

COVID-19 and Vaccine Hesitancy: How India Managed the Crisis Compared to the Rest of the World? A Review

Chaitali Sinha¹ and Tuhina Mazumdar²

¹Lincoln International Business School, University of Lincoln, UK.

E-mail: Chai_sinha@yahoo.co.in; csinha@lincoln.ac.uk

²Techno India University, India. E-mail: tm1996k@gmail.com

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Abstract: The outbreak of the corona virus suddenly struck the globe in December 2019. With no drugs or vaccines immediately in our hands, it was very much evident to the global leaders that we were not in a position to handle the epidemic immediately. Negative outlook, lack of immediate proper actions and incorrect programmes on the part of the global leaders increased the fatality rate. Both public health and societal costs of the pandemic were very large, and it was felt across the world. The virus spread to more than 200 countries. According to WHO (as of May 3, 2020), the World had already witnessed 3356205 confirmed cases, among which 238730 deaths had been reported. The vaccine was developed subsequently to control the spread of the virus as it plays a crucial role in saving human lives, improves the health of the population and helps in economic recovery. The spread of infectious diseases can be checked through vaccination. Successful administration of vaccines, however, is a major challenge as vaccines are identified as unsafe and redundant in different parts of the world. Lack of faith in vaccines is believed to be a threat to the success of vaccination programmes. This review provides an overall picture of COVID-19 in India and around the globe and sheds light on vaccine hesitancy. Novelty of this work lies in that we have calculated Spearman's Rank correlation coefficient between the percentage death rate with some determinant variables.

Keywords: COVID-19, India Scenario, Vaccine, Vaccine Hesitancy, World Scenario

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1. INTRODUCTION

The COVID-19 pandemic caught the globe suddenly, and with no effective drugs or vaccines initially, it was very much obvious that we were completely unable to handle the situation. Negative attitudes, late actions, and incorrect strategies on the part of the world leaders from many wealthy states increased the number of deaths in this regard. The USA, Italy, Spain, France and the UK were the worst sufferers. The 2019 novel Coronavirus has spread to more than 200 countries. According to the WHO, by May 3, 2020, the World had already witnessed 3356205 confirmed cases, among which 238730 deaths were reported. In the wake of the COVID-19 outbreak, there lay a life-threatening uncertainty for the world economy as a whole in the near future. A solid foundation of infrastructure, combined with much-needed health care services and monetary and fiscal policies on the part of individual countries, was the need of the hour. International relations were affected due to this widespread disaster. Amid this struggle for power among the world leaders, experts predicted that India has the potential to become an investor's hub in Asia in the near future if it can adapt to the changing world situation.

The development of the COVID-19 vaccine was eagerly watched by the whole world. Finding a safe and effective vaccine was the need of the situation, and it was recognised by the Director of the National Institute of Allergy and Infectious Diseases (NIAID), though it was not a very easy task. However, the progress ran successfully due to certain reasons (1) China shared the order of the genetic material of SARS-CoV-2 to the entire world. (2) The prevalence of the virus was already taken seriously by the health science researchers. (3) The knowledge gained from previous viruses, SARS and MERS. (4) Knowledge from the previous vaccines that were developed during SARS and MERS.

In the wake of Coronavirus Disease 2019 (COVID-19), more than one-quarter of the world's 7.8 billion people were largely confined to their homes, as governments had restricted movement and social contact in an attempt to avoid the spread of the virus. In most parts of the world, borders were closed; schools, shopping malls and hotels were shut down. These unprecedented measures disrupted many economies, resulting in mass job losses, thus raising the possibility of a widespread spectrum of hunger. As this pandemic had caused severe ruptures in the world economic system, which had serious implications

for world production and consumption, multilateral support policies were needed to get back on track.

