COVID-19 -A NEW PANDEMIC FOR 137 MILLION INDIAN - IMPACT, INTERVENTIONS AND SOLUTIONS

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both the authors. Author AAC designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Author SK managed the analyses of the study. Both author managed the literature searches, read and approved the final manuscript.

Original Research Article

ABSTRACT

Objective: There were many historical epidemics in India in the last century. COVID-19 is a new- age epidemic, which we have never experienced in the near past. The objective of our research is to highlight the effect of a pandemic, the impact of interventions, and to propose a concrete and useful mitigation plan for India to fight not only this epidemic but also for other disasters. We need to re-assess our strategies, planning and available tools to fight with this pandemic and the crisis due to pandemic.

Methods: This present study based on a literature review available for public reference as well as interviews conducted with different sections of society. Case studies of two nations- South Korea and Taiwan, which are successful in containing the pandemic, were reviewed. Literatures were sourced from reliable public domain sources and official government data.

Results: India may be successfully handling COVID-19 but at a significant cost. It is expected that lakhs of people will suffer from it, possibly thousands will die, but indeed 1.3 billion Indians will be affected directly or indirectly. It could have been avoided. We have included success stories of two triumphant nations Taiwan and South Korea, for their excellent use of technology during combat against COVID-19.

Conclusion: We concluded this study with scientific and social feedback to the government about their existing pandemic management program and helping them in building an innovative disaster management communication tool for the future. Our strategic, structured program, IFDM -Indian Firewall for Disaster Management, is the outcome of this research.

Keywords: Coronavirus; COVID-19; Indian society; pandemic.

1. INTRODUCTION

The epidemic is an outbreak of infectious diseases that spread rapidly in a given population within a short period of time. The global outbreak is termed as a "pandemic," and when it is restricted to a particular place, it is known as "endemic." All the pandemic diseases originate as endemic, and due to our social

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engagements and civilization, it spreads throughout the world and becomes a "pandemic."

2. HISTORY

Infectious diseases have been a constant companion of human beings throughout the history. Nothing has killed more humans than an infectious disease. From the earliest times to the present- day, epidemics have affected the human society in myriad ways: socially, culturally, politically, economically, and biologically. People had never known a period in history when epidemics did not pose a potential threat. This is as evident today as it ever might have been. Indeed, even in the cutting-edge period, outbreaks are nearly constant; however, very few of them reach the pandemic level like Coronavirus. Fig. 1 shows some of the most lethal pandemics in history, from Circa to the COVID-19 [1].

3. ORIGIN OF NOVEL CORONAVIRUS (SARS-CoV-2)

The Chinese government has told that the Wuhan seafood market is the place of origin of COVID19. A 55-year-old from Hubei Province may have been the first person to have contracted a viral infection on 17th November 2020, and cases have been on the rise since then [2].

The incidence of unknown pneumonia was reported to WHO on 31st December 2019 by Chinese authorities, and on 1st January 2020, the Huanan seafood market was closed. On 7th January, the virus was recognized as a coronavirus with > 95% homology to the bat coronavirus and >70% similarity to the SARS-CoV.

Like earlier coronavirus SARS passed from bats to humans via civet cats and MERS via camels, in the case of 2012. The WHO has stated that the new Coronavirus may have its biological origin in Rhinolophus (horseshoe) bats, but that another intermediate animal is likely to be responsible for transmission to humans. Some scientists have found genetic links with pangolin coronaviruses, but they have yet to be confirmed.

In the next few days, it spread throughout the globe, by the time it was declared a pandemic on 12th March 2020 by WHO, it occupied 30% global population with 187 countries including India.

Biology of Corona Virus: It is a simple micro-size protein structure having crown-like spikes, enveloped single-stranded RNA virus, which is capable of reproducing faster and reviewing at different surfaces. It belongs to family *Coronaviridae* with many species like HCoV-229E (Human coronavirus strain 229E), HCoV-NL6HCoV-NL6 (Human coronavirus strain NL63), SARS, and MERS [3,4].

Interestingly, this viral family has increased over the last few years as a result of the discovery of the newly appeared virus as a causative agent of severe acute respiratory syndrome (SARS).
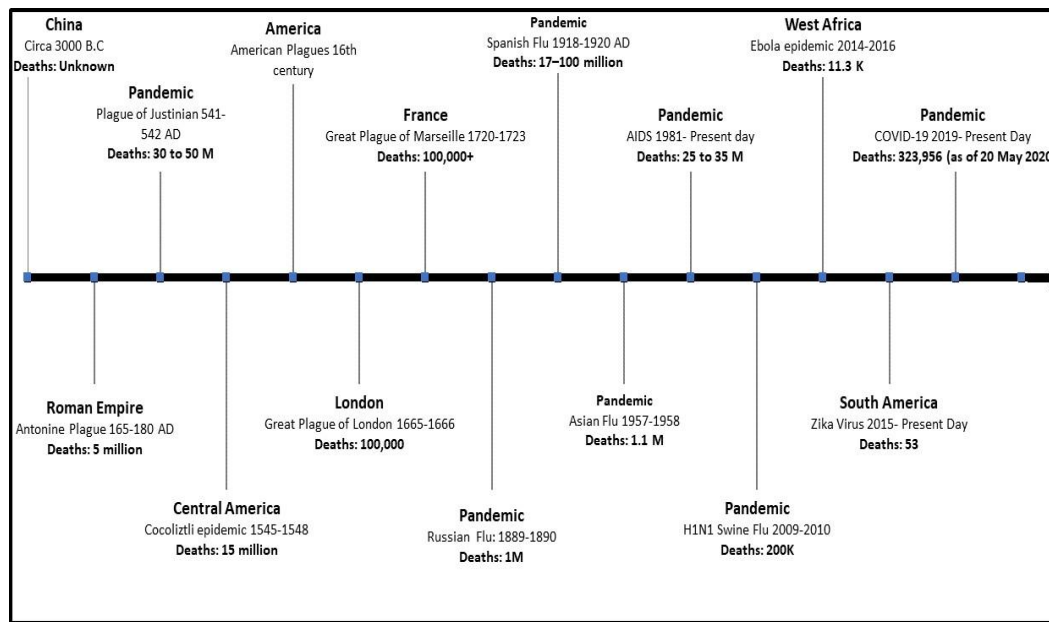

Fig. 1. Timeline of some significant past epidemics

At the molecular level, coronaviruses use several unusual strategies to carry out a complex program of gene expression. Coronavirus replication involves ribosome frame shifting during genomic translation, the synthesis of both genomic and multiple sub-genomic RNA species, and the assembly of progeny virions by a mechanism that is exceptional among enveloped RNA viruses. Progress in the study and investigation of these processes has been boosted by the development of reverse genetic systems, a development that had previously been obstructed by the enormous size of the coronavirus genome [5].

