemented in Lombardy and three weeks after the whole country was subject to "stay at home" orders.[29] Given Italy's weak pre-coronavirus economic situation, such decisions were not easy ones to take.

In addition to the economic consequences of Italy's industrial and commercial pause, there have been social repercussions as unemployment grows, business-owners incur debts, families plunge into poverty and pre-existing inequalities only grow deeper, especially for those whose livelihoods depend on the shadow economy, which has been forced to halt as well. In the meantime, the promised social safety nets for Italian workers and businesses have been slow to arrive, often tied down by bureaucracy, and have, so far, not been enough[30] (in March, the government had approved a decree allocating 25 billion euros to face the emergency[31]).

Finally, while the Italian government has strived to adopt a transparent approach and to enhance communication to inform the public, the result has sometimes been a little different: the daily briefing on national trends led by the Department of Civil Protection has been crucial in helping Italians understand the extent of the crisis, and Prime Minister Giuseppe Conte, who has received credit for his performance during the crisis, increasing his approval ratings, personally owned the government's decisions, talking to Italians and announcing the introduction of new measures on streamed social media press conferences.[32] However, these press conferences have sometimes been streamed late at night, somewhat undermining the intended collective reach; unofficial statements of ideas for measures[33] have been shared publicly, unnecessarily stirring reactions; and, ultimately, Italy's systemic use of *officialese* has often made the hyper-bureaucratic decrees hard to decipher, leaving Italians with more questions than answers.

What Lies ahead?

Many sacrifices were made, from staying indoors on beautiful spring days or not seeing a loved one for an extended period of time, to the long hours worked by doctors and nurses to guarantee care. Much has been lost too, from jobs and livelihoods to the lives of fellow citizens.

Italians are now eager to get moving despite the many uncertainties lying ahead and the looming economic crisis. Patience and caution will still be needed because the road back to *normal* will likely be long and socially, economically, and politically bumpy. In the meantime, the government has approved the text of a law decree,[34] which has been nicknamed *rilancio* – comeback, mirroring the country's mood, and it will come into force once it is officially published on the *Gazzetta Ufficiale della Repubblica Italiana*. The decree – a de facto recovery plan – was supposed to be introduced in April, but given the magnitude of the plan, worth 55 billion euros, lengthy negotiations stalled its deliberation within the Council of Ministers. With over 250 articles, the decree is aimed at laying the foundations for Italy's recovery with temporary measures and introducing changes that may help address some of the pre-existing systemic weaknesses.

Measures will include fiscal discounts, grants, and emergency income and allowances to support businesses, workers, families, and hard-hit sectors such as tourism.[35] Significant investments will be made to empower the national health system, building on the lessons learned to attain readiness for future health emergencies: local health networks will be strengthened to enhance assistance, prevention and monitoring, intensive care hospital beds will increase from 5,179 to 11,109, and additional personnel will be hired.[36] The school system will also receive funds to prepare its infrastructure to safely welcome back students and invest in digitalization. The decree also aims to reduce irregular, off-the-books employment for domestic workers and seasonal agricultural laborers (this is an important measure that will hopefully have an impact on the illegal, criminal practice of *caporalato*). Finally, acknowledging the hurdles posed by hyper-bureaucratization that have hindered initial payments, the decree aims to simplify and streamline some bureaucratic processes and procedures, to ensure timely disbursement of the much-needed benefits and liquidity.

The decree and its measures will not be the panacea to Italy's post-COVID-19 situation, but it definitely is a first, important step. Some measures will bring temporary relief, some might bring about long-term changes, and additional measures will be needed. The opposition forces have already voiced[37] criticism, and it will be up to them to improve the decree in Parliament through amendments, which the Prime Minister has openly invited them to do.

As they say, in every crisis there are opportunities, and the challenge will be seizing them through hard work, patience and, most importantly, political unity and political will.

Disclaimer: The piece was submitted on May 16, and the situation may have evolved since then.

Endnotes:

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Saving a Billion: How India Confronted the COVID-19

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Summary

Protecting a population of 1.35 billion people from a global pandemic is no mean task. Yet, through rigorous contagion mitigation initiatives and proactive disease control measures, India managed to keep the COVID-19 contagion under check with just around .0077 percent of its population being infected at its current spiral. Here's a cursory assessment of how this was done.

The outbreak of the Coronavirus (COVID-19) in the final months of 2019 in China had led to a global pandemic with the disease-causing pathogen, the SARS-CoV-2 (Severe Acute Respiratory Syndrome-Coronavirus-2), spreading virulently to almost all habitable land on Earth within a matter of 2-3 months. Even over six months after its first imprint in Wuhan, the pathogen remains unconquerable with over 4 million being infected and more than three lakh people dead. Most nations have largely responded uniformly by locking down economies and halting all ways of outdoor lives to break the chain of contagion. Yet, most of the heavily-affected countries, particularly the populous ones, have had their own distinct operational experiences and institutional challenges in the dual effort of halting the spread of the virus and effectively curing the infected populace.

Unlike the high-casualty rates in the Western world, known for superlative health-care systems and practices, the developing world, particularly China and India, which together accounts for close to one-third of world population, has had comparatively much lesser infection and mortality rates from the pandemic. While the Chinese experience has been mired in secrecy despite being the source of the outbreak, India's COVID-19 campaign, with its extensive population imprint and transparent disease control measures, provides significant insights for global public health systems and pandemic management strategies.

Protecting 1.35 billion people from an epidemic involves a colossal political and policy challenge. There are some key attributes to the strategies that India adopted in dealing with the spread of CoV-

2, which has ensured that the country's infection rate remains below .0077 percent of its total population, and deaths even a further minuscule percent of that.[1] Even at the current peaking rate of the first wave,[2] the infection spiral is expected to be around one to one and a half lakh, though it could be premature to predict how the subsequent waves, if at all they occur, will turn out to be. How should the Indian Novel Coronavirus experience be evaluated?

First, despite being of third-world standards, India's public health systems responded and functioned robustly to tackle the COVID-19 challenge in contrast to what was seen as world-class health-systems collapsing under the weight of the rapid contagion in western nations. India's public health infrastructure was instantly prepared to provide free and dedicated trauma care and treatment to the affected communities, whereas it was widely reported that the health care system in western nations was not easily accessible and costly.[3] Public health care institutions in many of the western countries had reportedly turned into critical care systems that resulted in large segments of infected patients having to confine to home-isolation and over-the-counter drugs thus aggravating the risk of those with co-morbidities. This was in sharp contrast to the scenario in India where COVID-positive patients were subjected to instant clinical exposure in highly-sanitized public health premises and provided with dedicated treatment and highest possible recovery opportunities.

Second, India managed to inhibit rapid initial virus contagion by early restriction of flights from affected countries (especially in the first wave of global CoV-2 imprint), enforcing access control at border points, initially, and thereafter (by early March) closing borders and terminating all international traffic from and to the country. This was in sharp contrast to the situation in many Western capitals where international air traffic and free movement of people, particularly in transit hubs like London, were happening uninhibited despite virulent spread in the region. By implementing early access control and opportunity denial, India was highly effective in delaying the swift surge of virus transmission in the country though many early infected carriers had already entered the country by the time these measures were initiated.

Third, unlike the rampant community spread that was witnessed in many of the Western hotspots, India was effective in mitigating rapid community spread as a national phenomenon though mild trends of community spread were subsequently evident in various localized hotspots in some parts of India. The Indian epidemic map of the CoV-2 spread is largely about primary to secondary spread in the initial phase and tertiary spread in the later phases which amounted to the expansion of infected clusters but rarely moving towards a community spread that could have entailed a spill-over beyond the clusters.[4] Nonetheless, there were certain pockets in the country – for example, Dharavi in Mumbai, Jehangirpuri in Delhi and Koyembedu Market in Chennai – that were instances of localized community spreads but sealed off through rigorous containment measures, which ensured that the spike seen during the second and third phases of contagion mitigation could be controlled and streamlined towards disease termination or herd immunity.

Having identified these significant divergences from how the rest of the world dealt with the CoV-2, India's response strategies could be described through two key elements:

(a) Contagion Mitigation

Since 30 January 2020, when the first COVID-19 case in the country was identified in Kerala, the country's contagion course has been akin to a roller-coaster ride. With its experience of containing an outbreak of Nipah virus in 2018,[5] Kerala managed to control the spread of the initial CoV-2 cases through immaculate mitigation measures including patient isolation, contact tracing and clinical improvisation, an exercise it pursued on a sustained basis to come up with the most efficient response methods in India.[6] The significant gap between patient zero in January and the sudden spiral through fresh cases in Delhi and Telangana in the first week of March could be attributed to the decision to enforce surveillance at airports with an initial focus only on East Asian hotspots like China and South Korea and later expanded to other affected regions like the Middle East and Europe. While the first case was a direct Wuhan import, the slow but certain surge in the rest of India since early March can be attributed to the cases from the Middle East and Europe who either evaded entry-point monitoring or were asymptomatic.

The decision to follow the Chinese model of lockdown for contagion mitigation was intended to contain infection within the then-existing clusters and deny the scope for a community spread through an extended mutation period of around 21 days, assuming the extent of spread could have been evident and mapped by then. These calculations went awry as spontaneous new clusters formed by undetected external inducers - cases like the Tablighi Jamaat spreading across the country, arrivals from the Middle East causing clusters in Maharashtra, pilgrim- and traveller-driven spirals in Punjab, among others causing primary-to-secondary spiral in the 21-day mutation period. This was followed by swift secondary and tertiary spread leading to the expansion of clusters and creation of new ones (as in West Bengal), and the migrant exodus from cities to states like Bihar and Uttar Pradesh (UP) being later cases.

While the initially infected states like Kerala, Rajasthan, Karnataka and UP had used effective tools of mitigation including rigorous containment of hotspots, contact tracing and clinical exposure to stem the spread, there are later cases like Gujarat, Tamil Nadu, West Bengal and Punjab (besides Maharashtra) where the dynamics of community spread and cluster bulges are beyond easy explanations. Notwithstanding these conditions, the fact that India's infection rate remains around .0077 percent and may not spiral beyond a population imprint of 1-1.50 lakh can be attributed to the success of contagion mitigation strategies covering 1.3 billion people.

(b) Disease Control

COVID-19 being a disease caused by a new pathogen, notwithstanding its other Coronavirus familial links,[7] is yet to be confronted with a potent treatment remedy even as various anti-viral drug-combinations are being tried out as placebo formula and data collated from patient trials. Of the over 25 drugs that were proposed for repurposing for COVID-19 treatment, the ones that found greater acceptance include: Lopinavir/ritonavir, which is a combination medicine for HIV and used earlier also for SARS and MERS, the earlier two coronaviruses;[8] Hydroxychloroquine, a widely used anti-malarial drug, after initial preference as a placebo pivot is now preferred as a precautionary dose for health workers;[9] Mycobacterium W, an anti-leprosy drug; Tocilizumab, an immunomodulator used to treat Arthritis; Favipiravir which was anti-viral treatment for Influenza;[10] and Remdesivir that was developed as a

treatment for respiratory viruses and tested earlier on Ebola, SARS and MERS, but is now being positioned as the most promising prospect for COVID-19 treatment.

Though there were initial unconfirmed reports that Kerala had tried out the lopinavir/ritonavir on its first three COVID-19 patients, both Kerala and Rajasthan were later allowed to try out this combination dose on patients.[11] Following these experiences, the Indian Council of Medical Research (ICMR) had approved extensive usage of this combination even as other anti-virals were subjected to clinical trials.[12] In fact, a governmental task force had found Favipiravir and Tocilizumab as among the most promising drugs for potential use against Covid-19 though results from further clinical trials were awaited.[13] Notwithstanding these findings, it is Remdesivir that has found greater acceptance in many countries and the favourite in the World Health Organisation's (WHO) Solidarity Trials.[14] Originally a drug developed for the treatment of Ebola by US-based Gilead Sciences in 2014, it was used to treat SARS and MERS patients, though without much success.

While authoritative medical journals like *Lancet* has dismissed any significant clinical benefits from Remdesivir to speed up recovery time,[15] the US Food and Drug Administration (FDA) had approved emergency-use authorization based on Gilead's claim of improved recovery time seen during patient trials. India had started clinical trials of four drugs at nine designated hospitals and had received over a thousand doses of Remdesivir from WHO as part of the Solidarity Trials.[16] Accordingly, the Indian Institute of Chemical Technology (IICT) has initiated the key starting materials (KSM) to develop the pharmaceutical ingredient of the drug and conducted technology demonstrations for drug manufacturers to begin commercial production of Remdesivir in India, even if under compulsory patent in the event Gilead refuses to license Indian manufacturers.[17] Health advocacy groups have asked the government to rescind the Gilead patent to ensure the Remdesivir's greater availability, thus indicating its increasing acceptance as the frontline drug against COVID-19.

The other key aspect of India's disease control strategy has been the efforts to set up a dependable testing and surveillance infrastructure. Identifying a COVID-19 infected person or a CoV-2 carrier is a complex and uncertain endeavour if one considers the fact that over 60-65 percent of India's COVID-19 patients have turned out to be asymptomatic.[18] The initial efforts at preemption in the February-March period was centred on heightened monitoring of international arrivals at airports which hinged on one simple benchmark – whether an in-bound traveller showed COVID-19 symptoms. That a thermal scanning of body temperature or assessment of visible conditions was not good enough was amply proven by how CoV-2 managed to enter the country and caused the subsequent contagion.

Accordingly, the actual detection of COVID-19 cases in the country effectively happened only when people who were subjected to compulsory isolation tested positive, which led to a whole series of tracking and hospitalization protocols including contact tracing (states like Kerala used to publish route maps of the positive cases to prompt social reporting from impact zones), quarantine measures and clinical exposure. For a considerable part of the initial contagion period (March-April), testing was confined to quarantine zones and of symptomatic or suspected cases. The grave shortage of RT-PCR (Real-time reverse transcription-polymerase chain reaction) kits and absence

of production facilities in the country seriously curtailed the ability to measure community spread and intensity of anti-bodies presence, besides limiting detection of infections in asymptomatic and immune communities. While the rejection of China-origin RT-PCR kits came as a further setback, the swift breakthrough attained by the National Institute of Virology, which developed an indigenous anti-body test kit, enabled the government to announce a population serosurvey in all 733 districts of the country and scale up to over 1 lakh daily tests nationwide.[19] The enhanced testing ability, in fact, allowed the government to ramp up diagnostic and clinical infrastructure with a realistic picture of the CoV-2 spread.