As published by the IMF in its *World Economic Outlook (2020)*, the global economy was projected to contract sharply by -3 per cent in 2020. The situation was much worse than the 2008-09 crisis, while experts predicted that the pandemic was expected to fade away in the second half of 2020, and containment efforts could be gradually wound down. The global economy was projected to grow by 5.8 per cent in 2021 as economic activity normalises, helped by the support policies. IMF predicted extreme uncertainty in the near future of the world economy as it continuously struggled to fight back the pandemic and the containment measures that were taking a toll on economic activities, leading to a global slowdown of both demand and supply processes. It was predicted that as many economies had already started to reduce their interest rates further² to boost production by providing funds for the domestic industries, there would be incidences of capital flight from these economies due to low interest rates, leading to volatile macroeconomic situations (*World Economic Outlook, IMF, 2020*). Conditions might aggravate if the demand conditions, both domestic and international, cannot be improved, leading to a crash in prices. Therefore, effective fiscal and monetary policies along with health care measures would be the need of the hour for most economies, irrespective of their levels of economic development. In addition to the individual efforts practised by countries, it was predicted that strong cooperation would be needed to overcome the effects of the pandemic, by giving financial help to the countries that are constrained by their poor health care system. During the pandemic, sizeable fiscal response had been shown by many developed countries such as Australia, France, Germany, Italy, Japan, Spain, the United Kingdom, and the United States; by many emerging markets and developing states like China, India, Indonesia, South Africa and by other SAARC nations. India, being the biggest member of the SAARC countries, announced a Rs 1.7 lakh crore (\$22.6 billion) economic incentive plan. Direct cash transfers were provided to the poor senior citizens and to the women. Free supply of food grains and cooking gas, which was targeted to give respite to millions, was hampered by the lockdown. Other SAARC countries like Bangladesh, Sri Lanka, Pakistan, Maldives, Nepal, Afghanistan, and Bhutan had also announced stimulus packages, most of which relied on

the recovery of the economy by focusing on agriculture, manufacturing and social safety nets³.

International Monetary Fund (IMF), along with other international bodies like the World Bank (WB), Asian Development Bank (ADB), provided emergency financial assistance and debt relief to its member countries facing a negative impact due to COVID-19. Figure 1 shows the IMF's contribution worldwide. Figure 2 shows the credit contribution of the IMF under different credit schemes across the world.