Epidemiology of Coronavirus: Coronavirus causes acute, mild upper respiratory infection (common cold). It affects different people in different ways. Most infected people developed mild to moderate symptoms. Common symptoms are fever, tiredness, dry cough, and some people may experience pain, runny nose, nasal congestion, sore throat, and diarrhea. On average, it takes about 5–6 days for someone to show signs of the infection; however, it may take up to 14 days.

The virus enters into the host cell, and the uncoated genome is then transcribed and translated. The mRNAs form a unique "nested set" sharing a common 3′ end. New virions develop by budding from host cell membranes [6,7].

Infection is spread by large droplets generated by symptomatic patients while coughing and sneezing, but may also occur from asymptomatic people before the symptoms begin [8]. The virus replicates locally in cells of the ciliated epithelium, causing cell damage and inflammation.

Laboratory diagnosis is made based on antibody titer in paired sera. It is hard to isolate the virus. Nucleic acid hybridization tests (including PCR) are now in operation. Treatment is mainly supportive and symptomatic; no vaccines or specific drugs are available. Social distancing, self-isolation, and maintaining proper hygiene can only reduce the rate of transmission [9].

Impact on Animals: We also have cases of transmission of COVID-19 from human to animal. Two pets (dogs) in Hong Kong and two pet cats (one in Belgium, the other in Hong Kong) incidentally exposed to COVID- 19.

On 5th April, the USDA National Veterinary Services Laboratories reported a positive case of SARS- CoV-2 in samples collected from one tiger at the Bronx Zoo in New York City. It seems to be the first instance of a tiger being diagnosed with COVID-19 [10].

Global impact: Despite modern age technology, COVID-19 has proved to be the fastest pandemic and has invaded 90% of the world's countries in just six months. The death toll has reached up to 200,000, and it continues. It shook the entire world and pulled down the global economy all the time. 80% of the global population will be affected in the near future, with an expected death toll of 5 million by the end of 2020.

Many countries have entirely shut down their activities and kept their people under lockdown. 20% of the world's population was under lockdown for more than two months. It triggered a massive uproar, and it is still going on. Fig. 2 shows the global spread of COVID-19 [11].
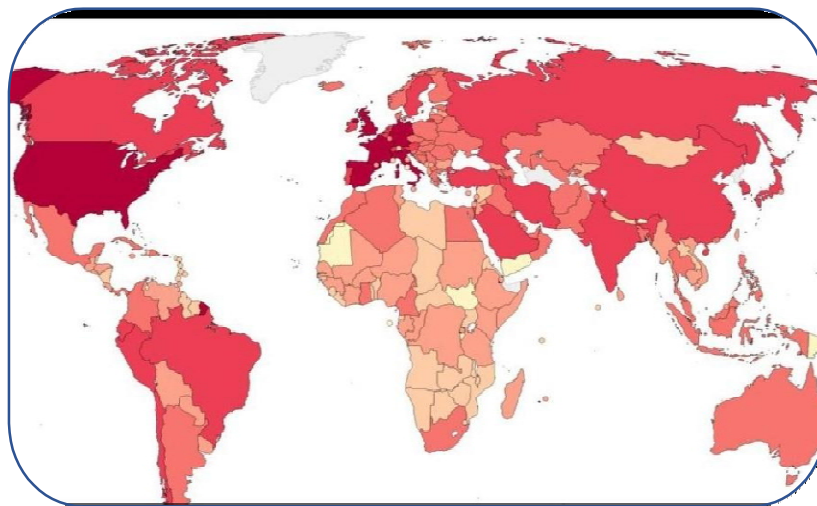

Fig. 2. Global spread of COVID-19 Credit: - Bloomberg News 28/04/2020

4. METHODS

The present study was designed to understand and analyze India's effort in fighting with COVID- 19 in comparison with nations like Taiwan and South Korea, which were successful in containing the pandemic. Our objective of the current research was to provide a concrete and useful plan for India in fighting with not only epidemic but also for other natural and manmade disasters. The study based on literature reviews available for public reference as well as detailed interviews conducted with different sections of society. The interview was conducted by random sampling over the telephone.

The interview was conducted as per the process made by Jane Agee [12], and a scoping study (review) was conducted as per the framework designed by Arksey and O'Malley [13].

The literatures used for this study were based on public data provided by WHO, Government of India, as well as Governments of South Korea, Taiwan, Italy, China, France, and the USA. The online database was also used, i.e., Google Scholar, PubMed, and medRxiv. Some databases were taken into consideration from biomedical journals and white papers published during this year by different countries.

5. RESULTS AND DISCUSSION

The Success Story of Taiwan in Fighting with COVID-19:

Taiwan is the only nation with the largest migrant workers who travel on a daily basis. The country has 23 million people, of which 404,000 work in China. It is just 81 miles off the coast of mainland China and was projected to have the second-highest number of cases of COVID-19 owing to its proximity to and the number of flights between China [14].

Italy and Taiwan confirmed their first cases by the end of January. However, tragically Italy had about 227,000 active cases and 32,201deaths, while Taiwan had about 441 confirmed cases and only seven fatalities as of 18th May 2020.

The Milestones:

a. The lowest mortality rate caused by COVID-19 compares to any nation.
b. Low confirmed cases for the number of tests performed
c. No lockdown implemented
d. Citizen's cooperation and belief on authorities

The story of Taiwan's success can be understood by analyzing the ten important measures they have implemented to fight with the crisis.