The way forward

Over three and a half months after the first infection was reported in the country and over 50 days after the country implemented complete lockdown, India's COVID-19 cases are surging towards the one-lakh mark. As in the case of other populous countries, two variables will determine the future course of this campaign: (a) the progress towards vaccine development and availability, and (b) the creation of herd immunity in communities and regions across the country.

While some reports indicate that at least three dozen initiatives are ongoing to develop a sustainable vaccine to subdue the CoV-2, the troubling question is about the actual time needed to develop a credible vaccine and ensure its global reach, and whether commercial and political interests will make the availability of the vaccine(s) a costly affair. Even as the WHO considers 5-7 of the ongoing initiatives as promising,[20] declarations by institutions in Italy and Israel of vaccine and anti-body breakthroughs have not, surprisingly, found much endorsement. This could be because a credible vaccine process could take between 2-5 years to be proven as effective after many rounds of trials on animals and humans.[21]

While the efforts of the global initiatives are to develop a credible vaccine in 12-18 months, it is noteworthy that over 14 projects have been commissioned by various bio-research institutes across India to develop a vaccine in the shortest possible time.[22] Notwithstanding such substantial push by the Indian government to gain an indigenous vaccine breakthrough, India has also partnered with some of the global projects with the Serum Institute joining hands with the Oxford University Vaccine Group.[23]

Even if the vaccine projects may not come in time to resolve the current waves of contagion, there is now greater acceptance of the need for communities to develop herd immunity to halt the further spread of CoV-2. Herd immunity, which presupposes that the healthier members of a community with their strong immune systems will break the contagion chain of the pathogen, is not a phenomenon on which faith can be irrefutably placed.[24] Besides the fact that countries like the United Kingdom and Sweden which attempted herd immunity initially saw massive death spirals, especially among vulnerable age groups, the assumption that immune people could stymie its further spread seems too costly a gamble considering the prevailing belief that healthy carriers of the virus can transmit it on to vulnerable sections while they remain unaffected.[25] Consequently, not many countries were willing to subject their populace to herd immunity experimentations though in cases like Italy and Spain there are indications that communities that have survived the virus onslaught might have developed natural herd-immunity. The clamour to lift

lockdowns, open economies and restore normal life in the US, UK and even India seems to be driven by the belief that beyond a threshold of contagion spike, herd immunity will naturally set in.

Albeit it might be difficult to surmise whether herd immunity is beginning to form in India with its young and healthy population anchoring the shield for the community, a realistic picture could only emerge only when the country returns to normal life, which, in turn, could also aggravate the risk of a second wave when full-fledged transportation movement and economic activity is revived. The challenge will be to augment the public health infrastructure and precautionary protocols in a manner that will enable India to effectively tackle future waves.

Endnotes:

[1] As of May 15, 2020, which happens to be 105 days after the first COVID—19 case was reported in Kerala, and 52 days after a nationwide lockdown was enforced on March 24, 2020, the total cases of infection in the country were 85,761 with 2752 deaths and 53, 219 cases of patients under treatment.

[2] The question of contagion wave had different connotations as governments are yet to conclusively determine between phases of spikes, surges and spreads. In India, for example, it is widely assumed that the first wave that started from early March is peaking at the moment. Public health groups have warned that the second wave might be in coming months, probably followed by subsequent waves. On the other hand, some states that had successfully contained the first bout of infections have seen recurrences that raise the question whether they amounted to new contagion waves. In fact, Wuhan, the original epicenter, is reportedly witnessing a new wave.

[3] For some reports on this aspect, see Dylan Scott, "Coronavirus is exposing all of the weaknesses in the US health system," *Vox*, March 16, 2020, https://www.vox.com/policy-and-politics/2020/3/16/21173766/coronavirus-covid-19-us-cases-health-care-system; Prabhjot Singh, "Why the US Health Care System Failed the Coronavirus Test?" *Foreign Policy*, May 12, 2020, https://foreignpolicy.com/2020/05/12/why-us-health-care-system-fail-coronavirus-test-cant-handle-covid19/; MelissaGodin, "Why is Italy's Coronavirus Outbreak So Bad?" *Time*, March 10, 2020, https://time.com/5799586/italy-coronavirus-outbreak/; Denise Chow and Emmanuelle Saliba," Italy has a world-class health system. The coronavirus has pushed it to the breaking point," NBC News, 19 March 2020, https://www.nbcnews.com/health/health-news/italy-has-world-class-health-system-coronavirus-has-pushed-it-n1162786; Selim Gonen, "Europe's healthcare system fails in the face of coronavirus emergency," *Daily Sabah*, 26 March 2020, https://www.dailysabah.com/world/europe/europes-health-care-system-fails-in-the-face-of-coronavirus-emergency;

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[5] Kairvy Grewal, "How Kerala's experience in tackling Nipah in 2018 will help it contain coronavirus," *The Print*, February 3, 2020, https://theprint.in/theprint-essential/how-keralas-experience-in-tackling-nipah-in-2018-will-help-it-contain-coronavirus/359037/.

[6] Kerala had two subsequent waves of district-wide outbreaks in Kottayam (Italy-origin traveler as source) and Kasargod (Middle-East returnee as source) and numerous, but minor localized spreads including the latest instance of a resurgence caused by infected in-bound travellers. For a recent analysis, see Julia Hollingsworth and Manveena Suri, "The way these Indian states handled coronavirus shows where you live matters," *CNN*, May 13, 2020, https://edition.cnn.com/2020/05/12/asia/india-coronavirus-kerala-flatten-curve-intl-hnk/index.html.

[7] Among the seven versions, the SARS-CoV, MERS-CoV and SARS-CoV-2 are supposed to

cause severe illnesses while the other versions, namely, HKU1, NL63, OC43 and 229E, display milder symptoms. See Kristian G. Andersen, et.al, "The proximal origin of SARS-CoV-2," *Nature Medicine*, No. 26, 17 March 2020, https://www.nature.com/articles/s41591-020-0820-9.

[8] For an analysis, see Jienchi Dorward and Kome Gbinigie, *Lopinavir/ritonavir: A rapid review of effectiveness in COVID-19*, The Centre for Evidence-Based Medicine, University of Oxford, 14 April 2020, https://www.cebm.net/covid-19/lopinavir-ritonavir-a-rapid-review-of-the-evidence-for-effectiveness-in-treating-covid/.

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COVID-19 Pandemic and its Socio-Economic Implications on Canada

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Summary

This paper dwells into the means and mechanisms adopted by the Canadian government in the fight against COVID-19. The paper also sheds light on the challenges faced by the government as well as the steps to overcome them. Furthermore, it talks about the status of vaccine research and the future course of action by the country.

The outbreak of the COVID-19 Pandemic in Canada from the middle of March 2020 affected the Canadian population with unexpected disruptions in almost all spheres of life that drastically altered the lifestyle in most of the provinces in Canada. Prime Minister Justin Trudeau requested Canadians to stay at home and self-isolate. Each province in Canada implemented its measures and plans to fight COVID-19. The provinces like British Columbia, Saskatchewan, Manitoba, Ontario, New Brunswick, Nova Scotia, and Prince Edward Island declared a state of emergency. Alberta, Northwest Territories, Quebec, Newfoundland and Labrador have issued public health emergencies. Similar warnings have been applied at the municipal levels as well. Most Canadians trust their government institutions; hence, people obey and follow the instructions given by government bodies to ensure that the health-care system can work properly and does not become overwhelmed. However, the disruptions in normal life became evident as borders were shut down, supply chains were broken, consumer demand collapsed, educational institutions were closed, almost all the sectors of the economy closed. Canadians became worried about paying for their groceries and their bills. The situation became especially grim for a vulnerable population like homeless, who were not able to self-isolate themselves and avoid getting affected by the pandemic.

The rapid spread of this virus in Canada demonstrated how much interconnected the global systems have become. This pandemic made Canadians change their daily routine. It seems, in a short period the threat of COVID-19 became more dangerous than the threats posed by terrorism or even by climate change. The COVID-19 virus killed

a huge number of people in a few weeks and affected long-term care facilities and retirement homes. Unfortunately, in Canada, around 80 percent of all COVID-19 deaths reported were in the senior homes. [1]

As the effects of the COVID-19 virus rippled through the Canadian system, this crisis has dented many other sectors. It has deepened the economic crisis of the country thus, pushing the innumerable population into poverty to meet their basic demands. However, the community response was applaudable, where many came together to protect the elderly and other vulnerable populations of the communities. Policy options were declared by the federal government, Prime Minister Justin Trudeau announced financial support plans to help the population of Canada in this difficult time.

The federal government declared to provide economic assistance in various ways. The low or zero interest business loans were announced, tax payment deferrals were declared, payroll tax holidays were given, expanded access to employment insurance (EI), boosted the Canada Child Benefit (CCB) and GST rebates and announced plans to ensure bank liquidity along with various stimulus spending proposals. Working-age people who relied on employment or self-employment as their primary source of income were badly affected by widespread business closures. Many who fall in the lower end of the income distribution were severely impacted. Looking into these challenges, the federal government also implemented the provision of a monthly income of CAD 1,000 to all individual working-age Canadians who had employment or self-employment income in 2019. The federal government also announced the "Canada Emergency Students Benefit", as students were significantly concerned about paying their tuition fees and student loans and handling their regular expenses due to the loss of part-time jobs. Prime Minister Trudeau also announced that people who qualify for old age security would be eligible for a one-time, tax-free payment of CAD 300 to help offset increased costs due to the pandemic and people eligible for the Guaranteed Income Supplement (GIS) will get an extra CAD 200.[2]

Due to the COVID-19 pandemic, digitalization, in Canada got a major boost within a few weeks of the lockdown. Digital cafes, Google meet-ups, zoom meetings and other virtual remote work arrangements enabled Canadians to continue with their work and educational activities from home. COVID-19 disrupted the education system in Canadian Schools, Colleges and Universities, as all were closed following March break and it is expected to remain closed till June. The country has adopted the online education system. Though online learning cannot fully replace the classroom experience, the main aim is to help students continue their education and the learning process. There have been challenges adjusting to these changes for students and teachers both. Yet, the educators and officials continuously tried to deliver messages of positivity. There were both live and pre-recorded lessons delivered online. For the special needs students, the online classes are tough to adjust, but teachers are supporting these students through online meetings and with extra consultations. Teachers also address the queries of parents of young students who are struggling to learn how to navigate the online tools and assist their children. Every academic institution before starting the online classes crafted a plan to address the needs of students who may not have access to the internet, computers or tablets. Ministry of Education collaborated with tech-companies to provide technological support for the 'learn at home', programs to help meet the educational needs of students and teachers. Devices were distributed to students who did not have them along with

a fast internet facility. Educational Institutions provided these facilities at no cost and will keep these facilities intact until 30 June 2020. During the online teaching, students and teachers are maintaining continuous communication with one another, especially, through email or video communications. Pandemic has made people more considerate and understanding regarding the expectations of both teachers and students.

In Canada, the restrictions on international and domestic travel continued leading to clear skies and lower levels of pollution which was probably not seen in decades. Clear skies and no traffic is a rare phenomenon in big cities in Canada. During the lockdown, people started cooking and entertaining themselves at home, as all outdoor activities like professional sports, theatres, restaurants, clubs and bars have been closed to avoid the spread of the virus.

Canada has been able to manage the coronavirus crisis so far. However, Canada's ability to continue to keep people safe from the pandemic while successfully rescuing the economy would be a challenging task. This pandemic has made one thing clear that no one is safe unless the basic safety measures are followed effectively until an effective medical solution is in place. In fact, many have started re-thinking the whole idea of globalization and many opine that it may lose its significance and nations may favour the idea of local self-sufficiency.

In all likelihood, this pandemic will stay for long until a vaccine is invented. A Chinese and Canadian research team conducting clinical trials on a COVID-19 vaccine and China has asked to test the vaccine in Canada. The National Research Council is scaling up its vaccine production capacity in anticipation that Health Canada will approve the trial. On 13 May, Health Canada released a statement mentioning that blood tests, known as serological tests, will be used in Canadian laboratories to detect antibodies specific to COVID-19. [3]

This pandemic has taught Canadians that access to health care, medication, housing, and basic income is the most essential. Additionally, it is time to fundamentally restructure the societies around the ideals of local self-sufficiency and environmental sustainability. Perhaps, now it is also the time to empower international institutions to establish the rule of law globally.

Another very important thing that this crisis has changed, is the decades old belief, that the best institution to guarantee people's security and safety is the military institutions. It was advocated that the main threat to citizens security emanates from other states and maintaining powerful military institutions of their own would assure peace and security of the nation and its people. However, the larger lesson taught during this pandemic is that there is a need to allocate a large budget for the health care sectors. The federal government needs to inject more funds in health care research, focus on increasing medical supplies, provide support to health care personnel's, as viruses like COVID-19, SARS, Spanish flu, threatens human health security directly and pushes a countless number of population to endure difficult situations. It is hoped that this tough time will provide everyone with the opportunity to practice and learn adaptability, patience, resilience to overcome any such future challenges and hardships.

Author shared personal views and experiences during the Covid -19 Pandemic crisis and lockdown in Canada from March - May 2020.

Endnotes:

[1] Globe and Mail Data

[2] Coronavirus disease (COVID-19): Outbreak update, Government of Canada, https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection.html

[3] Ontario Ministry of Health Report, 14 May 2020

The COVID-19 Outbreak: Learnings and The Way Ahead

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Summary

There are many unanswered questions related to COVID-19. Is it natural or artificial? How can it be contained? When will the medication be available for this deadly virus? What will be the future of the world order? However, one thing is crystal clear, biological agents, whether leaked accidentally or deliberately, whether natural or laboratory-made, have the power to bring the entire world to a situation of standstill. Apart from the immediate life-threatening effect, they also instigate long-term political, social, economic and psychological consequences that can change the world forever. COVID-19 opens a new world of challenges coming from the unseen and novel biological agents. Whatever the source be, the world needs to respond effectively and collectively based on the scientific remedies and ensure comprehensive biological disarmament.