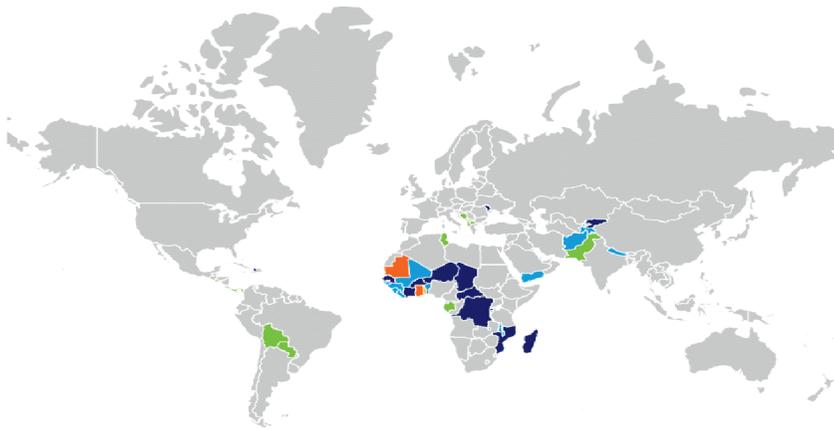


Figure 1: Countries Receiving Emergency Financing from the IMF

Source: IMF 2020

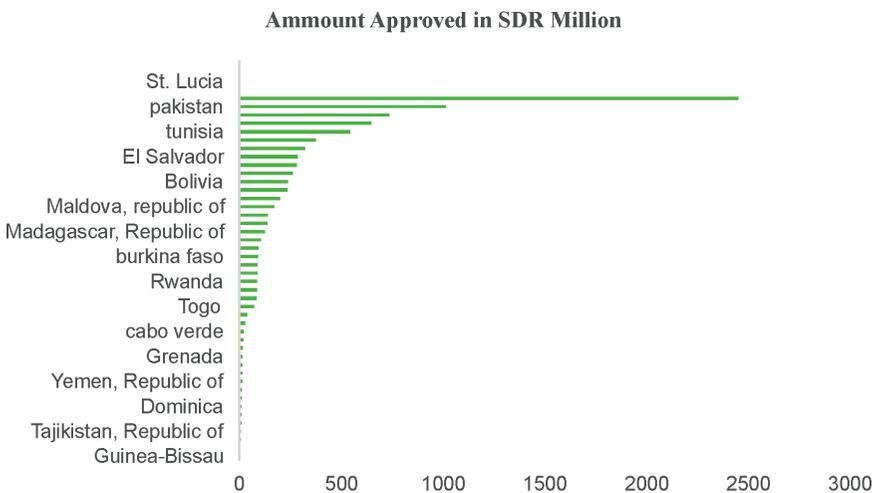


Figure 2: Showing Credit Contribution of IMF Under Different Credit Schemes

Data source-IMF, 2020; Note-Author's Calculation

On the other hand, the prevention of infectious diseases through vaccination was one of the most significant achievements of contemporary science. However, the major challenge to its success was vaccine hesitancy. The global prevalence of Corona virus disease had caused health, economic and social challenges worldwide. So, the vaccine was developed subsequently to control it, as it plays a critical role in saving lives, improving population health and facilitating economic recovery. In this context, it is to be mentioned that there's growing evidence of vaccine delays and refusals due to lack of trust in the safety and effectiveness of the vaccines, persisting together with the issues of accessibility. There had been a significant lack of trust in vaccines during 2015 to 2019 in countries like Afghanistan, Pakistan, South Korea, the Philippines, and Indonesia. During 2018 to 2019, however, we find the situation had improved in EU countries like France, Italy, Finland, Ireland, etc. This indicates a link between religious beliefs and vaccine uptake, focusing on the fact that minority religious groups have a lower possibility of uptake. WHO has named vaccine hesitancy as one of the top ten threats to global health, alongside climate change⁴.

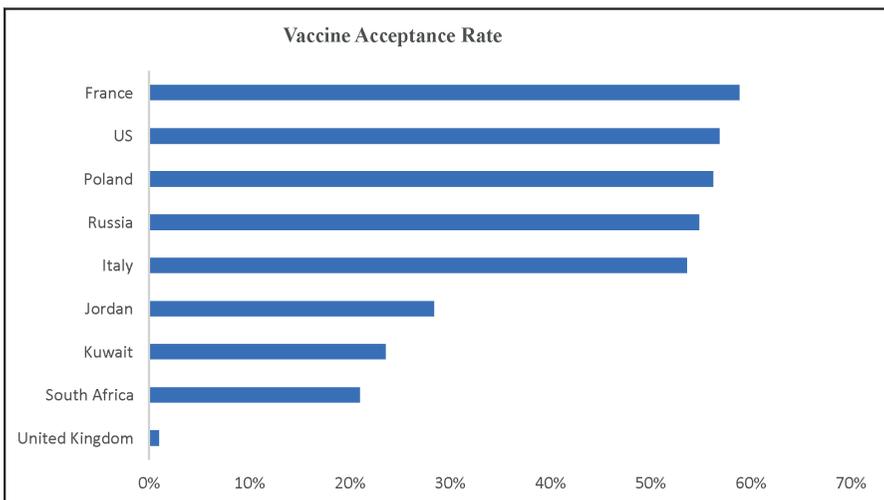


Figure 3: Vaccine Acceptance Rate in Different Countries

Data source-IMF, 2020; Note-Author's Calculation

It became necessary to identify how to develop more trust-building so as to optimise uptake of the new life-saving vaccine. Vaccine hesitancy is time,

space, and context specific with respect to the targeted population. Developing literature in this regard suggests that there exists a rising trend regarding vaccine hesitancy across the world, and it has been observed recently among healthcare workers. There has been a rising proportion of the population denying the vaccine, and this is predominant in the Global North, especially in the EU and the USA.