1. Lesson from Past Experience: Preparedness:

Taiwan has been on a constant alert and ready to respond to epidemics emanating from China since the SARS outbreak in 2003. During the SARS epidemic of 2003, Taiwan was among the worst-hit territories, along with Hong Kong and southern China. More than 150,000 people were quarantined, and 181 people died.

This helped many parts of the country react faster to the current pandemic and take the risk more seriously than in the rest of the world, both at a governmental and societal level, with border checks and the wearing of face masks quickly becoming routine as early as January in many area [15].

2. Integration of Authority for Central command

In 2004, the year following the outbreak of SARS, the government of Taiwan founded the National Health Command Centre (NHCC). The NHCC focuses on large-outbreak response and serves as an operational command point for direct coordination between national, provincial, and local authorities. On December 31, 2019, when WHO did notify of pneumonia of unknown origin in Wuhan, China, Taiwanese authorities started screening aircraft and testing passengers on direct flights from Wuhan for signs of fever and pneumonia before passengers could leave. Passengers showing symptoms of fever and coughing were quarantined at home and assessed whether medical attention at a hospital was necessary for them.

3. Use of Big data:

The Taiwan government merged citizens' recent international travel records with their digital health-insurance files and allowed doctors and pharmacists access to the information. A Real-time alerting system was created during a clinical visit based on travel history and clinical symptoms to assist in the detection of cases.

Taiwan's authorities have made it possible for all hospitals, clinics, and pharmacies to view the travel records of patients.

4. Use of Latest Technologies in reporting

New tools, including QR code scanning and online travel records and health symptoms, have also been used to identify travelers' infectious risk on the basis

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of on-flight origin and travel history over the past 14 days.

The toll-free number 1922 served as a hotline for people to report suspicious signs and symptoms or cases in themselves or others.

The government tackled the issue of disease stigma and compassion for those affected by providing food, regular health checks, and support for those under quarantine. A mobile health declaration pass was then sent through a text message to phones using a local telephone provider, allowing for faster and easier immigration clearance for those at minimum risk. On February 18, the government declared that all hospitals, clinics, and pharmacies in Taiwan would have access to patients' travel records.

5. Strict enforcement of quarantine rules:

President Tsai Ing-wen promulgates a new regulation on Prevention, Relief, and Restoration of COVID-19, including a special budget of NT$60 billion to support businesses, employees, workers, and the health sector, and updating fines and punishments for violating quarantine or hoarding medical supplies. $ 3000 fine for violating the quarantine rules.

In the span of two weeks at the beginning of March, Taipei municipal government-sanctioned 70 peoples for violating quarantine laws, with dissuasive penalties up to 1 million NT$. Sanctions are not; however, the only aspect of the quarantine policy.

To improve the surveillance of incoming travelers to the island, the Taiwanese government has released a mandatory safety policy for all incoming travelers. Providing incorrect details can result in a fine of up to US$ 5000.This declaration provided a basis for classifying travelers into risk categories and implement Taiwan's quarantine policy [16].

The Taiwanese Government has introduced regulations to compensate quarantine people who have to take care of children under the age of 12 – the compensation is of NT$1,000 per day.

6. Border Control, Case Identification and Containment:

On January 27, the NHIA (National Health Insurance Administration) and the National Immigration Agency collated patients' past 14-day travel history with the data from the NHI identification database & the NHIA; this was accomplished in just 24 hours. Taiwan citizens' household registration database and the foreigners' entry card allowed the government to track high-risk individuals with recent travel history in affected areas.

7. Resource Allocation: Logistics & Operations:

The CECC took an active role in systematic resource allocation, including regulating the price of masks, utilizing government funds, and resourcing military personnel to increase the production of masks. On January 20, the CDC of Taiwan announced that the government had a stock of 44 million surgical masks, 1.9 million N95 masks, and 1100 negative-pressure isolation rooms.

8. Transparency in public reporting:

In addition to daily press briefings by the minister of health and welfare, the CECC, the vice president, and a prominent epidemiologist gave regular public service announcements broadcast from the office of the president and published the same on the internet.

The Taiwan Centers for Disease Control has launched a newsletter in January through the "Disaster Prevention Cell Broadcasting System" to provide accurate and up to date data to the public.

The government has also collaborated with the civil sector to launch a range of "mask maps" and "epidemic prevention maps" that allow the public to instantly know the location and quantity of epidemic prevention supplies in more than 6,000 pharmacies in Taiwan.

9. Alternative social etiquette and lifestyle changes

The most crucial measure for epidemic prevention is to establish correct cognition and adjust social etiquette and lifestyle in a timely manner. In Taiwanese society, wearing masks is part of a normal lifestyle. In addition to promoting the new concepts of "social distancing" and "self-quarantine," Western culture has also slowly shifted their habit of shaking hands, hugging, and kissing cheeks during interpersonal communication. It has been replaced by other alternative methods, such as touching the elbow or nodding.

10. Identification and clarification of misinformation and disinformation:

To order to avoid the transmission of misinformation and disinformation, Taiwan has set up a "Taiwan Fact Check Centre," and each department currently has a "Meme Engineering Team." When misinformation or disinformation is found online, the team will check it within 60 minutes and make it clear to the public instantly, which can avoid unnecessary confusion and anxiety [17,18].

Table 1. Comparative effects of early intervention till 18th April 2020

Country	Population in million	Total test	Date of reporting of first confirmed case of COVID19	Total confirmed case of COVID19 on 18th April	Total Deaths
South Korea	5.16	546,463	20th January 2020	10,653	232
Italy	6.1	1,244,108	31st January 2020	172,434	22,745
USA	32	3,401,064	21st January 2020	702,164	32,823
India	130	302,956	30th January 2020	14,378	488

Case Study 2: - The success story of South Korea: South Korea's COVID-19 pandemic response has set an example to the world; however, it is a lesson they learned the hard way. Korea's horrific encounter with the MERS epidemic in 2015 paved the way for much of the government's positive policies this time around. One coronavirus epidemic could teach a country and its government a lot about how to cope with another.

Table 1 shows the impact of early intervention on the spread of COVID-19 [19].

In South Korea, infections surged over ten days in late February when a cluster of a few dozen cases mushroomed into more than 5,000. Out of more than 8,000 confirmed cases of the virus, only 75 people have died so far, with a fatality rate lower than the 3 percent average seen worldwide.