We are living in a world of highly advanced technologies where drones can deliver pizzas, robots can serve food in restaurants, chatbots can help us online and more. In this world of IT (Information Technology) enabled lifestyle, things seemed to be perfect until a virus, without any alarming symptoms, entered into our lives, created havoc, and brought everything to an unexpected halt. How this virus, known as Corona, spread across the world? Is it natural or artificial? How can it be contained? Is there any medication available for this deadly virus? What will be the future of the world? There are many unanswered questions. However, one thing is crystal clear, biological agents, whether leaked accidentally or deliberately, whether natural or laboratory-made, have the power to bring the entire world to a standstill. Apart from the immediate life-threatening effect, they also instigate long-term political, social, economic and psychological consequences that can change the world forever.

To date, more than four million cases of COVID-19 have been reported across the world with over 312 thousand deaths. Despite having the best technologies, modern workforce and world-class infrastructure, even the most developed nations like the USA (United States of America) seem to be helpless in fighting against this lethal virus outbreak. With no medication and vaccine available for COVID-19 so far, the most significant question remains how can a comprehensive civil defence system be prepared against such outbreaks?

What is COVID-19?

Corona is the name given to the virus that causes COVID-19. COVID-19 stands for Corona Virus Disease-2019. International Committee on Taxonomy of Viruses (ICTV)

announced 'severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)' as the name of the new virus on 11 February 2020. This name was chosen because the virus is genetically related to the Coronavirus responsible for the SARS outbreak of 2003. World Health Organisation (WHO) announced 'COVID-19' as the name of this new disease on 11 February 2020.[1]

Coronavirus belongs to the family of viruses that cause disease in animals. Seven, including the new virus, have entered into humans, with flu-like symptoms. Covid-19 is closely related to Severe Acute Respiratory Syndrome (SARS), which severely impacted the world in 2002-2003. was comparatively easier to control and had a lower transmission rate. Another Coronavirus is Middle East respiratory syndrome (MERS), which has been re-occurring since it first emerged in 2012.[2] COVID-19 is different from these Coronaviruses in terms of its nature. As the virus transmits from human to human, many people carrying COVID-19 may display no symptoms but work as carriers, making it very difficult to control. The symptoms of COVID-19 include fever, dry cough, breathlessness and headache. This could be one of the reasons for the late diagnosis of the disease as the symptoms are akin to normal flu. So far, no treatment or vaccine is available. Although many countries and research groups are working on developing treatment and vaccines for Corona. Presently, the medicines used for treating Malaria and normal fever are being used for the treatment of COVID-19. Till the right medication and vaccines are made available for COVID-19, there would be continuous chaos and panic across the world.

COVID-19: How it spread?

By the end of December, Wuhan Municipal Health Commission, China, reported mysterious cases of spread of an unknown virus that had symptoms similar to flu. Eventually, this novel virus was identified as Corona by the Chinese experts, later classified as COVID-19. On 4 January 2020, the WHO reported the cases in Wuhan on social media, with no deaths.[3]

Soon the cases started rising exponentially with reports of the death of few patients. As per the timeline maintained by the John Hopkins University and reported in Hindustan Times, by 23 January, China registered over 500 cases and 20 deaths due to COVID-19. By this time, Wuhan was put in a complete lockdown. By 3 February, China registered over 13,000 cases with nearly 500 deaths. By mid-February, this number crossed 60,000 with over 2000 deaths. China banned trade, consumption of wild animals, and postponed its annual parliamentary meeting.[4] Though, by this time, the virus had reached other parts of the world through travellers. Even at this stage, the world did not wake up to the alarming call of the Coronavirus and continued as business as usual. At this stage, China could have easily sealed its borders and stopped both incoming and outgoing flights. Unfortunately, this small mistake costed the entire world to suffer from a dreadful pandemic.

The first recorded case outside China was registered in Thailand on 13 January 2020. Post this, WHO experts from its China and Western Pacific regional offices visited Wuhan to analyze and understand the related facts and situation. The experts acknowledged the risk of a wider spread and by 30 January, the WHO Director-General reconvened the Emergency Committee (EC), which was constituted to analyze various aspects related to COVID-19 earlier. The EC advised the Director-General that the outbreak constituted a Public Health Emergency of International Concern (PHEIC). The Director-General accepted the

recommendation and declared the novel coronavirus outbreak (2019-nCoV) a PHEIC. Still, WHO remained reluctant to call it a pandemic. After registering cases reported in 18 countries outside China, and alarmingly growing levels of spread and severity of COVID-19 worldwide, WHO finally announced COVID-19 as a pandemic on 11 March 2020.[5] By this time, the virus had already spread in across the world and the experts were questioning the origin of the virus and China's role in this whole situation.

Role of China in Spread of COVID-19

The role of China in the global outbreak of COVID-19 is under question by many governments, institutions and experts. Many news articles, news channels and reports suggest that China not only provided wrong numbers about the infected people but also concealed the facts related to COVID-19 from the world, which resulted in a global outbreak. China too later admitted that it made mistakes in the calculation of the death toll and recording the infected cases. Many reports claim that China was busy hiding the facts instead of sharing them with the world. In fact, the whistleblowers were chided, who tried to raise the alarm for COVID-19 online, by the Chinese government. This was reported and shared by WHO officials.

"Wuhan, the COVID-19 epicentre, admitted gaffes in tallying its death toll, abruptly raising the city's count by 50 percent-following growing world doubts about Chinese transparency over the outbreak.

The WHO said Wuhan had been overwhelmed by the virus, which emerged in the city in December, and the authorities had been too swamped to ensure every death and infection was properly recorded.

Authorities in Wuhan initially tried to cover up the outbreak, punishing doctors who had raised the alarm online, and there have been questions about the government's recording of infections as it repeatedly changed its counting criteria at the peak of the crisis. Later, China added many more cases to its earlier reported numbers of infected people and the death toll."[6]

Also, there have been media reports on the unpublished data of the Chinese government that suggest the first case of COVID-19 was reported in China in November 2019. However, the official statements by the Chinese government to WHO reported that the first confirmed case had been diagnosed on 8 December. "Authorities did not publicly concede there was human-to-human transmission until 21 January. Jonathan Mayer, professor emeritus at the University of Washington's department of epidemiology, said it was 'entirely conceivable' there were cases as early as mid-November. He said there were three possibilities: that cases weren't detected at the time, that they were detected but not recognised as a new disease, or they were detected and recognised but reporting was suppressed."[7]

Then, the reason provided by the Chinese experts for the spread of COVID-19 is also under the radar of interrogation by many scientists and experts. The Chinese authorities believe that C OVID-19 spread from the local seafood market of Wuhan which sold wild animals like bats, rabbits and snakes. From here the transmission of the fatal virus from animals to humans might have taken place. Although a study by the scientists of Wuhan Institute of Virology claimed 96 percent similarities between the genetic makeup of the novel Coronavirus and the Corona found in bats. However, later studies by many experts questioned this claim as many of the initially infected people had no link with this market.[8] To date, the exact reason behind the spread of the

Coronavirus is under question and still requires detailed study. Similar claims by many scientists put a question mark on the nature of the Coronavirus itself. Many experts believe that Coronavirus is a laboratory-made virus. French Nobel prize-winning scientist Luc Montagnier claimed that the SARS-CoV-2 virus was an outcome of the Chinese attempt to develop a vaccine against the AIDS virus. In his interview with a French news channel, he explained that the Wuhan city laboratory has been working on Coronaviruses since the early 2000s. Montagnier, who co-discovered Human Immunodeficiency Virus (HIV), claimed the presence of elements of HIV in the genome of the Coronavirus and the probability of elements of the Malaria too. Although his claim has been discarded and criticised by many of his colleagues, still many experts are not denying the possibility of Coronavirus being a laboratory-made virus.[9]

Due to such claims and reports, China is now under question by many countries and experts who believe the virus has been accidentally or deliberately leaked by China as a part of its ambitious biowarfare program. In recent days, US President Donald Trump and Secretary of State Mike Pompeo also claimed that COVID-19 has originated from the Wuhan Institute of Virology in Wuhan. The two leaders also stated that China must explain why it declined to provide international scientists access to understand what happened. On the other hand, China has responded wrathfully to this allegation and has demanded proof for making such claims.[10] Thus, due to the lack of transparency, the origin of the virus has become a reason for a concerted US-China diplomatic conflict, fuelled by US officials calling the disease 'Chinese Coronavirus' or 'Wuhan virus'.[11]

Also, it has been alleged by Donald Trump that China stopped all incoming flights to its provinces however did not stop any outgoing flights that resulted in the global spread of COVID-19. It is also a matter of study how the Coronavirus was able to spread fast to the rest of the world from China, however, the neighbouring regions of Wuhan remained comparatively less affected.

After declaring itself almost COVID-19 free, wherein very few cases were getting reported post quarantine period, China itself has reported 14 new COVID-19 cases on 10 May. This included one new case from Wuhan where no new COVID-19 case was reported in over a month, as per the reports from Reuters.[12] This indicates the dangerous recurring tendency of the virus, wherein it may reoccur despite it's spread being contained.

Spread of COVID-19 around the World

The deadly virus has created unimaginable mayhem in all parts of the world. There are confirmed cases in at least 200 countries and territories across the globe. The US has reported the highest number of cases with over 1.5 million confirmed infections and over 89,000 deaths.

As in May, in Europe, the UK has been the worst impacted country. The UK Prime Minister, Boris Johnson himself struggled for his life after getting infected from Coronavirus. After the UK, Italy has recorded the highest number of deaths in Europe, with over 31,000 people while over 225 thousand infected people. Spain has over 221 thousand confirmed infections and over 27,000 deaths. Germany comparatively has numbers lower than other European countries with over 8,000 deaths.

Latin America has been a late entrant in the list of COVID-19 affected regions. However, now the Latin American countries like Brazil,

Argentina, Ecuador, Chile, Columbia and more are registering new cases of COVID-19 every day. Initially, Brazil did not endorse any lockdown mentioning economic reasons. Now, the number of infected people in Brazil are exponentialy growing. In this critical situation, its second health minister has resigned within a month indicating the internal political issues during such testing times.[13]

India, being the world's second largest populated country has registered over 1 lac cases so far with over 3000 deaths. It is following the step-by-step lockdown mechanism that helped in containing the virus. Otherwise, the projections made in April 2020 by the reputed institutions like Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Indian Institute of Science, Bangalore, Indian Institute of Technology (IIT), Bombay and Armed Forces Medical College, Pune through a joint study anticipated over 500 thousand cases and 38,000 deaths by mid-May in India.[14]

In the Middle East, where the countries have already been struggling to establish peace over cross-border conflicts and political instability, COVID-19 has created a big-time challenge as the healthcare facilities are not adequate in most of these countries, and are controlled by external factors other than the government. Iran alone has registered over 150 thousand cases and 7000 deaths.

Amid the global smouldering of COVID-19, there was a fear of a vital spread of the virus in Africa. However, so far, less than two percent of the total number of global cases have been reported from Africa that has around 17 percent of the global population.[15]

Almost all major countries in the world are facing the fatal challenge of COVID-19, with Italy and the US becoming the case studies for the experts for being the worst hit countries despite having cutting-edge technology and the healthcare system.

What went wrong in Italy?

Italy has registered the largest number of infected people after the US in the western region. With over 225 thousand registered cases of COVID-19 and a death toll of over 31,000, Italy has faced a brutal brunt from COVID-19 that will be remembered in the history of global affairs. The first case in Italy was reported on 30 January when the virus was found in two Chinese tourists visiting Italy.[16] By 21 February, 16 people were found to be Corona positive in Lombardy and Veneto. This was the time when the WHO was still insisting the virus was 'containable' and not nearly as infectious as the flu. Soon, the cases started increasing exponentially.[17]

Although Italy announced the first lockdown on 21 February, yet the virus kept spreading across the country. Epidemiologists believe that what went wrong in Italy is a matter of study and research for years, as the healthcare system of Italy is considered as one of the best in Europe. The situation became so critical in Italy, that the country was forced to ask the patients to stay in home care in part because of its low Intensive Care Unit (ICU) capacity. Due to COVID-19, Italy was left with 8.6 ICU beds per 1,00,000 people, below the average of 15.9 within the developed countries of the Organisation for Economic Cooperation and Development (OECD).[18]

Initially, Italy was confident about its well-equipped medical care system. Italy has 3.2 hospital beds per 1000 people (as compared with 2.8 in the US). However, when the situation went out of control, all non-critical surgeries were cancelled and operating rooms were turned into makeshift ICUs. With all beds occupied, corridors and

administrative areas too filled with patients, the preparedness eventually turned in to panic.[19]

There is another set of studies, that state that Italy has the most elderly population in Europe and the second most elderly population in the world after Japan. According to the analysis, the average age of people infected with COVID-19, who died in Italy, has been 80 years, and the average age of patients requiring critical care support has been 67 years. Additionally, Italy also has a high proportion of patients with heart diseases. Since COVID-19 mortality is strongly dependent on the age group and the presence of associated serious diseases, the researchers believe Italy had to face the worst effect of the outbreak.[20]

Some experts suggest that when the entire world started following social distancing and other precautions to check the spread of COVID-19, Dario Nardella, Mayor of Florence, Italy, initiated a 'Hug a Chinese' campaign on Twitter on 1 February. Following the mayor, many Italians posted their pictures hugging Chinese people. Although there has been no study that proves that this particular act was the reason for the rapid spread of coronavirus in Italy. However, the probability of such acts increasing the transmission rate cannot be denied.

After rounds of lockdown across the country, Italy has now started providing some relaxations. Apart from the health crisis across the country, Italy is also facing severe economic challenges due to COVID-19. To cope up with the situation and start rolling up its economy again, Italy's government has allowed the café, restaurants and other outlets to open. It would gradually open the travel, tourism and other economic avenues. However, this may prove to be a perilous step as still there is no treatment or vaccine available for COVID-19 and Coronavirus tends to reoccur.

Why US failed in containing COVID-19?