2. REVIEW

Corona viruses belong to the *Coronaviridae* family in the *Nidovirales* order. Corona characterises crown-like spikes on the outer surface of the virus and therefore, it was named as a Coronavirus, Figure 4a and 4b. Coronaviruses are microscopic in size (65–125 nm in diameter) and contain a single-stranded RNA. Alpha (α), beta (β), gamma (γ) and delta (δ) are the different subgroups of Coronavirus⁵.

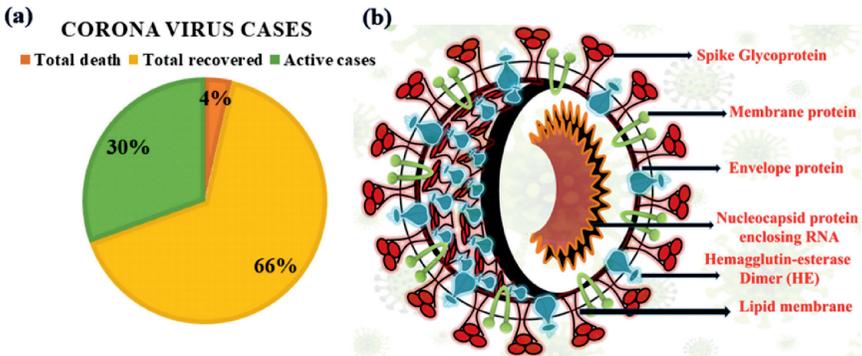


Figure 4: a.: Global trend of COVID-19 reported death, recovered and active cases till August 13, 2020; 4. b.: structure of SARS-CoV-2

Source: Ojha et al., 2021

The world witnessed the first coronavirus outbreak, SARS (severe acute respiratory syndrome), in 2002. This epidemic originated in China and then spread very quickly to different nations around the globe with infecting more than 8000 people and 776 deaths. A decade later, in June 2012, some Saudi Arabian nationals were detected with another virus and the spotted virus was confirmed to be a member of Coronaviruses and was termed the Middle East Respiratory Syndrome Coronavirus (MERS-CoV). The World Health Organisation reported that MERS-CoV infected more than 2428 individuals

and caused 838 deaths. Cases were reported in 26 countries; however, the majority occurred in Saudi Arabia (79%) and South Korea (13%)⁶. By the end of 2019, several cases of pneumonia were reported by the Chinese Government to the WHO. The outbreak originated from the Hunan seafood market, where live animals like bats, frogs, snakes, marmots, and birds were sold regularly. On January 12, 2020, the National Health Commission of China shared further information about the epidemic and suggested viral pneumonia. By August 13, 2020, 20,881,635 cases were confirmed cases with 748,503 deaths and 13,771,549 recoveries. Among the active cases, 6,297,028 cases were in minor condition, and 64,555 cases were reported to be serious or in critical condition. The virus was identified as a novel Coronavirus, and the disease was named by the WHO as SARS-CoV-2 (Table 1). Initially, it was endorsed that the patients who were infected with the Wuhan Coronavirus might have visited the seafood market where live animals were sold, or they might have consumed the infected animals or birds. However, further investigations exposed that some persons with no history of visiting the seafood market were also infected. These observations indicated a human-to-human transmission capability of this virus. Additional investigations revealed that this human-to-human transmission of the virus occurs due to close contact with an infected person, exposed to cough, sneeze, respiratory droplets or aerosols. Table 1 below shows the process of transmission of Coronavirus and a comparative study between SARS-CoV and SARS-CoV-2, respectively.

The related literature discusses about seven coronaviruses (CoVs) that cause human disease. The strains 229E (α -CoV), HKU1 (β -CoV), OC43 (β -CoV) and NL63 (α -CoV) were responsible for causing minor contaminations of the upper respiratory tract in humans.

On the contrary, the other two strains, SARS-CoV (occurring in 2002–2003) and MERS-CoV (Middle East respiratory syndrome occurring in 2012) and the newly identified SARS-CoV-2, belonging to β -CoV, are responsible for serious health problems and have caused death.