The first coronavirus case was confirmed on 20th January 2020 in South Korea. As it happens, that is the same day, the first case was reported in the USA.

To understand the success of South Korea, we need to understand learning from the past.

The Master Lesson:

MERS viruses broke out in one hospital in Pyeongtaek, South Korea, in May 2015. Thirty-six patients died, and 186 people were infected [20]. The Koreans experienced a national crisis, contributed to by the poor initial response of the affected hospitals, an inadequate response from the government, the economic depression that followed the outbreak and the psychological impact of the outbreak on the Korean population.

Lessons learned:

During the MERS outbreak, Koreans lacked the data and did not know who was infected and which hospitals had cases.

The government did not release the information because of three reasons:

a. Because disclosure of patients' private information was violating medical ethics.
b. Because people feared economic fallout as hospitals and other private businesses might have to shut down for decontamination.
c. They believed that hospitals would reject diagnosing suspected infections for fear that they would be forced to close, which would only decrease the country's medical capacity.

A second major lesson the South Korean government learned from its MERS outbreak was the importance of early warning and accurate diagnoses.

South Korea has taken the following Steps-

1. **Amendments in Infectious Disease Control and Prevention Act:** In 2016 South Korea made specific amendment in existing laws:

a) The Personal Information Security Act (PIPA) in South Korea places stringent enforcement requirements on organizations that gather certain information that can be used to classify a single individual. Government agencies requesting personal data for purposes of public interest can collect and use data without the need for consent. The ability to collect, process, and widely disclose personal data has enabled health authorities to conduct contact-tracing with military precision.
b) Law added, which allows laboratories to use unapproved in-vitro diagnostic kits in the case of a public health emergency [21].

2. **Tracing, Testing, and Treatment:** Following the discovery of a reported case of COVID-19 in South Korea, the health authorities performed an epidemiological survey to analyze the point of exposure and potential close associations. This cycle started with an interview and was improved by credit card transaction info, cell phone monitoring, and CCTV.

The outcome is a thorough hour-by-hour reconstruction of the individual's position in the days leading up to infection confirmation. Near contacts

found in the epidemiological survey were then contacted and, where possible, screened, and quarantined. The government also uses location data to send teams to clean sites where the case has been confirmed, such as hospitals, residences, offices, and even schools. On February 4, the Korea Centers for Disease Control authorized an unlicensed Covid-19 test; the government went on to test an extraordinary number of people. By February 26, Korea had tested 46,127 cases, while by that point, Japan had tested just 1,846 cases and the United States only 426 [22].

3. **Activated 24/7 Emergency Response System**.

4. **Use of Information Technology and Telemedicine apps:** Companies have developed apps that allow users to visualize the information. Koreans can now learn where infected people went when they were there, and how they got there. Mobile apps also include an inventory management system for fighting COVID19, location of nearby medical stores, availability of masks, and sanitizers.

5. **Dick out roots of Super Spreaders:** 31st case was reported in Daegu, a city of about 2.5 million in the country's southeast. While in Daegu, patient no. 31 attended services at the Shincheonji Church of Jesus, a Christian denomination, but one that was often accused of being a cult. Covid-19 cases in Daegu skyrocketed. South Korea's Ministry of Health and Welfare officially reported 3,150 total confirmed cases, including 17 deaths, as on 29th February 2020. For example, epidemic investigations confirmed that some cases were tied to a church mega- event held in Gwacheon City, Gyeonggi Province, on 16th February 2020. The church submitted a list to public health authorities of 1,290 members it said attended the event, but the governor of Gyeonggi Province revealed that the church's disclosure was inaccurate. An epidemic investigation team raided the church headquarters and obtained data showing that close to 10,000 members had attended the event. As of 1st March 2020, Korean authorities reported 3,526 confirmed cases, and about 60 percent of these cases were tied to the church [23].

6. **Production of Test Kits**: Korean companies acted fast to produce test kits, and the country now has enough to screen some 20,000 people a day [24].

"Testing is vital because that leads to early detection, it minimizes further threat, and it quickly treats those found with the virus," South Korean Foreign Minister Kang Kyung-Wha told the BBC.

COVID-19 in India: Like other parts of the world, India was also notify on 12th January 2020 by the World Health Organization (WHO), confirming that a novel coronavirus was the cause of respiratory disease in a group of people in Wuhan City, Hubei Province, China. The WHO was informed the outbreak on 31st December 2019.

First Confirmed Case of COVID 19 in India: The first case of the coronavirus pandemic in India was registered on 30th January 2020 in the Kerala district of Thrissur, a student who had returned home on vacation from Wuhan University. That increased to three cases by 3 February; all of them were students who had returned from Wuhan, China [25,26]. There was no substantial rise in incidents in the rest of February. Transmission intensified during March after multiple cases were identified around the country, several of which were related to individuals with a travel history to the affected countries. On 4th March, 22 new cases were detected, including those of the Italian Tourist group with 14 infected members.

First Victim: On 12 March, a 76-year-old man from Kalaburgi, Karnataka, who had a travel history to Saudi Arabia, became the first victim of the virus in the country. Since then, it spread all over the country, occupying all the states and most of the cities [27].

India's effort in fighting with COVID 19:

1. India initiated required preparedness and action at field level since 17th January itself, much before the advice from WHO.
2. National Institute of Virology, Pune, is the nodal Laboratory. As part of ICMR's preparedness for emerging/ re-emerging infectious disease, NIV, Pune has established capacity for molecular diagnosis of COVID-19.
3. The screening of passengers was initiated in the country since 18th January 2020 only for flights originating from china only at three airports. Later, from 4th March onwards, compulsory screening of all international passengers was initiated across all the airports.
4. The Government of India evacuated the Indian students and other professionals working in Wuhan and neighboring cities in the Hubei Province.
5. The Ministry has issued operating guidelines to support States on surveillance, contact tracing, surveillance at points of entry, and supervise laboratory sampling, packaging and transport, a clinical management protocol, and prevention and control of infections in healthcare facilities.
6. A 24x7 Control Room established
7. District Collector designated as the nodal officer at field level to lead containment operations.