Amid the global toll of COVID-19, what is happening in the US is indeed shocking. With over 1.5 million cases and over 89,000 deaths, the US is another case study to understand why and how a "superpower" failed against a virus outbreak. This sounds more dreadful as the US has been working for years on preparing a comprehensive civil defence mechanism against the usage of biological agents or an outbreak. It has a strong normative framework, agencies, healthcare system, proficient workforce, very advanced technologies and most importantly, enough funds to invest in the required facilities to fight such outbreaks. However, the current situation in the US can be considered as an alarming bell for those who are working on preparing holistic and efficient responses against any biological agent outbreak. When the other countries like India were announcing total lockdowns, the US preferred to keep its economic interests above social health. The US kept itself engaged in a blame game with China instead of paying attention to its measures to contain the virus. Despite the increasing numbers of infected people, the country remained reluctant on announcing lockdown in the initial stage of COVID-19 spread. It seems it was overconfident about its healthcare preparedness and vaccine development program. Later on, when lockdowns were introduced in several states, both government and people did not support it wholeheartedly, which resulted in a failed response against COVID-19.

India's measures to contain COVID-19

India, despite having a huge population and limited resources comparatively, adopted

the lockdown way of containing COVID-19. After facing the initial hiccups and challenges, India could successfully create a comprehensive response against COVID-19. First of all, India announced a day's Junta Curfew or lockdown on 22 March 2020. After a supportive response from its system and the people, it then announced the first phase of nation-wide lockdown on 24 March 2020. Closure of all commercial and retail businesses, except for essential services like healthcare, sanitation, administrative, banks and security facilities, grocery and banks. The state borders were sealed, and the government banned all non-essential travel except in cases of inevitability. The government also announced the closure of schools and universities. However, the online mode of teaching and assessment was adopted. The country also observed the shutdown of all non-essential businesses and industries and followed under-surveillance quarantine of infected persons. This way, India delayed the spread period of virus so that it does not face a situation like Italy whose healthcare system failed due to devastating numbers of infected people at a time. It also provided enough time for the government to prepare against the dreadful outbreak with required measures, infrastructure and policies. This also created a well-planned awareness and preparedness in the masses without creating any panic. India is presently following the fourth stage of its total lockdown. Gradually the relaxations are being given, however under strict surveillance.

In its report based on data from 73 countries, the Oxford COVID-19 Government Response Tracker (OxCGRT), appreciated the Indian Government that has responded more stringently than other countries in managing COVID-19. It also acknowledged the Indian government's emergency policy making, instant investment in healthcare, financial measures, investment in vaccine research and active response to the situation and India was given '100' for its strictness.[21]

Here an important question arises. Most of the developed countries with availability of enough funds, good infrastructure and advanced public and community health systems have failed in tackling the pandemic effectively. Generally, the availability of good infrastructure and advanced public and community health systems are considered as one of the most significant components for building a strong and holistic civil defence against biological agents or outbreaks. Then what went wrong? Here the scale of the outbreak and unavailability of accurate medication or vaccines against the virus played the most important role in causing the obliteration of a global scale. None of these countries were prepared for an outbreak of such a large scale.

Moreover, the human-to-human spread created another challenge as the medical staff too started getting infected. A country like China made make-shift arrangements for new hospitals overnight to occupy COVID-19 infected people. The US is also facing the same issue. This is the reason the countries that followed a complete lockdown could contain the virus more effectively as they could manage the scale of infection.

World Order Post COVID-19

It is very important to understand that COVID-19 is not going to vanish all of a sudden. It will exist and would again hit the world in its second wave, as predicted by many scientists. Hence, it is critical at this stage to be more vigilant and cautious with all measures in place to mitigate its infection. It is also significant to accept that the world has entered into a stage of acceptance where

biological outbreaks through the novel agents are no more a fallacy. Also, such novel agents may be used by terrorist organisations or the rogue states to disrupt the global system, challenge the international security and create a state of panic. At the same time, it is no more a secret for masses that such outbreaks, natural or deliberate, may disrupt their lives.

Although it is too early to comment on the future world order. However, scholars are continuously debating and deliberating about the shift in the power centers, upcoming challenges, regional and global alliances. The nature of the global system post COVID-19 would depend on the emerging leaders and countries based on their response to COVID-19. Experts believe that even in the era of globalisation, counties would prefer to keep their priorities at the top and hence COVID-19 would certainly change the world forever where multi-realities could be the new realities. Multilateralism would continue and may get more strengthened.

Going forward social distancing, face masks and virtual way of working could become the new normal. The power centers will shift too as the world is living in a shadow of the threat of economic slump due to COVID-19. Be the elements of conventional or hard power such as military capabilities and funding or the factors associated with soft power such as culture, diaspora and tourism, all have been impacted due to COVID-19. It would be interesting to see how countries would get over the associated challenges emerging due to COVID-19. COVID-19 is working as a catalyst for prevailing political, social and economic problems in different countries. It seems that many of the problems may reach their peaks during or post COVID-19 and hence would change the existing global system in both scenarios, if they get solved or they get worst.

Conclusion: What is needed?

Today, the world is facing a war without any missiles or guns. The enemy is right in front of us and not visible. A comprehensive civil defence is the need of the hour. A strong global mechanism is required to combat the plausible threat of usage of biological agents for outbreaks along with belligerent use of technology. However, at present, the most critical requirement to defeat COVID-19 is the right treatment and vaccine. Although many countries are working on it, so far, no verified medication or vaccine is available to treat COVID-19. Many countries have reported about the successful outcomes of using plasma of the recovered people to treat infected people, however, it cannot be considered as the exact treatment for the disease. On the other hand, the normative procedure for development, verification and production of a vaccine for COVID-19 needs to be expediated so that the containment and reoccurrence of the outbreak can be checked. One more significant point has to be considered here. The possibility of the use of more novel biological agents cannot be denied, and we cannot vaccinate ourselves every time for a novel agent. Hence, in terms of vaccination, a well-planned global vaccination strategy needs to be developed based on the advice of experts.

From a futuristic perspective, a strong normative framework for both, the tactical challenges as well as the strategic roadmap is needed keeping outbreaks like COVID-19 in mind. Usage of advanced technologies for developing easy and fast detection systems, promoting vaccination programs to develop broad-spectrum vaccines, mass production of Personal Protection Equipment (PPEs), creating general awareness in public so that they can learn to respond to such outbreaks without panic and most significantly, scientific collaborations are the key steps in solving this global issue. Also, when the issue

of dual use dilemma cannot be solved, the countries need to be transparent and cooperative in case of inspections and visits from International Organisations. This has been a challenge for Biological Weapon Convention (BWC) too and needs to be sorted to form a holistic bio-defence for all.

Collaboration and connectedness seem to be the most critical key for combating COVID-19 efficiently. First of all, countries need to form a web of networks from local to global levels either directly or through International Organisations. Sharing information immediately holds the most critical solution for COVID-19 like outbreaks. Imagine the impact if China would have shared the information related to COVID-19 immediately with the world and had quarantined itself? Then, preparing public and community health systems to act effectively is needed wherein underdeveloped and developing countries may be helped by other countries to prepare themselves for such outbreaks. Multi-spectrum vaccination programs also need to be discussed and run at a global level. COVID-19 opens a new world of challenges coming from the unseen and novel biological agents. Whatever the source be, the world needs to respond effectively and collectively based on scientific remedies. Bio-security and bio-defence seem to be and need to be 'the' priority for the world to ensure the existence of the human race.

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Mitigating Fear and Regaining Trust: How to Understand China's Response to COVID-19

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Summary

This paper attempts to understand the logic and thus, gives a critical analysis of China's response plan against COVID-19 from the fear and trust perspective. It proves that the biggest challenge for any public health strategy is to strike a delicate balance between caring for public sentiment and initiating exclusionary protective measures.

Introduction

There is a long history of human fears toward infectious disease and it doesn't necessarily disappear with the development of medical science. The ancestral fear toward infectious diseases plays a due role and the emergence of a new virus tends to waken up that fearful memory. Collateral damage from human greed and government corruption will paradoxically lead to more infection and higher moral and physical death.[1] Hence it is strange to find some argument goes that those from the pharmaceutical industry tend to sell the threat of infectious disease and benefit from the thus expanded public expenditures.[2] Nonetheless, the outbreak of COVID-19 reminds the world of real threat and heavy lethality of an infectious disease.

It calls for concrete measures to be taken to address and mitigate the stress thus caused to human beings by the pandemic. In the case of Zika, studies find that individuals who suppress their fears would have higher levels of fear later.[3] The first thing a spreading virus destroys is people's trust on the environment. Any working public health strategy should aim at maximizing the trust and minimizing the stress thus caused.[4] For centuries, measures such as quarantine, lockdowns and contact tracing have been central in responding to infectious disease outbreaks.[5] The same still applies today, albeit with much larger mega cities involved. That said, the root causes of fear is always the same, that is an uncertainty due to the increase of fatality and the lack of effective vaccine and cure.

This paper tries to understand the logic and thus gives a critical analysis of China's response to COVID-19 from the fear and trust perspective. There are different logics

on how to mitigate public fear and regain trust among the people and with the government. The discursive approach stresses that the government should carefully design narratives to calm people down, and a functional approach that only concrete measures serving the control of disease matter. Be that as it may, the biggest challenge is how to strike a delicate balance between caring public sentiment and initiating exclusionary protective measures. China's response against COVID-19 witnessed setbacks with a heavy human loss at the initial stage and recognition when it finally controlled the situation. Discussions in summarizing useful experiences and lessons become extremely relevant when a second or even third wave of contagion might occur before a working vaccine can be found.

Mask-Wearing and its Comforting Effect

There were debates in China whether people should wear masks in confronting COVID-19 and the Chinese government's positive suggestion generated a discussion on whether and how to wear face masks could help to control a highly contagious disease like COVID-19.[6] Similar discussions emerged when other governments were entertaining the same suggestion to citizens.[7] With all the valid points on the measure, it is difficult to construct its positive logical links with the eventual control of the pandemic. The discussion does not have a solid conclusion yet from a medical science perspective, still, its psychological effects in addressing public fear and rebuilding the trust among people and with the government should be properly recognized.

Wearing masks does not change the particular fact that the invisible virus is making the environment dangerous. But a psychological suggestion it carries is that others in the environment care your sense of insecurity and none in the environment would intentionally or unintentionally spread the disease. Even if there are no other visible effects, at least it provides a comforting effect. It is not about its effectiveness. Subconscious measures like this would distract individual stress and thus mitigate the fear caused by environmental uncertainty. It can work as an indicator to others that their chance of infection is reduced when people in the environment wear masks.

When the Chinese government suggested and the public was willing to wearing masks, the next question was how the supply could meet the demand. In China, the National Medical Products Administration (NMPA) is responsible for ensuring medical supplies and in 2009 it has established standard procedures for emergent medical supplies for public health needs.[8] On 7 February 2020, NMPA issued a further administration notice to expedite registration and approval procedures on PPE production.[9] Then provincial and further local levels would take over to make detailed plans and local NMPA agencies were making guidelines and temporary measures on emergency and temporary approvals.[10] But it was chaotic as the fear drove people to store masks at all costs, the supply chain was further severed when most manufacturers were on holiday leaves for Chinese lunar new year. Only when big players like SINOPEC as an example of state-owned enterprises and BYD of private companies launched mask manufacturing lines of massive capacities that the supply-demand gap was filled.

It proved an equal challenge to transport PPEs to affected areas since major highways were closed due to holiday leaves and forthcoming lockdowns. The lack of intra-provincial coordination only made the situation worse when local governments were storing and competing for ready PPE

products. Public opinion backfired when reports showed that some local governments took expropriation of pandemic prevention materials crossing their districts.[11] These obstacles could only be dealt with when the State Council stepped in pressing provincial governments, and the latter pressing further local governments to ensure smooth transportation of anti-epidemic materials.

Lockdowns and Physical Separation

On 23 January 2020, Wuhan announced the lockdown. Later, several other cities announced the same, and the subsequent nation-wide social distancing measures were implemented to prevent epidemic spreading. Eventually, a quasi-national lockdown remained in place for about two months. On every count, it was a risky political decision to make. First, it might work to flatten the curve, but public stress would become more and more intense with the duration of lockdown and rising numbers of confirmed cases. The sooner the curve went to the other (declining) side, which nobody knew when the lower political costs there would be. Second, the Chinese New Year meant a lot of domestic and international travel, traditional processions and extensive visits from relatives and friends.[12] The power of tradition should be properly understood here, no one could make sure the public would cooperate. You can understand it as asking people to stay at home during the Holi in India, and Christmas in the West. It would be a huge task to get a public understanding of this.

The lens of fear and trust can help to understand the logic of the Chinese government's choice of measures of high political costs such as massive quarantine and lockdowns.[13] A counter-argument is that drastic measures themselves would create panic. However, its marginal effect would decrease to a minimum when there is a high level of fear in existence due to the contagion. With a spreading panic in sight, the counter-measure should be far harsher and a physical isolation strategy can serve as a stabilizer of public sentiment.[14] Such drastic measures carried a message that as long as people stayed at home, they would be safe. With initial resentment, the public was quick to accept that it would be in their best interest to suspend social activities and thus cut short the transmission chains. Again, it helps to comfort the public in a time of high uncertainty.

Quarantine and lockdowns are indeed ancient tools to conquer epidemic disease, modern technology only transforms these into more powerful public health weapons. In China, people got used to online shopping during the SARS quarantines, and COVID-19 would only further drive the public ascribing an online living in a largely cash-less society developed since then.[15] Despite so, it is no easy task to ensure the basic supply of daily commodities and the sheer size of the population being affected is enough to demonstrate the scale of the challenge. After the initial mess, the big data technology and intelligent supply chain took the charge and the feature of door-to-door and zero-contact delivery regained public trust on the environment.

Epidemiological source-tracking and Slow-down of Community Transmission

Besides wearing masks and lockdowns, tracking close contact is "probably the most important thing" as noted by Dr. Zhong Nanshan on 21 January 2020.[16] Dr. Zhong is the leading medical scientist to contain COVID-19 in China and a public health veteran who had led China's campaign against SARS. Modern technology again intervened to make these ancestor toolkits more effective. In China, popular apps such

as WeChat and Alipay were used to monitor and track the travel route, and possible contacts if needed. Colored health codes of green, yellow and red were generated after people filling out information about their temperature, whereabouts in the last 14 days in a quick health survey and these tools allow them to go to other cities or enter residential areas or official buildings.[17] Some apps develop functions for people to check nearby infection and transmission status so that depending on the status they could feel relieved or keep high alert. Despite all the controversies over privacy invasion, the massive surveillance measures proved useful in tracking close contacts and places visited by confirmed patients.