8. States have been guided in terms of identifying containment zone, buffer zone, and preparation of micro plan to ensure effective active and passive surveillance and contact tracing through inter-disciplinary teams in the areas where cases were located [28].

9. Declaration by WHO: The World Health Organization (WHO) on 11th March 2020, has declared the novel Coronavirus (COVID-19) outbreak a global pandemic.

10. The Lockdown: On the evening of 24th March 2020, Prime Minister Narendra Modi declared, with just four hours' notice, a 21-day lockdown from midnight onward to prevent the spread of Coronavirus. All the businesses and government offices were shut down except essential services and commodities. India has imposed one of the strictest coronavirus lockdowns in the world, handing out on the spot punishments such as physical jerks, canings, or fines. Authorities were desperate to keep infection rates low to buy time for hospitals to prepare themselves.

11. On 15th April 2020, the lockdown was extended for another 19 days till 3rd May 2020, which was later extended till 17th May 2020 due to the constant rise in new cases. There is still a possibility of some restrictions after the third lockdown—the objective of lockdown to stop community spread and get time for preparedness.

12. Testing: Till 08th May 2020, India claimed to have conducted more than 15,25,000 tests throughout the nation. States were given freedom in treatment. Testing was conducted at a substantial level for an asymptomatic person.

13. Awareness: Almost all media houses were involved in spreading awareness about Coronavirus, symptom, and its impact. Radio, TV, Celebrities and social media were tooled for awareness. Briefing on national TV by the authorities.

14. Relief Packages: Nirmala Sitharaman, the Minister of Finance, declared a ₹ 1.7 lakh crore Covid- 19 mitigation economic relief package under the PM Garib Kalyan Yojana (PMGKY). For the next three months, the package offers additional 15 kg grain (rice or wheat) and 3 kg of dal free to 80 crores poor Indians; ex gratia ₹1,500 (₹500 over the next three months) to 20 crores Jan Dhan account-holding women; free liquefied petroleum gas (LPG) to 8.64 crores Ujjwala beneficiaries; additional support of an extra one-time ₹1,000 to the three crore senior citizens, widows, and divyangs (differently-abled). In addition, the five crore families of MGNREGA workers will receive increased wage support of up to ₹ 2,000 [29]. On 12th May 2020 government announced a 20-lakh crore relief package including earlier relief packages and loan facilities altogether.

Treatment of COVID-19 in India:

COVID-19 research is advancing at immense speed, and researchers are working at their full capacity to develop a treatment. However, no clinically proven antiviral agents for COVID-19 are available for its treatment. Discovering a new treatment/ vaccine will take a long time as it involves multiple phases of clinical trials.

Since the virus is unknown and we lack immunity for the same. There are three modes of clinical management of the disease-

1. Boosting immunity:

Hygiene, Yoga, good sleep, meditation, and improved diet can be immunity boosters in the case of COVID 19. Diet supplements rich in omega 3 & 6 fatty acids should be used. Some natural immunity supplements include ginger, garlic Basel leaves, Black cumin, gooseberries (amla), and turmeric.

2. Convalescent Plasma Therapy (CPT):

In convalescent plasma therapy, plasma extracted from the blood of recovered patients, which has antibodies developed in response to successfully curing the disease, is transfused into severely ill patients to strengthen their immunity.

Preliminary studies conducted in China and the USA have shown promising results. Indian Council for Medical Research (ICMR) has also approved to carry out clinical trials. Kerala became the first state in India to start the experimental therapy on 8th April 2020, followed by Mumbai.

3. Drugs to combat virus:

There is no such specific drug for COVID 19, patients are treated symptomatically. However, several drugs are in various stages of the trial around the globe for the treatment of COVID-19.

An oral drug called EIDD-2801 has shown promising results in test-tube experiments with human lung and airway cells.

The potency of NHC/EIDD-2801 against multiple CoVs and oral bioavailability highlights its potential

utility as an effective antiviral against SARS-CoV-2 and other future zoonotic CoVs [30].

EIDD-2801 introduces genetic mutations into the virus's RNA. As the RNA makes its copies, so many damaging mutations accumulate that the virus is no longer able to infect cells.

Favipiravir is expected to be an essential therapeutic agent for severe influenza, the next pandemic influenza strain, and other severe RNA virus infections for which standard treatments are not available [31].

Initially, FDA approved anti-malarial & rheumatoid arthritis management drugs Chloroquine and hydroxychloroquine for the treatment of COVID-19. However, further studies showed that they were ineffective in treating COVID-19 and caused severe side effects [32].

4. Vaccine:

Vaccine for COVID 19 is under development by around 75 different bio laboratories. Many of them have completed animal testing and are in the second phase of human trials.

Remarkable Achievements:

1. **Less number of Cases in comparison of the population:** Since January 2020, India is fighting against COVID-19, more or less, it is good to see that in spite of second largest global population around one lakh are suffering and less than 3200 people died (as on 18th May 2020) with a meager mortality rate of 3% in comparison with 5% global mortality [33].
2. A state like Kerala, Delhi, and Maharashtra has done commendable work during crisis management. These three states had innovated few things which were never existed earlier in India.
3. **Trials of Convalescent plasma therapy** in the treatment of COVID19 caused a very low mortality rate in Kerala, nearly 0.59%. It was initiated the very first time in India.
4. **5 T-plan:** Delhi government announces 5 T-plan, i.e., Testing, Tracing, Treatment, Teamwork and tracking, and monitoring to fight with Covid-19.
5. **Extensive testing by Maharashtra government:** The biggest slums of Asia - Dharavi in Mumbai was sealed, and the entire area was tested. The state conducted the maximum number of testing.

However, this is not the outcome, and India is still in lockdown.

Major Failures of India:

So far, the country's approach to the disease has been to deal with the cases as and when they occur, just one step behind the virus. Scientists agree that pandemics are likely to become a way of life in the future. The first order of business will be a major increase to the currently measly budget for health, followed by progress in primary health services and education drives on the primacy of hygiene [34].

With around 100,000 confirmed cases and around 3200 deaths (as on May 18th, 2020), India cannot claim to be a successful country in fighting with COVID 19 due to testing ratio as per population. Experts believe that a large portion of the population will be infected after the lockdown is lifted by the end of May. It is estimated that 2 million population will suffer from COVID-19 by the end of June 2020, and the number of fatalities will also increase. India will also pay the price of one of the largest lockdowns of the world in terms of population and one of the largest migration of workers during the lockdown. There are possibilities of widespread cases from one state to another state.

Lapses of Indian Government:

1. Valuable time lost:

The country like Taiwan, South Korea responded instantly; on day one, screening of passengers started at Taiwan airports from the First flight from Wuhan after Chinese notification to WHO about the novel virus on 31st December 2019. Indian authorities underestimated it, possibly due to lack of attitude and no experience in dealing with pandemics as earlier coronavirus SARS and MERS outbreaks did not affect India. Initial 75 days, which were crucial, were wasted in meetings and framing guidelines.

Like other Governments, they could have appointed a Team of Experts in the first week of January 2020 and have strict monitoring over the situation.

2. Very late declaration of the state of emergency:

A 123-year-old law, once used to imprison freedom fighters, is India's primary weapon against Coronavirus. The Epidemic Diseases Act of 1897 confers exclusive powers on state governments. India's Narendra Modi government has also urged states to use it to make their coronavirus advisories more comprehensive. Karnataka was the first Indian

state to do so on March 11, 2020, for a year. This legislation enables states to prohibit public meetings and gatherings, order schools, colleges, and large institutions to stop functioning, and encourage companies to develop work-from- home models. It also grants the state the power to penalize media outlets to propagate misinformation [35].

In spite of government claim of screening of passengers since 18th January 2020, screening of incoming travelers and the enforcement of obligatory home quarantine were lax as of late as17th March. At the time, the disease had spread to 160 nations, and only 12 of the affected countries had been screened for passengers in India. The price of this slippage was steep.

3. Ignorance of Public Gathering:

Most of the political mass gathering organized by the government of India was between January to March 25, 2020. One of the prominent events was the gathering of 5 million people (as claimed by USA president) in Gujrat during Namaste Trump (Welcome Trump).

4. Religious Gathering:

Huge religious congregations allowed to organized at different places from January till 18th March 2020 (48041 people participated in Tirumala Tirupati Darshan & around 3000 people attended a religious gathering of Tablighi Jamaat).

5. Educational Institutions remained open:

Educational Institutions remained open and no health advisory was given to them. 1.76 million students were appearing their SSC exams on 21st March at Maharashtra. A million more were attending colleges and Schools.

6. Open access to foreign travelers:

The government allowed nearly 1.5 Million passengers to land in India from December 31st till the third week of March 2020 on March 19, the DCGA released an advisory stating that no international commercial passenger flight operations will take place in India from 23rd March 2020 [36].

7. Low Testing Rates:

India is testing only 105 people per million citizens as of April 12 [37]. In comparison, South Korea was testing more than 4,000 per million population, an achievement that has helped it contain the pandemic to some degree. This is a strong reason to believe that the number of reported confirmed cases in India could be deceivingly low, given its vast geography, huge population, and inadequate testing and screening facilities.

8. Extensive tracking and testing must complement the lockdown:

India needed to complete millions of community testing and get ready with 500,000 quarantine beds for Covid-19 patients during the lockdown. Unfortunately, India's preparations were prolonged and could only reach 20% of the targets. Unlike other countries, a higher percentage of health workers in India were infected with COVID-19 due to a lack of training and lack of PPEs [33].

9. Untimely lockdown:

The nationwide lockdown may be too little, too late to prevent the spread of a pandemic. Worse, a muddled approach by the Centre has degraded the effectiveness of the lockdown in itself. The sudden announcement sparked a mass migration of thousands of daily-wage laborer, which, health authorities suggest, may have aggravated the risk of infection [33].

Public opinion about lockdown:

Q1: Is there any other option apart from complete lockdown (the way it is administrated) to check the spread of COVID-19 in India?

Table 2. Public opinion about complete lockdown

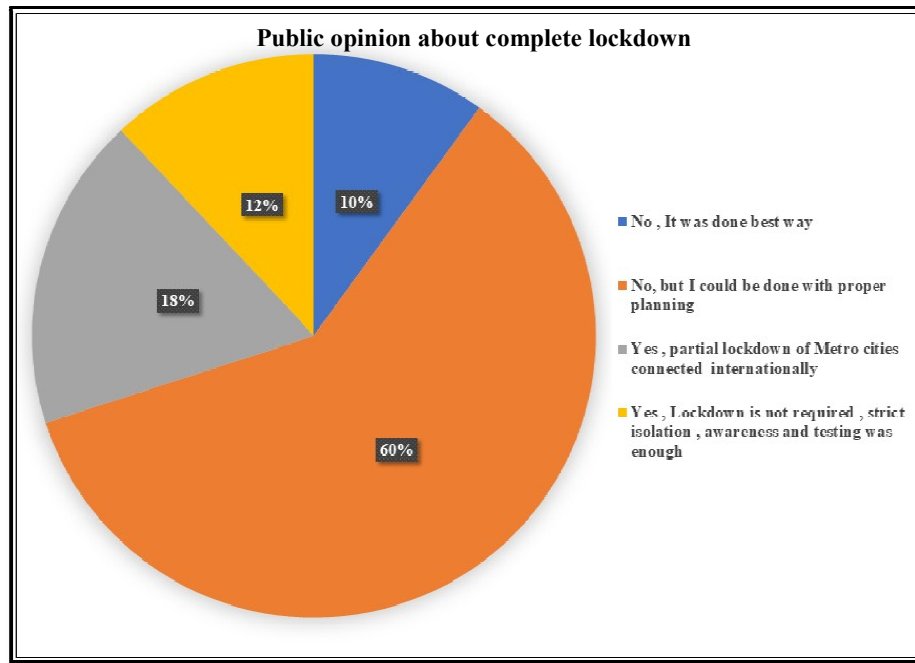| Options	Responded in %
It was done the best way	10
It could be done with proper planning	60
There should have been partial lockdown of only Metro cities connected internationally	18
lockdown is not required, strict isolation, awareness, and testing was enough	12

Fig. 3. Public opinion about complete lockdown

Fig. 3 shows that 70% of people are in favor of lockdown, but most of them said that it should be implemented with proper planning. Sudden lockdown caused inconvenience and financial loss to many people. Lakhs of people had to take shelter away from their homes as transportation was hampered due to sudden lockdown. Millions of workers were all of a sudden unemployed. The government did not plan it properly, so people could not prepare for it causing additional loss of lives apart from the fatalities due to Coronavirus.