Combined with source-tracking, testing all close contacts and admitting all suspected and confirmed cases for treatment will be the ultimate tool to control the disease. Without proper testing, affected persons might have to delay seeking medical help and remain undetected in the community.[18] In the case of a pandemic, the number of tests in discussion could have easily discouraged any attempt.[19] Demand spurt of testing caused a huge shortage of testing kits, and a huge influx of confirmed patients overwhelmed hospitals and public health workers in pandemic epicenters such as Wuhan and Huangshi. In ordinary times, a city in China would only have dozens of beds, hundreds in the case of a megacity for infectious disease, but during the COVID-19 time, it was tens of thousands of confirmed patients we were talking, and the number would be multiplied if suspected cases were admitted.

The situation was only partially addressed when differentiated and phase treatment plan was adopted that the situation stabilized. Suspect cases were quarantined in independent houses and hotel rooms; confirmed cases with light and modest syndromes went to temporary hospitals that were specially established to monitor and provide them basic medical care; and those with severe syndromes to designated hospitals with epidemiological experts and intensive care units.[20] At a later stage, health workers from cities and regions that had largely controlled the situation came to help, with each province assisting one city or region of Wuhan, the city hit first and most by the disease.

Concluding Remarks

It is understood that both unlimited and limited governments have records in succeeding and failing the epidemic prevention and control on history, it is noticed that a people of limited government tends to rely more on themselves rather than receiving parental care from the government. Public resentment is obvious, for example, in the US against wearing masks and lockdowns. In Michigan, a supermarket security guard was shot dead when he asked a customer to wear a mask.[21] It seems that cultural and historical factors make big differences in public acceptance. Chinese culture is full of stories about how ancient kings like King Shennong tastes a hundred herbs and Dayu tames the flood to conquer diseases and natural disasters. Such cultural background makes the public more cooperative in tolerating the cost and observing government measures.

Psychological perspective is one of the lenses to understand the logic of China's response plan against COVID-19, and other factors should get fair credits too. For instance, a higher public saving rate in China ensures allows the public more likely to get through the hardship of living thus caused. A public memory from the effective fight against SARS in 2003 when rural areas were cordoned off and kept untouched even though they were most vulnerable to the epidemic disease,[22] assures a quick manner

of public acceptance of similar measures. And the necessity of drastic measures was obvious in that week-long holiday and month-long vacation meant numerous human flow and gatherings, and immediate lockdowns would slow down, if not cut the community transmissions, tangibly.

A public mindset also plays a role. Chinese people tend to prioritize the rights of development and survival before they can enjoy freedom and liberty rights in social life, and most of them tend to accept that there will be limits for latter rights. In the West, individual freedom and liberty come on top of other rights that the public would defend and protest any attempt to sabotaging their rights, and a pandemic won't simply change that belief. A fair note is that this doesn't mean in China people don't have freedom and liberty and in the West, people don't have development and survival rights, but differences in prioritizing rights tend to influence the acceptance of certain drastic measures to fight the pandemic. Therefore, mass surveillance tools for the source-tracking purpose were accepted as a temporary measure in China, and in the West, people are more critical of such measures and focusing more on the potential data abuse.

Human history evolves forward by conquering numerous disasters and diseases and COVID-19 won't be the last pandemic. The danger of second or even third wave of the pandemic is real until a vaccine comes out and hence discussions on proper public health strategies that suite countries of different national characteristics and their situations are extremely relevant. In the discussion, countries need to mitigate public fear and hence restore public trust among themselves and with the government. With a high cost, China has largely controlled the situations, but this does not mean its public health strategy can be simply copied by others. Besides domestic debates on the controversial decisions, China's response against COVID-19 is under international criticism that it was still using medieval tool kits in the 21st century.[23] Even now a haunting question for China is whether measures other than massive lockdowns could do the same effect.

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The UAE and the Coronavirus Pandemic: Maintaining the Geopolitical Status Quo Will Not Be an Option

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Summary

With UAE playing a larger geopolitical role, the UAE will have to face up to hard economic choices that vast currency reserves and wealth funds had previously provided a kind of buffer against. On top of the practical challenges of reopening and stimulating a depressed local economy once it is deemed safe to do so, the UAE will likely have to undertake domestic reforms that it had hoped would otherwise have been indefinitely delayed. The paper articulates UAE's position in the changing global geopolitics wrought by damaged great power reputations.

Over the past decade or so the United Arab Emirates (UAE) has emerged as one of the savviest and most agile geopolitical actors not only in the Arabian Gulf, but more broadly across Southwestern Asia, the Eastern seaboard of Africa, the Western part of the Indian Ocean, and South Asia.

The UAE has also taken on a larger role in the Caucasus and Central Asia in more recent years and is widely viewed as a pivotal power in everything from global energy policy and regional security and economic matters through to space policy, renewable energy development, new agricultural technologies, and innovative construction techniques, among other things.

Perhaps the most impressive aspect of UAE foreign policy has been its careful balancing of competing interests of the United States and China in the Emirates as well as in the region. Abu Dhabi has managed to maintain the military security guarantees and presence of the US while at the same time skillfully propel China to become the country's largest economic partner, to include being a significant part of Beijing's Belt and Road Initiative (BRI).

The impact of the Coronavirus pandemic is, of itself, not necessarily a challenge for the UAE and its foreign policy and geopolitical position. This is not to say that the UAE has not felt the economic hardship experienced around the world, or that the pandemic has not affected the country's timeline for greater economic diversification from oil. In both cases, the UAE will have to face up to hard economic choices that vast currency reserves and wealth funds had previously provided a kind of buffer against.

Now those reserves and funds are being unexpectedly used to shore up an economy battered by collapsing oil prices and, domestically, sclerotic economic policies and consumer demand that practically disappeared in days because of public health lockdowns and individuals staying at home instead of shopping at malls and eating at restaurants.

On top of the practical challenges of reopening and stimulating a depressed local economy once it is deemed safe to do so, the UAE will likely have to undertake domestic reforms that it had hoped would otherwise have been indefinitely delayed. These reforms, while necessary, will also be painful in that they will hasten the end of an overly generous welfare state for Emiratis and, at the same time, improve economic and property rights for the middle-class non-Emirati residents.

For South Asian countries, in particular, these UAE economic reforms could be both a blessing and a curse. On one hand, the vast majority of middle-class non-Emirati residents in the UAE are from India and Pakistan, and they constitute the backbone of the country's economy and government functions. While there has been a contraction among middle-class jobs in the UAE – and with more losses to come post-pandemic – these high-value jobs will likely see an eventual rebound and, and assuming that there are not enough appropriately educated, qualified, and motivated Emiratis to fill them, this non-Emirati middle class will endure.

On the other hand, the pandemic has exposed the UAE's vast reliance on imported cheap labour primarily from South Asia, leaving tens of thousands of individuals stranded in camps and elsewhere with no work and no options to leave. Their plight has sparked a much-needed ethical and economic debate about the conditions under which these individuals live and work. This situation has also sparked a diplomatic row between the UAE and India, and to a lesser extent Pakistan, about their repatriation as Delhi and Islamabad initially refused their return because of concerns that they might accelerate the transmission of the virus.

In many respects, these immediate issues caused by the pandemic are not exclusive to the UAE and are being faced by practically every other country within the Gulf Cooperation Council (GCC). When viewed in this light, the UAE along with Saudi Arabia is likely to find itself economically in a better position after the pandemic eventually recedes than a number of its neighbours, such as Oman, Bahrain, and Kuwait.

One bright spot for the UAE during this pandemic is its public health reputation, both domestically and internationally. On the outset, UAE leadership took the Coronavirus seriously and did not politicise it as was the case in Europe and North America. Instead, leadership in Abu Dhabi and Dubai utilised the lessons learned from their experience in dealing with the small outbreaks of the Middle East Respiratory Syndrome (MERS) in previous years, and also looked to countries such as Singapore and South Korea in how to tackle Coronavirus.

As a result, the UAE has carried out a vast and effective testing regime, with an emphasis on the most vulnerable populations such as laborers, as well as stringent lockdowns in Dubai and Abu Dhabi. The number of positive cases rose as more testing was conducted, but these measures have managed to reduce the rate of transmission and keep the mortality rate low within the population and have allowed Emirati leadership to better calibrate the easing of lockdown measures and carefully reopen

parts of the economy. This, in turn, has reflected well on the UAE's reputation for good and competent governance in the World Health Organisation (WHO) international rankings.

Amid the Coronavirus pandemic, the UAE's challenges are typical of those faced by all other GCC countries, yet simultaneously contrasted by an impressive (to date) public health strategy in dealing with the virus.

The aftermath of the pandemic, however, will pose significant challenges for the leadership in Abu Dhabi and Dubai in maintaining the UAE's foreign policy and geopolitical position. The reasons for this are not just because of depressed oil prices, but also because of changes in global geopolitics wrought by damaged great power reputations as well as accelerated economic and technological trends. These challenges are as follows:

Struggling oil prices will constrain UAE ambitions and force needed reform: Globally, a post-pandemic economic recovery will be slow and fitful and oil prices will struggle to return to their pre-pandemic prices (which were already concerning). While China, India, Japan, and South Korea will remain the biggest importers of GCC oil and gas, these economies will also struggle with lower global demand for their products, in turn compounding the price-point of oil. As a result, the UAE will tighten its fiscal belt, rationalize its considerable foreign and economic interests, reduce (but not eliminate) its reliance on foreign labour, and enact painful yet necessary economic reforms that it had previously hoped could have been put off.

Post-pandemic 'Green New Deals' could further depress demand for oil and hasten economic diversification: The probable scenario outlined above could be further compounded should enough major economies in Asia, Europe, and North America look to enact so-called 'Green' post-pandemic economic recovery plans that emphasise renewable energy grids, ecologically-friendly and sustainable infrastructure programmes, and the widespread electrification of transportation, thus further reducing the global demand for hydrocarbons. Such an eventuality would further compound challenges for the UAE and would force the country to enact even more painful (and potentially, politically dangerous) economic reforms that many Emiratis, accustomed to lavish welfare programmes and lifestyles, might find difficult to adjust to. The only factor that might help the UAE, and other oil-producing economies, avoid such a fate is if policymakers in major Asian, European, and North American countries choose to revive their economies quickly through a traditional reliance on hydrocarbons.

Damaged great power reputations will likely encourage a more independent UAE foreign policy: The post-pandemic geopolitical reality will not just be a one-way street that the UAE will have to contend with – the geopolitical traffic will travel in both directions. None of the traditional great powers on the international stage will come out of the pandemic unscathed. Leaders in Abu Dhabi are doubtlessly looking around the world at the moment and are finding few examples from the great powers that inspire them with confidence and reassurance. Both the United States and China have suffered, for different reasons, extreme reputational damage because of the way they are handling the pandemic and their distasteful squabbling for position. The British handling of the crisis has left Emiratis that traditionally looked to London as a cultural/governance style to emulate distinctly unimpressed, and the rest of Europe will be preoccupied with its own economic recovery for many years to come. Russia's recent ill-

considered attempt to undercut OPEC oil production policy has finally discredited its already limited influence in the Gulf. True to their style, Emirati leadership will never deign to voice their misgivings about these powers publicly, but there is a strong possibility that they will quietly seek to chart a foreign policy course that reduces their reliance on any one of these powers for the UAE's security and economic wellbeing.

Worsening Sino-American relations will challenge the ability to balance the competing interests of the United States and China: Pre-pandemic fears that the United States and China could end up in an adversarial 'cold war' redux relationship are now looking all but inevitable in the geoeconomic sphere, if not in wider geopolitics. As has already been mentioned, Abu Dhabi has previously trodden a skillful path between the unreasonable demands for absolute loyalty emanating both from Washington, DC, and Beijing. This approach would likely be more difficult to maintain for UAE leadership, and even if this approach can be extended into the future, the potential gains will be diminished. As difficult as the Emirati ability to balance the jealous interests of the United States and China, it is unlikely that Abu Dhabi will allow itself if at all possible, to be forced into choosing a side. Instead, the pressures resulting from even more adversarial and unstable Sino-American relations will likely reinforce a desire among UAE leadership to chart a more independent foreign policy course. Underpinned by a regionally superior military, the UAE may, perhaps, eventually adopt a certain kind of neutrality that we have seen in European countries such as Finland, Ireland, and even Switzerland.

Most of the scenarios outlined above are, of course, eminently debatable among reasonable people, but undoubtedly a leaner, wiser, and more prudent UAE will emerge from the ravages of this pandemic into a world more divided and diminished.

After COVID-19: Time to Agree A Biosecurity Code of Conduct Under the Biological and Toxin Weapons Convention*

Simon Whitby, Cheng Tang, Lijun Shang and Malcolm Dando

Summary

The devastating COVID-19 disease outbreak of 2020 is likely to cause a profound rethink of how national and international communities deal with such outbreaks whether they are caused naturally, accidentally or deliberately. This paper suggests that now is the time to build on two decades of work within the BTWC and for States Parties to agree on a Biosecurity Code of Conduct under the Convention as proposed by China. Over the past two decades, as part of their attempts to strengthen the BTWC and thereby to help prevent the development of biological and toxin weapons, States Parties have given considerable attention to the potential utility of Codes of Conduct for life and associated scientists. This paper reviews these debates about this novel dual-use ethical challenge within the Convention and concludes that a Code of Conduct should be agreed at the 2021 Review Conference, but that radical reorientation of the mandatory education of such scientists will also be needed to make the agreed code effective.

I. Introduction

Largely out of sight of most people, States Parties to the Biological and Toxin Weapons Convention (BTWC) have been meeting at the United Nations in Geneva over the last two decades trying to find ways to strengthen the Convention following the failure to agree on a Protocol during the 1990s. Given the application of developments in science in the major offensive military biological warfare programmes of the Twentieth Century, where viruses, toxins, bacteria and fungi had been weaponised[1], one major concern for the States has been the impact of rapid advances in the life sciences on the potential ease with which novel and very dangerous biological and toxin weapons could be developed by States, Non-State Actors, or even individuals.[2] The devastating COVID-19 disease outbreak in early 2020 is likely to cause a major rethink about the dangers of natural, accidental and deliberate disease outbreaks in humans, animals and plants when the outbreak is eventually brought under control[3]. As part of that rethink, it should be possible now, 45 years after the Convention entered into force[4], to bring the protracted discussions on a Code of Conduct under the Convention to a successful conclusion at the 2021 9th Five-Year Review Conference of the BTWC. This would make a major contribution to the prevention of further such outbreaks by engaging life scientists effectively for the first time in support of the prohibition of biological weapons that are embodied in the BTWC.