Q2: Is lockdown successful?

Table 3. Public opinion about the success of lockdown

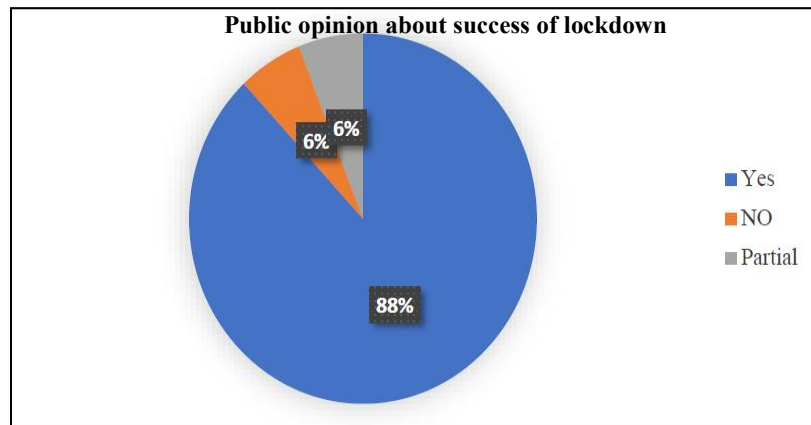| Options	Responded in %
Yes	88
No	6
Partial	6

Fig. 4. Public opinion about success of lockdown

Fig. 4 shows that most people believe that lockdown is successful, but we could not prevent COVID-19 from causing widespread damage. All the state governments have made exceptional efforts to make it successful.

10. The imposition of Useless Janta Curfew:

On 18th March 2020, Prime Minister Narendra Modi declared Janta Curfew to be observed on 22nd March 2020 from 7 am to 9 pm [38]. The purpose of the curfew was not clear, and just after two days, a lockdown of 21 days was declared in a very hasty manner. It shows a lack of a holistic approach and systematic planning. Later on, the government declared public curfew as a trial of lockdown. This time would have been utilized for mobilization of migrant workers to their respective states after the declaration of lockdown.

11. No attempt to implement aggressive tracing and testing:

Very less random sampling was conducted in India. Testing was conducted majorly for symptomatic cases. 80% of the cases turned out to be asymptomatic, which were not tested on time.

12. Lack of planning throughout the nation:

On 20th April 2020, the Kerala government was strictly notified and asked by the central government to take back their circular for keeping hotels, book stores, and other businesses out of lockdown, which was shut in the rest of India. Instead, India could have planned it at the micro-level based on the Coronavirus spread at regional levels. Lockdown should have been planned at the Tahsil level or even local ward level, just like we conduct political elections. The needs, resources, weaknesses, and strengths of every state are different in India. Maharashtra is known for its industries; Himachal, Goa, Jammu, and Kashmir are well known for tourism. Uttar Pradesh, Punjab, Haryana, and Madhya Pradesh have an agriculture-based economy. Proper planning could have allowed states to support each other as per their strengths and weaknesses.

6. RECOMMENDATION: INDIA'S MITIGATION PLAN AGAINST ANY FUTURE PANDEMIC SHOULD INCLUDE THE FOLLOWING

1- Training the NDMA:

National Disaster Management Authority of India should be well trained, be proactive, and should have the ability to forecast and plan in advance. The team should consist of technicians, philosophers, academicians, scientists, and field workers. Continuous training with national and international exposures should be a part of their job role. NDMA – should be well versed with essential data management, resource allocation, and delegation of authority. No one should be less than perfect through confidence, skills, and expertise gained by study, repeated training, and practices. The roles and targets of each internal core expert team should be clearly defined. Continuous mock drills should be conducted with the strategic involvement of the public.

2- Direct Communication:

Communication during a disaster should be transparent, frequent & direct from the head of authority to the people of the country. There is a constant danger of two damaging factors during pandemics:

1) Missing out of important and useful information and 2) Spread of fake news or false information, which may cause damage greater than the pandemic itself.

3- Epidemics should not be allowed to be a Social Stigma in society:

Any discrimination in handling pandemics is very dangerous. Pandemics do not distinguish between individuals, so society should be prepared accordingly. It was commonly observed during COVID19 pandemic - people committed suicides, neighbors did not welcome doctors, every coughing person was seen as a suspect & hospitals were hesitant in admitting patients even other than COVID-19. It caused a significant increase in the mortality rate of patients suffering from other diseases due to the closedown of hospitals and OPDs. Tough to believe, but many governments coined the term social distancing, which is not the correct attribute, physical distancing was the right term for society.

4- Media should not be allowed to create fear and uncertainty in society:

In recent pandemic it was observed that at many places Muslims were blamed for the spread of COVID-19, they were targeted by mobs, thrown out of villages and not allowed to do business at some places especially after finding of a good number of COVID-19 positive cases in participants of International Conference organized by Tablighi Jamat in Delhi from 13th to 15th March 2020.

5- Strategic planning of lockdown:

Preparedness plan during lockdown from day one to day 21st was neither properly designed by the government nor citizens were aware of it till the last moment. It was again extended until May 17th, 2020. All awareness campaigns were about staying at home, and there was no appeal made to people to come for testing or help in tracing of the cases.

Before the Announcement of Lockdown, three things were not considered –

A- Not every city/ village was at risk of Coronavirus spread due to various factors like population dynamics, foreign contacts, and lifestyle. No zonation was done before lockdown. The entire country could have been divided into different Zones and as per the risk assessment report. Lockdown rules could have been stricter in high-risk areas and little relaxed in low-risk areas. Lockdown is an excellent step towards isolation, and zonal divisions could have made it less costly.

B- The economic impact associated with lockdown was miserably miscalculated. Indian economy is expected to lose over $4.5 billion every day of the lockdown and around $100 billion during the 21-day nationwide lockdown period, according to Acuité Ratings, with equal loss in the second phase. India lost more than gained, and nearly 1% of GDP was lost due to these lockdowns.