The problem that concerns States Parties to the BTWC was set out at the turn of the century in 2000 by Matthew Meselson, Professor of Molecular Biology at Harvard University when he questioned whether, as all previous scientific and technological

revolutions had been applied in major ways to hostile purposes, it was probable that the same would happen to the revolution in civil biotechnology unless we found ways to prevent that happening. He also thought that this would be a long drawn out struggle, stating that:[5]

> "...During the century ahead, as our ability to modify fundamental life processes continues its rapid advance, we will be able not only to devise additional ways to destroy life but will also become able to manipulate it – including the processes of cognition, development, reproduction and inheritance....Therein could lie unprecedented opportunities for violence, coercion, repression, or subjugation..."

And he pointed out that dangerous capabilities could be available to a much wider range of actors than were available in relation to nuclear weapons:

> "...Unlike the technologies of conventional or even nuclear weapons, biotechnology has the potential to place mass destructive capabilities in a multitude of hands and, in coming decades, to reach deeply into what we are and how we regard ourselves. It should be evident that any intensive exploitation of biotechnology for hostile purposes could take humanity down a particularly undesirable path."

In the following two decades these concerns were illustrated by a series of publications of experiments by civil scientists that caused increasing consternation amongst the security analysts about the possibility of their facilitating the development of novel biological weapons, and this led to a series of major meetings and reports about this *problem of dual use* – the fact that benignly-intended civil research might later be used by others for hostile purposes. It became clear during these two decades that a range of different means applied at various levels in a "Web of Prevention"[6] would be required in order to minimize the potential for the biotechnology revolution to be misapplied for hostile purposes.[7] This paper examines the evolution of the idea of a Code of Conduct under the Convention being a useful part of that web in meetings of the States Parties to the Biological and Toxin Weapons Convention (BTWC) during the past two decades.

Following the failure to bring the decade-long efforts to strengthen the Convention to a successful conclusion at the 2001 5th Review Conference the UK, as one of the three Depositary States for the Convention, produced a summary (a Green Paper) of the available options for developing the Convention in the run up to the recommencement of the meeting in late 2002. A review of this paper[8] noted that one option was "codes of conduct for professional bodies" but also noted that "[W]hile there would be benefits from such an international code of ethics, the Green Paper says nothing as to how such a code might be developed or implemented." Nevertheless, at the meeting in Geneva States Parties to the BTWC agreed that as part of the new Intersessional Process of annual meetings at Expert (MX) level (in the summer) and State Parties (MSP) level (later in the year) the content, promulgation, and adoption of codes of conduct for scientists would be the subject for the meetings in 2005.[9] These annual meetings in 2003, 2004 and 2005 would be used to discuss, and promote common understanding and effective actions to support the Convention.

2. The Initial Meeting on Codes of Conduct in 2005

By the time of the 2005 Meeting of Experts, the difficulties encountered in the later stages of the attempt to negotiate a verification system during the 1990s had reduced and there was certainly an attempt to deal seriously with the issue of codes of conduct

with large numbers of papers being produced for the meetings in 2005 (Table 1).

Table 1: Papers produced for the 2005 Meeting on Codes of Conduct*

Background Papers
Four Papers by the SecretariatOne Presentation by the United States
State Working Papers (Total 35)
Argentina 1, Canada 7, UK 4, Germany 6, Russia 2, China 1, Japan 2, India 1,
Indonesia 1, South Africa 1, Iran 1, Australia 4, Cuba 2, Korea 1, Italy 1
Additional Working Papers at the MSP
India 1, Russia 1

*Data from the UN website in Geneva under Biological Weapons Convention/Meetings and Documents.

The papers[10] by the Secretariat covered codes that referred to the BTWC, codes relevant to the life sciences that did not refer to the BTWC, elements of codes from other fields and relevant organisation, associations, professional bodies and institutions which could serve as sources of guidance in the formulation of codes of conduct. The presentation by the United States was a wide-ranging review of relevant codes in the United States.[11] It began by asking some basic questions about codes of conduct (Table 2).

Table 2: Some Basic Questions about Codes of Conduct*

What is a "Code of Conduct"? ● Formal statement of values and professional practices of a group of individuals with a common focus, either an occupation, academic field, or social doctrine. ● Defines the expectations and directs the actions of a group.
Examples of Codes of Conduct for the Life Science ● The Nuremberg Code ● The Belmont Report ● American Society of Microbiology (ASM) Code of Conduct ● Code of Ethics for the Life Sciences
What is a "Code of Conduct"? ● Government cannot oversee all scientists and experiments across the nation. ● Offers greatest opportunity for improving security of research at the level of individual scientists: ● Increases understanding of biosecurity; ● Persistent reminder of moral and ethical responsibilities: ● Creates a "culture of responsibility and accountability." ● Sets professional standards that may have legal implications.

*From BWC/MSP/2005/MX/MISC.4.

Canada similarly submitted a series of papers on common elements codes used in government, professional associations, academia and biodefence together with separate papers on the overlap between codes of conduct and legislation and on the functions of codes of conduct. However, the paper on the functions of codes also considered their possible weaknesses noting, for example, that:[12]

> "False or unrealistic expectations can damn the best of ideas. The creation of code of conduct that will make for a safer, happier, more productive work environment is a lofty goal, but one that will be doomed to failure if the code is ignored.... In addition, an ambitious code of conduct can be derailed by individuals who decide that they do not wish to follow its provisions, with no perceptible consequences to them. This is a key problem with virtually all codes of conduct that lack the power of applying sanctions to violators. Even a code that may have the backing of a financial, professional or legislative sanction may succumb to the pitfalls of disillusionment if not properly constructed."

A related point of particular interest here was raised by Australia in its Working Paper 29.[13] This stated that:

> "1. Amongst the Australian scientific community, there is a low level of awareness of the risk of misuse of the biological sciences to assist in the development of biological or chemical weapons. Many scientists working in 'dual-use' areas simply do not consider the possibility that their work could inadvertently assist in a biological or chemical weapons programme. *For most of these researchers, biological weapons issues may seem irrelevant and therefore strong advocacy is required to overcome natural resistance or ignorance...*" (emphasis added)

The paper therefore continued by reasoning it followed that"

> "... Introducing Codes of Conduct that highlight these issues is an important step in raising awareness. *However, it is not enough simply to put such Codes in place. Without effective measures to educate scientists about the existence and importance of such Codes, attitudes and awareness will remain largely unchanged."* (emphasis added).

Brian Rappert and Malcolm Dando had reported just before the Meeting of Experts on the results of a series of seminars that they had conducted at life science departments in universities in the UK. They concluded that:[14]

> "There was little evidence from our seminars that participants:
>
> a. Regarded bioterrorism or bioweapons as a substantial threat;
>
> b. Considered that developments in the life sciences research contributed to biothreats;
>
> c. Were aware of the current debates and concerns about dual-use research; or
>
> d. Were familiar with the BTWC." (original emphasis).

These authors were therefore in agreement with the Australian position. Moreover, in a further paper before the Sixth Review Conference in 2006, they reported very similar findings from seminars in five other countries.[15] The need for education of life scientists was reiterated by the Russian Federation in a paper for the Meeting of States Parties later in 2005.[16] Russia supported the idea of a code and gave it as the first core element that scientists should

"[B]e well informed of, and apply in their practice, international and national regulatory legal instruments on the prohibition of biological and toxin weapons." So even in 2005 just introducing a code of conduct was not seen to be sufficient to deal with the problem of the potential misuse of research by some of the States Parties.

3. The Meeting on Codes of Conduct in 2008

Given this level of interest it was unsurprising that the 6th Review Conference in 2006 decided that in 2008 during the Second Intersessional Process States Parties would focus on two topics, the second of which being:[17]

> "...Oversight, education, awareness raising, and adoption and/or development of codes of conduct with the aim of preventing misuse in the context of advances in bio-science and bio-technology research with the potential of use for purposes prohibited by the Convention."

Again in 2008, there were two contributions by the Implementation Support Unit on Codes of Conduct, Education and Awareness-Raising and a further eight Working Papers by States Parties, including by China,[18] on these topics. The most significant contribution was by the Netherlands. Their Working Paper stated that:[19]

> "A code is a set of principles and instructions that are binding on members of a particular group in a profession or industry....Moreover, *codes can be classified into different types. Brian Rappert developed this typology..."* (emphasis added).

Brian Rappert, as a Sociologist, had suggested the typology that the Working Paper then set out. This typology can be summarised as follows:

- Aspirational Codes (Set Standards);
- Advisory Codes (Provide Guidelines)
- Enforceable Codes (Make Legal Requirements)

Today, a decade and a half after Rappert's original 2004 paper, it is well worth reading, particularly his summary of the state of the discussions about codes of conduct at that stage:[20]

> "There is a renewed interest in codes to apply to the scientific and industrial life sciences community. Despite the extent and varied interest in a code or codes, there is a lack of detailed proposals about just what such a code or codes would entail. A close reading of the initial proposals shows that there are different concepts about who should devise codes; whether they should be voluntary or enforceable; what purpose they might serve (e.g., raise awareness, proscribe specific actions); what issues they should cover; by what mechanisms they could be agreed; whether a new code is necessary or existing ones should be augmented; and whether there should be a single universal code or various local ones..."

Rappert also argued that it could be very confusing if different people were discussing different types of codes. It has become clear that the discussions in Geneva are best related to an *Aspirational Code* that could be agreed at this international level and then implemented in a variety of codes to fit the different requirements in various countries.

What it is important to understand is that in 2008 it was widely thought that developing a code could be a means to raise awareness of the problem of dual use amongst scientists. This idea was in direct contradiction to the view put forward in 2005 by Australia. As was quite clearly stated in the Netherlands paper as *"[T]he*

main aim of the Dutch Code of Conduct on Biosecurity is to be seen as a contribution to awareness raising." The code developed by the Netherlands was widely circulated for example by the InterAcademy Panel, but while the need for education was noted in the code there was no requirement for it to be in place to support the code. The impact of the lack of education was illustrated by the account given by Koos van der Bruggen of the surprise, among the young researchers in the Netherlands who researched on the airborne transmission of highly pathogenic avian influenza in 2011, at the consternation caused by the submission of their work for publication. According to this account, one of the researchers said that:[21]

> "…he never imagined that the paper would get a red light from the NSABB [National Science Advisory Board for Biosecurity in the United States] and become the focus of a heated international debate about the limits of academic freedom. Watching the flood of news coverage, 'it was strange to think that we had created all of that in our lab'…"

That in regard to an experiment that many security analysts would see as raising very obvious dual-use concerns.

Nevertheless, progress was being made in the development of educational material linked to the BTWC for life scientists. For example, at the 2008 Meeting of Experts Professor Norihiko Yamada made a Statement in the Non-Government Organisations section on a joint Japan/UK project on the development of an Educational Module for Life Scientists. The module is still available on the website of the Federation of American Scientists and consists of lecture slides, references and question topics for 21 lectures in five sections: Introduction; The Threat of Biological Warfare, Biological Terrorism and the International Prohibition Regime; The Dual-Use Dilemma and the Responsibilities of Scientists; National Implementation of the BTWC; and Building an Effective Web of Prevention to Ensure Benign Development.

4. Developing Ideas on Education in Support of Codes of Conduct

This lack of education about dual use was again brought to the attention of States Parties in a contribution by Japan in a joint Working Paper titled *Possible approaches to education and awareness-raising among life scientists* by Australia, Canada, Japan, New Zealand, Republic of Korea, Switzerland, Kenya, Sweden, Ukraine, United Kingdom and the United States at the Seventh Review Conference in 2011. Japan's contribution stated that:[22]

> "…the National Defense Medical College (NDMC) in Japan and the University of Bradford in the UK conducted collaborative research to analyse the current state of biosecurity education in Japan. The research found that there was a lack of educational topics on biosecurity despite a certain level of presence of dual-use references, mainly due to an absence of space in the existing curricula, an absence of time and resources to develop new curricula, an absence of expertise as well as doubt about the need for biosecurity education…"

The paper also noted that "[P]arallel to this survey, the NDMC and the University of Bradford also jointly developed an online learning module in applied dual-use biosecurity education." Moreover, given that level of interest in the topic amongst States Parties it was not surprising that the Review Conference decided that, under the Standing Agenda on developments in the field of science and technology related to the Convention, the Third Intersessional Process would consider:[23]

(d) voluntary codes of conduct and other measures to encourage responsible conduct by scientists, academia and industry;

(e) education and awareness-raising about risks and benefits of life sciences and biotechnology…"

Thus, the Meeting of States Parties in 2015 concluded that:[24]

> "To further address education and awareness-raising about risks and benefits of life sciences and biotechnology, States Parties recognized that the continuous and accelerating rate of progress in scientific knowledge requires the necessity of deepening a culture of responsible use of this knowledge, which takes into account the object and purpose of the Convention without undermining peaceful uses. In order to further efforts on education and awareness-raising about risks and benefits of life sciences and biotechnology, States Parties discussed the need to share information and knowledge on these developments, including dual-use research of concern."

Then in 2016 at the Preparatory Committee for the Seventh Review Conference, China and Pakistan put forward a significant proposal for the development of a template for a code of conduct. Their Working Paper stated that:[25]

> "With the aim to prevent abuse and misuse of bioscience and technology, fulfil the aims and objectives of the Convention and strengthen global biosecurity governance, China has proposed the development of a template of biological scientist code of conduct within the framework of the Convention in December 2015…"

The paper went on to point out that many States had indicated support for the idea and provided suggestions. The elements of the proposed code are set out in Table 3A. The Working Paper proposed that States Parties should "[F]ully exchange views on the issue 'the development of the template of biological scientist code of conduct under the framework of the BWC' under relevant agenda of the Eighth Review Conference."

Table 3A: Elements of the 2015 China/ Pakistan Draft Model Code of Conduct for Biological Scientists*

1. Ethical Benchmark
2. Legal Restraint
3. Research Integrity
4. Respect for the Object of Research
5. Applying Science Research and its Relevant Process
6. Constraint on the Spread of Research
7. Popularizing Science and Technology
8. Organisation's Role
9. international Exchange

* From BWC/CONF.VIII/WP.30

At the Review Conference itself Ukraine and the UK, reflecting on their joint studies and research, pressed the case for serious attention to be given to the education of scientists given the current lack of awareness of the Convention and its implications. Their joint Working Paper argued that:[26]

> "18. The Conference should therefore adopt the following language in the Final Declaration text for Article IV:
>
> The Conference stresses the critical importance of biosecurity education and awareness-raising in achieving effective implementation of the Convention, which should be put into effect through national implementation measures, as appropriate, in accordance with the constitutional process and practices of each State Party.

19. The Conference notes that such measures could include...

(c) promoting the development and implementation of training and education programmes as well as training guides, handbooks and course materials, including raising awareness of the implications of dual use research and technology, for those granted access to biological agents and toxins relevant to the Convention, and especially for those with the knowledge or capacity to modify such agents and toxins..."

Ukraine, Japan and the UK again pressed the case for serious attention to be given to education at the 2017 Meeting of States Parties in a Working Paper on *Recent Developments in Education*. The joint paper suggested that:[27]

"19. There are a number of key points that States Parties might draw from these experiences, taking into account what is most appropriate given their own national structures and organisations:

The need to reach out and engage with stakeholders over a period, obtain their interest and support, and build networks; it is especially important to engage with staff who will deliver the teaching, and students who will study the materials, to ensure that learning will be effective.

The need to develop appropriate teaching materials, adapting what is already available for their own national circumstances and developing complementary material where necessary.

The benefits of international collaboration and shared experience and expertise.

The benefits of using websites and online techniques to facilitate communication and learning.

The importance of continuing efforts to ensure sustainability."

Finally, China and Pakistan made a clear-cut proposal for bringing this long period of development to a conclusion at the Ninth Review Conference in 2021. At the 2018 Meeting of Experts, they presented a Working Paper that included a draft *Model Code of Conduct for Biological Scientists* (Table 3B).

Table 3B: Elements of the 2018 China Draft Model Code of Conduct for Biological Scientists*

1. Ethical Standard
2. Research Integrity
3. Respect for the Object of Research
4. Process Management for Science Research
5. Constraint on the Spread of Research Outcome
6. Popularisation of Science and Technology
7. Institution's Role
8. Education and Training
9. Awareness and Engagement
10. International Exchanges

*From reference 24

Crucially, China's Working Paper stated:[28]

"9. Hereby, we propose to:

Continue in-depth discussion on the topic of 'development of a model code of conduct for biological scientists', with a view to reaching consensus on the content of the model code of conduct.

Facilitate the approval of the model code of conduct for biological scientists by the Ninth Review Conference, as well as the authorization by the Review Conference to work on implementation and promotion of the model code of conduct in the future inter-sessional process."

The presentation at the Meeting of Experts had been preceded by an international conference in Tianjin, China on *Building a Global Community of Shared Future for Biosecurity: Development of a Code of Conduct for Biological Scientists* at which China's ideas for the code were discussed in detail by a range of 28 experts from 14 different countries, 6 experts from international organisations and a large host delegation from China itself. The elements of the Code as set out in Table 3B.

It will be noted that there was a significant change in the elements of the code after the Tianjin meeting. As emphasised in Table 3B the elements 8 and 9 were added to the previous version of the code shown in Table 3A. The envisaged code of conduct now clearly had a key element (8) concerned with emplacement of an effective system of education for scientists which stated that:

> "8. (*Education and training*) Scientific community and professional associations should play an active role in education and training. Increase public awareness of the Convention, and *establish a safety education and training system for all parties involved in biotechnology research.* Biological scientists should be encouraged to engage in dialogue and cooperation with social scientists, philosophers and anthropologists, so as to have a better understanding of the possible ethical and social implication of relevant biological research and its outcome." (emphasis added)

It also had element 9 devoted to awareness-raising and engagement of scientists that stated:

> "9. (*Awareness and engagement*) *Biological scientists should be fully aware of the potential threats of dual-use research to human society, ecological environment and economic security.* It is advocated to promote the peaceful application of biological research achievements, to prevent the abuse and misuse of biological products, scientific knowledge, technology and equipment, and to consciously resist any unethical scientific conducts that are harmful to human society." (emphases added)

The new version of the code retained element 10 on the kind of international cooperation that will be needed for example to deal with threats of the kind illustrated by the present COVID-19 outbreak.

Then in his report of the meeting, the Chair of the MX2 Session on science and technology concluded that such a code of conduct would be one of the elements that had the most chance of being agreed at the Ninth Review Conference:[29]

> "...It is the Chair's view that...activities of the ISP should focus on issues that achieved greater commonality of approaches among delegations. In this regard, two areas could be explored: (i) risk assessment and management, and (ii) a voluntary code of conduct for biological scientists and relevant personnel."
>
> "The Chair sees the two topics above as those that could lead to a meaningful discussion during the remaining meetings of the ISP, in 2019 and 2020. They seem to present the best prospect for an agreed outcome on S&T [Science and Technology] issues in the 2021 Review Conference of the BWC..."

How this plays out will depend on how well meetings of the BTWC succeed in 2020 and 2021 in the lead up to the decision making 9th Review Conference. However, China's attitude to the misuse of biotechnology became very clear at the end of 2019 when the scientist who used CRISPR/Cas technology to edit the genomes of three human babies was sentenced to 3 years in jail and a large fine by a court in Shenzhen for illegal medical practice.[30]

5. International Comparisons

Of course, biological weapons are just one of the three types of generally acknowledged weapons of mass destruction and it is therefore not surprising that similar discussions have taken place in regard to chemical and nuclear weapons. The Organisation for the Prohibition of Chemical Weapons (OPCW) that implements the Chemical Weapons Convention (CWC) produced the *Hague Ethical Guidelines*, essentially an Aspirational Code of Conduct, in applying the norms of the practice of chemistry to support the CWC in 2015 (Table 4). There clearly exist differences between the code proposed by China for the BTWC (Table 3B) from that agreed for the CWC (Table 4). For example, the biological code necessarily has more emphasis on respect for the subjects of research as much more of the experimentation involves living organisms, but the clear prominence given to education and awareness-raising is obvious in both.

*** Table 4: Core Elements of The Hague Ethical Guidelines**

1. Sustainability
2. Education
3. Awareness and Engagement
4. Ethics
5. Safety and Security
6. Accountability
7. Oversight
8. Exchange of Information

* From the OPCW Website

The newly established Advisory Board for Education and Outreach (ABEO) of the OPCW produced a major report in 2018 that emphasised the importance of active learning in engaging practicing scientists in maintaining and developing the prohibition to prevent the re-emergence of chemical weapons. The report stated that:[31]

> "One of the most important implications of this research is that 'active learning' methods, as opposed to traditional, lecture-based instruction in which students are passive recipients, produce better and longer lasting results. The results hold for factual information and for more fundamental concepts. The methods can be applied in many settings, including the classroom, the laboratory, or the field."

These developments related to the CWC have been reported by the OPCW in detail to meetings of the BTWC States Parties in recent years.[32] It is to be expected that the OPCW will over the coming years pursue a robust programme of education in support of the *Hague Ethical Guidelines*. Similarly, major developments have taken place in relation to nuclear security education. In 2012 it was already clear that significant efforts were being made to improve the security education of scientists (and others) connected with the nuclear industry. A Briefing Paper titled *Biosecurity Education for the Life Sciences: Nuclear Security Education Experience as a Model* stated that:[33]

> "The INSEN [International Nuclear Security Education Network] is a partnership between the IAEA and educational and research institutions, and competent authorities. Its mission is *'to enhance global nuclear security by developing, sharing and promoting excellence in nuclear security education'*. In order to achieve its main objective, namely to foster and support the implementation of nuclear security education, the Network has identified a set of key areas and activities for collaboration..." (original emphasis).

The text continued by setting out some of these key areas as follows:

-"Development of peer-reviewed textbooks, computer-based teaching tools and instructional material, including exercises and materials for laboratory work;

-Faculty assignment and development in the different areas of nuclear security through mutual faculty exchanges and/or joint development and implementation of in-depth nuclear security training programmes or school....

-Quality assurance: consistency with IAEA defined terminology described in the IAEA Nuclear Security Glossary, the Fundamentals and the Recommendations documents...

-Performance of surveys on the effectiveness of nuclear security education among students and faculty."

Even in 2012, this was an endeavour of a different order to anything being envisaged in relation to the BTWC even today.

The importance of the INSEN model was emphasised in a major review of the literature on dual use and responsible conduct in 2018. The authors concluding that:[34]

"...We found that while there were discussions in the literature about specific elements of culture (management systems, leadership and/or personnel behavior, beliefs and attitudes, or principles for guiding decisions and behaviors), there was a general lack of integration of these concepts, as well as limited information about specific indicators or metrics and the effectiveness of training or similar interventions. We concluded that life scientists seeking to foster a culture of biosafety and biosecurity should learn from the substantial literature in analogous areas such as nuclear safety and security culture, high-reliability organizations, and the responsible conduct of research, among others."

Then in a follow-up effort to find means of assessing the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences an attempt has been made to modify the nuclear security approach for the life sciences. The working draft titled *Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences: (Self) Assessment Framework* stated that:[35]

"This tool intends to provide a measure of the organizational culture of biosafety, biosecurity, and responsible conduct to aid in the process of enhancing such culture at the local level through baseline and periodic assessments."

And it pointedly drew upon the nuclear security programme adding that:

"While this is an attempt to adapt the nuclear safety and security culture model to the biological domain, future efforts to holistically integrate characteristics and indicators of an organizational culture across chemical, biological, and radiological/nuclear (CBRN) domains may help establish a framework for holistically assessing the CBRN safety and security culture in laboratories and other related organizations working with such hazardous materials. Such efforts will not be possible without the leadership of major international organizations and the support of professional associations."

In this tool biosafety, biosecurity and responsible is defined as:[36]

"An assembly of beliefs, attitudes, and patterns of behavior of individuals and organizations that can support, complement or enhance operating procedures, rules, and practices as well as professional standards and ethics designed to prevent the loss, theft, misuse, and diversion of biological agents, related materials, technology or equipment, and the unintentional or intentional exposure to (or release of) biological agents."

Then, for a particular laboratory, assessments are made of the management systems in place; the behaviour of the leadership and personnel; the principles for guiding decisions and behaviours; and the beliefs, opinions and attitudes of those involved. For example, in regard to beliefs, opinions and attitudes people carrying out the self-assessment are asked to state the extent that they agree with a series of questions such as those set out in Table 5.

Table 5: Questions about Beliefs, Attitudes and Opinions*

1. There is a risk of bioterrorism or an attack with a biological weapon.
5. Biosafety and/or biosecurity deficiencies or vulnerabilities are corrected with a sense of urgency.
10. I am aware that there are ethical, legal, and societal issues and consequences attached to my research.
13. My organization has a culture that supports and encourages trust, collaboration, consultation, and communication with regard to biosafety and biosecurity.
14. National policy and legislation relevant to the life sciences aim to provide protection against the misuse of science.
17. I have received adequate training on the procedures necessary to conduct my work without compromising safety and security.
19. Scientists have an obligation to do no harm.
20. I do/would/will report my concerns to the appropriate people, authorities, and/or agencies if I become aware of activities that violate the Biological and Toxin Convention, United Nations Security Council resolution 1540, or international customary law

*From reference 31.

Answers to these questions can then be summarized in a colour chart to give a picture of the state of the organization in regard to biosafety, biosecurity and responsible conduct and from that picture suggestions can be made as to how the organization can be improved.

6. Conclusions

When the COVID-19 outbreak is over there will undoubtedly be many investigations about what happened and what should be done to prevent any further outbreaks – natural, accidental or deliberate – in the future. There will be many proposals put forward of various importance and difficulty of implementation. We would suggest that one important proposal should be the agreement of an *Aspirational Code of Conduct* under the BTWC as proposed by China with mandatory education in order to effectively engage life scientists in protecting their work from misuse. After almost 20 years of discussion, the proposal is well understood by many States Parties and could be agreed as a set of principles like the *Hague Ethical Guidelines* and then implemented in national codes of various kinds as fits different national circumstances.

In relation to awareness-raising and education initiatives of the kind that would be needed to underscore understanding of the relevance of such codes, important contributions in this connection have already resulted from the state – academic collaboration with the production by the University of Bradford of a Guide to Biological Security[37] that is accompanied by

a Team-Based-Learning Handbook[38]. The chief objective of the latter is to supplement the former by combining teaching material in biological security with an active learning training approach – Team-Based Learning (TBL) - so as to empower educators, students and practitioners as they begin to engage with biological security. Further to this, the use by Bradford[39] of such techniques in proof of concept continuing professional development training has been undertaken under the auspices of the European Union's Human Brain Project where, in 2017 and 2018, evidence-based training of neuroscience professionals and practitioners at the Karolinska Institutet, Stockholm, demonstrated improvement in the knowledge and understanding of participants through engagement in discussions concerning the ethical, legal and social aspects of biological security.

The world is in the midst of a century of unprecedented change, and the 45-year-old Biological and Toxin Weapons Convention stands on a new starting line. It is to be hoped that the international community will take the commemoration of the 45th anniversary of the entry into force of the Convention as an opportunity to keep pace with the times, comprehensively advance the aims and objectives of the Convention, deepen international cooperation on biosecurity, and actively promote the establishment of a community of biological security for the destiny of mankind.

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A Brief Overview of Pandemics

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Summary

This is a brief overview of major pandemics across the world.

As per World Health Organisation (WHO) 2010, a pandemic is the worldwide spread of a new disease. David M. Morens, Gregory K. Folkers, and Anthony S. Fauci (2009) define pandemic as a disease of very different etiologies that exhibit a variety of epidemiologic features. Any pandemic will sure to possess one invariable common denominator: wide-spread geographic extension. In A Dictionary of Epidemiology (2008) Pandemic is defined as an epidemic occurring worldwide or over a very wide area, crossing international boundaries, and usually affecting a large number of people.