C- The seasonal migration of Millions of laborers in different cities of India was hindered. Millions of migratory workers were about to move to their villages, and they remained jobless due to the lockdown. Nearly 20 million workers and their families moved from different cities towards their villages on foot.

6- Mobilization of resources:

Every state is acting independently. Mumbai suffered mostly as the economic capital of India and having maximum international exposure. Planning should be in place to supply sufficient medical teams, protective equipment, and supportive devices to save more lives as Mumbai has the highest number of cases in Maharashtra. Whereas neighboring state Goa till 18th May 2020 has only fifty positive patients. A part of Goa's control team could be instrumental in helping Maharashtra State in the time of crisis. Sharing of resources between states will also help in quarantine efforts, tracking of cases, and on-demand distribution of health care systems in areas with a higher number of positive cases.

7- Complete control on social media:

There should be complete control over social media, to stop rumors, and for quick information flow. AI & Machine Learning could be implemented to detect fake news and block the same.

8- Use of telemedicine:

Encourage and felicitate people for the use of telemedicine. Local private hospitals and clinics could implement telemedicine to cater to their localities.

9- Social Education about Disasters:

Unfortunately, we lack awareness about such mega-disasters; people must be made aware of pandemics, right from school to specialized courses for the rest of the citizens.

10- Awareness about special laws of emergencies:

We found that 95% of people were not aware of special IPC. Social Media could be used to spread awareness of such special laws applicable during the times of epidemics.

11- Preparation of Manual:

Every disaster has different sets of mitigations, epidemic wise social isolation, lockdown, and quarantine. Similarly, for floods and earthquakes, we require area mapping and latitudinal information. Every municipal council/ward/village should know the evacuation plan and safety procedures based on the disaster.

12- Prediction of Hotspots:

Social, cultural, and economic behavior of the population will help us in understanding the hotspots of society. Religious congregations, as we have experienced in Delhi, public or private ceremonies or celebrations, can be screened on priority and with strictness. In Mumbai, we have 12 hotspots, but all are not well defined. Every time a disaster strikes, it will have different types of impacts on society. We need to Identify and classify our population to be prepared for every type of natural and manmade disaster that may strike in the future.

13-Corner the High-risk Areas:

Hospitals, quarantine centers, and isolation centers should be away from the city or human population to reduce risks of an outbreak in the locality. Four large hospitals for quarantine and critical care are adequate for metropolitan cities like Mumbai.

14- Use of mobile technology and lifesaver firewall system:

We have seen that the government of South Korea was able to monitor its citizen with the help of the latest surveillance technologies with the integration of Area Unique Identity Number of every citizen and outsiders. This number is linked with their debit/credit cards and mobile phones for accurate position tracking.

IFDM - Indian Firewall for Disaster Management:
We propose a permanent, unique disaster management software that must not only sync but also communicate with other software and services used by the person during a disaster. In the current era of technological revolution, we can create a firewall with help of GPS and Cellular (WiFi) Location technologies. Man-made or natural disaster, if can't be predicted certainly can be easily located and managed by this firewall system. Earthquake, war time, epidemic or large-scale fire in particular area can be manage properly by transporting information and resource timely and adequately. It needed scientific research of disasters and countries resources and most accurate and tested protocol of management. During current pandemic we felt lack of data of hospitals, ICU beds, ventilators in working condition, resources for quarantine centers, inventories of medical equipment and medicines it-self. Few Indian states recently develop software program for this but they all have very limited scope and approach completely based on hospital facilities. IFDM will be unique and scope will be much larger than any software till now.

Italy, Chine, USA and Bangladesh were following different line of treatments but our doctors were not accessible to these data easily, few doctors collected data by their personal approaches. IFDM will be a great support in Big data analysis as well as a master software for our country to control and limit impact of such disasters.

It will include inventory management of local medical stores, online purchases, booking of transport, availability of resources, occupancy of hospitals, nearest safe zones, areas at risk, government communications, and support during times of crisis. Presently we have Aadhaar number, which is unique for every citizen, it should be linked with the mobile phone to enable the above services.

Multiple levels of authentication will be required to update accurate information. For example, in the current scenario, any registered doctor (family physician or else) can authenticate about the present health status of a person. Aadhaar card and electricity bill can be the source for Name, age, gender, and current residential address. Authentication of Information should be done by designated programming and authorities.

The administrator can do the second level of verification at the district level. A unique identification number should be provided to every person during the immigration process, and their mobile number should be registered in the program.

The program will be based on the "big data," and the government should make it compulsory during disasters to help to locate victims, identify risk factors, teach survival practices, and track movements. It will be instrumental in saving and serving human life during pandemics and other disasters. Multiple firewalls will be guarding the programme. This software should be used only in emergencies as it may violate the right to privacy. Satellite images and information can be very crucial during a disaster. It should be inculcated within disaster programming. The nature of programming should be specialized and adaptable to suit all types of disasters.

Once the program is downloaded, it should not allow deletion by the user till firewall permits.

15. Use of Satellites:

Even in this pandemic, we have witnessed the use of drones for mass control during a lockdown. Geospatial information from satellites can play a role more significant than drones, which can only cover limited places: It can help locate people in desperate need of assistance and can predict which spots on the globe might need help in the near future. Disaster responders and those being affected by the virus need to know where to find hospitals, pharmacies, and stores. They also need a navigation system that will let them transport food and medicine to those in need. Count of the local population can help aid workers to decide how much health supplies will be required [39].

16. Use of Culture for disaster Management:

We lack awareness about disaster management, so it should be taught in schools, colleges and should be inculcated in our culture through reinforcement of awareness as part of the routine.

17. Conversion of College research laboratories into the testing lab:

Every year, UGC funded millions of rupees to the colleges, especially those who have recognized

research laboratories. These labs should organize specialized training for staff and install additional instruments that can be used for testing during disasters. The designated authority can control accuracy and quality.

7. CONCLUSION

We concluded this study with scientific and social feedback to the government about their existing pandemic management program and helping them in building an innovative disaster management communication tool for the future. Our strategic, structured program, IFDM -Indian Firewall for Disaster Management, is the outcome of this research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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