Plague: "Plague of Justinian", "Black Death" and Plague in India

In the last two millennia, the plague has created several incidents of a pandemic. The first certain pandemic is known as Justinian's plague in the sixth century AD, between 542 and 546 AD. It spread across Asia, Africa and Europe and claimed nearly 100, 000, 000 victims. The second plague pandemic is known as the "Black Death" which took place in the fourteenth century from 1347 to 1350. It caused the death of approximately 50, 000,000 half of which was in Asia and Africa and the other half in Europe. One-fourth of the European population succumbed to this disease. The third phase of the pandemic began in Canton and Hong Kong in 1894 and spread by rats to 77 ports on five continents within 10 years from 1894 to 1903. Plague entered India in the third phase when it caused nearly 13,000,000 deaths. The cause of this disease was only understood in the late 19 century that is a Yersinia Pestis pandemic. This strain of Yersinia infects the oriental rat fleas or *Xenopsylla cheopis* forcing them to regurgitate concentrated bacteria into the host. Such infected hosts then transmit the disease to humans.

Humans can transmit the disease by droplets, leading to pneumonic plague[1].

The spread, source and severity of the first plague pandemic is disputed due to lack of documentation. Plague of Justinian, the first of three human plague pandemics, either spread from central Asia or Africa across the Mediterranean basin into Europe through the ships loaded with grain which also carried rats. This plague killed an estimated 100 million people according to the contemporary scholar Procopius, approximately 50 to 60 percent of the population of these regions contributing to the end of the Roman Empire.[2]

In the 14 Century with an absence of medicinal progress people turned to religion, Catholic Europe sought to identify sinners against God and in the process frequently singling out minorities, women, Jews or Non-Catholic Christians. During this phase, young doctors from any ranks were contracted to perform the duty of the plague doctor and address the shortage of specialized physicians. Venice was among the first city-states to establish such practice during 1348. Their principal task was to take care of people with plague and to put in public records the cases of deaths. In cities such as Florence and Perugia, plague doctors were the only ones allowed to perform autopsies to help determine the cause of death. This period also understood the significance of quarantine or isolating the infected population. They noted that, after a period of isolation, individuals who had not developed symptoms of illness would likely not spread the disease any longer. Thus, the rule of mandatory isolation was initiated. The first known instance of quarantine was implemented in 1377 in Ragusa, the City-state of Dubrovnik for 30 days to all new arrivals before entering the city.[3]

The third wave of plague began in China's Yunnan province in 1894 and then spread through the shipping routes to the United States (US). A ship with infected rodents from Hong Kong came to Hawaii in December 1899, and then San Francisco, where the pandemic began in March 1900.[4] However, except for China and India, its spread was limited.[5] In India as well the spread was contained to selected zones. It arrived in India in 1896. During the first three years, almost fifteen percent of the total number of deaths in India was from Bombay. In the year 1903 Bombay witnessed 20,788 plague deaths, and in 1907 total death toll of India was 1,315,892. Till 1921, an estimated twelve million Indians lost their lives, in comparison with three million in the rest of the world. Punjab had the second largest numbers in plague mortality.[6]

Influenza Virus: "Spanish Flu" or H1N1, and "Swine Flu" or H1N1/09

There are two bouts of influenza virus that had reached a level of the pandemic. One took place from 1918 to 1919 and another in 2009. Both influenza viruses have similar flu-like symptoms such as fever or feeling feverish/chills, cough, sore throat, runny nose, muscle or body aches, headaches, fatigue, and diarrhea.[7] However, one distinctive trait of both these viruses was their ability to affect the younger healthier population whereas common flu tends to impact children and elder generation more.

An estimated one-third of the world's population was infected during the 1918–1919 influenza pandemic. The fatality rate was more than 2.5 percent, compared to other influenza viruses with less than 0.1 percent fatality rate. The first wave of influenza pandemic appeared in March 1918, followed by two much more fatal second and third waves in September to October of 1918 and January of 1919 respectively.[8]

Despite advances in epidemiology and public health, the true origin of Spanish flu remains unknown. The pandemic took place in the middle of World War I in a time of uncertainty, press censorship and advanced modes of transportation, including intercontinental travel. Within months, it spread from Europe, where military movements contributed to larger spread, to the United States (US), Asia, Africa, and the Pacific Islands. The mortality rate of Spanish flu ranged from 10 percent to 20 percent. This influenza virus had the highest fatality rate among the H1N1 strains, approximately 100 million. This virus affected mostly younger and healthier populations. By August 1918, the virus had mutated to another form which was supposedly even deadlier than the first wave.[9]

Spanish flu to some extent also determined the outcome of the First World War because it affected armies of Germany and the Austrian–Hungarian Empire more virulently than their Allied opponents (Price-Smith 2008:58). Many notable politicians, artists, and scientists were either affected by the flu or succumbed to it. Its distinguished survivors include Walt Disney, Greta Garbo, Raymond Chandler, Franz Kafka, Edward Munch, Franklin Delano Roosevelt, and Woodrow Wilson; whereas painters such as Gustav Klimt and Egon Schiele, and poets like Guillaume Apollinaire were among the fatalities of this virus.[10]

The 2009 H1N1 pandemic started in Mexico in April 2009. By the end of April, cases were reported in several states in the United States (US), and in countries such as Canada, Spain, United Kingdom (UK), New Zealand, Israel, and Germany. On 25 April 2009, the WHO declared the situation a public health emergency of international concern.[11] It continued to spread for over a year and on 10 August 2010, the Director-General of WHO, Dr Margaret Chan declared the end of this pandemic. The first doses of the H1N1 pandemic vaccine were administered on 5 October 2009. The virus infected over 10% of the global population and had a death toll approximately from 20,000 to over 500,000. The largest of these fatalities may have occurred in countries in the African and Southeast Asian regions as per a report published in the Centers for Disease Control and Prevention (2012), where more than half of all 2009 H1N1-related deaths occurred. This study estimated that 80 percent of H1N1 fatalities were younger than 65 years of age. It is different from seasonal influenza epidemics which usually kills 80 to 90 percent of the population that is 65 years of age and older. It was estimated that 0.001–0.007% of the world's population died of respiratory complications caused by the 2009 H1N1 virus infection during the first 12 months.[12] Although its death rate was lower than the regular influenza death rates, at its peak it was perceived as threatening because it primarily affected healthy young adults. This pandemic was the first disease where mental health was considered an important aspect of preparedness and mitigation policy efforts.[13]

HIV Virus

The first cases of Acquired Immuno-Deficiency Syndrome (AIDS) were reported in 1981, and very quickly infection with the virus (HIV) has grown to pandemic proportions. At present treatment of HIV infection with antiretroviral therapy (ART) are available.

From 1981 till the end of 2018, 74.9 million people have become infected with HIV and 32.0 million died.[14] It causes about one million deaths a year worldwide. This virus's spread is especially alarming in some Sub-Saharan African countries such as Botswana, Lesotho, and Swaziland, where it has infected

more than 25 percent of the population. As per the WHO report of 2018, 67.99 percent of the total HIV positive patients are from Africa, 10.5 percent from South East Asia, 9.26 percent from both the continents of America, 6.61 percent from Europe and 5.03 percent from Western Pacific.[15] In the US, approximately 1.2 million people are HIV positive and the death toll is 12,000 per year. It used to be over 40,000 per year in the late 1990s. In the US, HIV also has disproportionately affected the gay population, transgender women, and African-Americans both in terms of the number of infected and social discrimination.[16]

Despite spreading slowly than any other pandemic, HIV has received significant public health attention from national and international administrations and pharmaceuticals. It is also a disease that has managed to focus on the mental health of the patients so as to make others comprehend some of the challenges generally associated with infectious diseases.[17]

Corona Virus: SARS

Severe Acute Respiratory Syndrome (SARS) was caused by the SARS Coronavirus (SARS-CoV) and first appeared in China in 2002 where it had infected almost 10,000 individuals, mainly in China and Hong Kong[18]. By the end of 2002, the disease spread to 26 other countries, such as Canada with 251 cases. The outbreak was contained by mid-2003. Although there are disputed theories regarding its inception, SARS-CoV is thought to come from an animal probably bats, which spreads to other animals (civet cats).[19]

Symptoms of SARS-CoV are primarily similar to influenza and include fever, malaise, myalgia, headache, diarrhoea, and shivering. However, the disease has no proven specific symptoms so far. For example, fever, one of the most frequently reported symptoms, is sometimes absent at the beginning of the infection, especially in elderly and immunosuppressed patients. From the perspective of severity and mortality rate of about 10%, SARS-CoV created a global health concern. The outbreak of SARS also witnessed an increase in the study of patient's mental health both among the active patients and survivors of the disease.[20]

Ebola Virus Disease

Ebola Virus Disease (EVD) first appeared in 1976 in two simultaneous outbreaks, one in the present Nzara in South Sudan, and the other a village near the Ebola River in Yambuku, Democratic Republic of Congo.[21] The 2014 to 2016 outbreak in West Africa was the largest EVD outbreak since the virus was first discovered in 1976. Most likely it was first spread through fruit bats in a village in Guinea in December 2013. From Guinea, it reached Sierra Leone and Liberia, where it infected over 28,000 and the fatality rate was approximately 11,000. Cases were registered in Nigeria and Mali as well, albeit small in number and quickly contained. In September 2014, a passenger from Liberia died in Texas simultaneously infecting two nurses caring for him which led to a significant public concern over possible Ebola outbreak in the US.[22] This again led to the US Department of Defense deploying military personnel for training Liberians to manage the disease and build hospitals. This mission was called Operation United Assistance[23].

As per WHO guidelines 2020, EVD is introduced into the human body through contact with the blood, secretions, organs or other bodily fluids of infected animals such as fruit bats, chimpanzees, gorillas, monkeys, forest antelope or porcupines. After it enters

a human-body, EVD spreads through human-to-human transmission via direct contact through blood or body fluids or objects that have been contaminated with body fluids from a sick person. The symptoms of EVD include fever, fatigue, muscle pain, headache, sore throat vomiting, diarrhea, rash, impaired kidney and liver function, internal and external bleeding.[24]

Zika Virus

Zika virus is found in rhesus monkeys in Uganda in 1947.[25] The only known outbreaks of this virus were recorded in Micronesia in 2007 and South America and the US from 2015 to 2016. It was identified in Brazil in 2015. Symptoms of the Zika virus are flat pink rashes, bloodshot eyes, joint pains, fever, and headaches. It is a mosquito-borne disease, typically borne by the species *Aedes Aegypti* but it also can be sexually transmitted. Initially, its mild symptoms made it rather insignificant form the public health perspective. However, as later infections showed that Zika can cause Guillain-Barre syndrome in adults and cause microcephalia (a condition in which the brain does not develop or has stopped growing thus making the circumference of the head smaller than normal[26]) in unborn children of infected mothers (a risk of about 1%).[27] Guillain-Barre syndrome is a neurological disorder for which the body's immune system attacks part of its nervous system located outside of the brain and spinal cord. GBS can cause mild weakness to paralysis.[28]

For example, in the year 2015 Brazil witnessed 2400 birth defects and 29 infant deaths due to suspected Zika infection. Zika transferred from Micronesia, across the Pacific, to Brazil, where it continued to spread. Since 2016, Zika has spread throughout South America, Central America, the Caribbean, and several states within the USA. It remains a significant public health concern, as there is no vaccine available so far.[29]

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Chemical and Biological News

NATIONAL AND INTERNATIONAL DEVELOPMENTS

Styrene Gas Leak in India

LG Polymers, the Indian Unit of South Korea's LG Chemicals, that operated its plant at Vishakhapatnam in Andhra Pradesh suffered Styrene gas leak before dawn on 7 May 2020. The resultant vapour cloud spread over a radius of about 3 kilometeres, affecting nearby areas. The death toll was thirteen besides leaving over 1000 exposed to the gas. Preliminary reports reveal that the cause could be maintenance failures, operating errors, and improper storage of the toxic styrene gas, may have led to the tragedy.

Styrene, the gas leaked is an important commercial chemical, which is used in making make plastics, paints, synthetic rubber, insulation, fibreglass, pipes, automobile parts, food containers and disposal cups and is harmful if inhaled in excess quantity.

See: https://www.livemint.com/news/india/lg-polymers-admits-leaking-vapor-from-gas-storage-tank-caused-vizag-tragedy-11589009346537.html

Specialist in Biological and Chemical Warfare dies of COVID-19

Julian Perry Robinson, who has died aged 78, combined academic research with behind-the-scenes advocacy to enhance controls on some of the most inhumane weapons in the world. His focus was on issues related to chemical and biological warfare (CBW) and the international efforts to eradicate the use or possession of such weapons.

During the cold war differences between the major powers on the control of biological weapons, he examined the challenges of CBW in factual terms rather than the rhetoric of the time. A key concept Julian promoted – that all disease-causing organisms and the toxins they produce should be considered biological weapons, unless held for clearly peaceful purposes – became the core of the 1972 Biological Weapons Convention, the first treaty to ban a whole class of weapons of mass destruction. This concept, which became known as the "general purpose criterion", has meant the convention has not been overtaken by scientific and technological developments. He also facilitated the common understanding in the Geneva negotiations that resulted in the Biological Weapons Convention.

See: https://www.theguardian.com/world/2020/may/08/julian-perry-robinson-obituary

INTERNATIONAL COOPERATION

First Report by IIT Released by OPCW

Organisation for the Prohibition of Chemical Weapons (OPCW) released the findings of Investigation and Identification Team (IIT) on 8 April 2020. The IIT is responsible for identifying the perpetrators of the use of chemical weapons in the Syrian Arab Republic where the OPCW Fact-Finding Mission (FFM) has determined that chemical weapons have been used or likely used in Syria.

The IIT's first report sets out its mandate, the legal and practical challenges of its work, and the findings of the investigations conducted between June 2019 and March 2020, focusing on the incidents in Ltamenah, Syrian Arab Republic on 24, 25, and 30 March 2017. The IIT's investigation and analysis included a comprehensive review of all of the information obtained including: interviews with persons who were present in the relevant places at the time of the incidents, analysis of samples and remnants collected at the sites of the incidents, review of the symptomatology reported by casualties and medical staff, examination of imagery, including satellite images, and extensive consultation of experts. The investigation relied on relevant FFM reports as well as on samples and other material obtained directly by the Technical Secretariat in the territory of Syria.

See: https://www.opcw.org/media-centre/news/2020/04/opcw-releases-first-report-investigation-and-identification-team

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