The current situation and available pathophysiology postulate that SARS-CoV-2 is highly infectious and transmissible than its ancestor, not only affecting the respiratory system but also the gastrointestinal system and, central nervous system, leading to failure of major organs.

The SARS-CoV-2 virus replicates via numerous procedures after it enters host cells.

The proteins associated with these duplication steps are the main targets to treat the infected patients by obstructing the viral replication.

Table 1: Comparative analysis between SARS-CoV and SARS-CoV-2

<i>Features</i>	<i>SARS-CoV</i>	<i>SARS-CoV-2</i>
Year when it first appeared	November 2002	December 2019
Country/region where it was first seen	Guangdong, China	Wuhan, China
Main hosts	Bat, palm civets and raccoon, dogs	Bat
Incubation period	2–7 days	2–14 days
Primary modes of transmission	Droplet, aerosol, and contact	Droplet, aerosol, and contact
Illness caused	SARS, ARDS	SARS, COVID-19
Fatality rate	~15%	1–3%

Source: Partially taken from Zeinab Abdelrahman, Mengyuan and Xiaosheng (2020)

Presently, no specific treatment or approved drugs are available for the treatment of the COVID-19 virus. The mild cases are treated based on symptoms, and the critically ill patients are given oxygen therapy and ventilator support. A set of approved drugs (e.g., hydroxychloroquine (HCQ), chloroquine (CLQ), remdesivir, etc.) is being evaluated for the treatment of the infection and scientific experiments are going on in different pharmaceutical labs.

Table 2: Some of the Drug Candidates Under Trial, their Application and Current Status

<i>Drug Candidate Under Trial</i>	<i>Company Name</i>	<i>Application</i>	<i>Current Status against Covid-19</i>
Remdesivir (anti-viral)	Gilead Science	(1) Broad-spectrum antiviral (2) In vitro activity against coronaviruses (under trial) (3) Diminishes pulmonary pathology (4) Tried on the Ebola virus	Phase-III clinical trials are underway in China and the USA

<i>Drug Candidate Under Trial</i>	<i>Company Name</i>	<i>Application</i>	<i>Current Status against Covid-19</i>
Favipiravir [favilavir or Avigan]	Fujifilm Toyama Chemical	Viral Infection	Yet to be approved by the US FDA for COVID-19
Chloroquine	Sanof (Aralen)	(1) CLQ has been proven effective in treating coronavirus in China (2) Treating pneumonia patients with SARS-CoV-2 infection	Approved for clinical trial against COVID-19
Hydroxychloroquine	Sanof (Plaquenil); Mylan, Teva, Novartis, Bayer, Rising Pharmaceuticals (generics)	Used for the treatment of COVID-19 disease.	At present, one of the most emphasised drugs against COVID-19
Azithromycin	Pfizer	(1) Is used to prevent bacterial infection (2) Is used as adjunct therapy due to its certain properties	It is combined with HCQ and showed promising activity against COVID-19. Pfizer has declared positive clinical trial data obtained in France for this drug, along with HCQ
COVID-19 convalescent plasma	Mount Sinai	In China, 5 patients suffering from SARS-CoV-2 and ARDS are treated with convalescent plasma, and this shows better results	Clinical trials are going on to treat patients with COVID-19 infections
Ascorbic acid	University of Palermo	Operative against COVID-19 pneumonia	Under clinical trials (NCT04323514)
Lenzilumab	Humanigen	This drug has defensive consequence against cytokine release syndrome (CRS) associated with CAR-T therapy. This can be used in case of lung injury and acute respiratory distress syndrome (ARDS).	On 2 April 2020, FDA sanctioned the use of lenzilumab in COVID-19 patients under an eIND application. There is planning of phase-3 clinical trial.

Source: Ojha et al. 2021

Along with this, a sequence of new vaccines is also under clinical trial (e.g, mRNA-1273, Ad5-nCoV and ChAdOx1, nCoV19, along with the existing Bacillus Calmette–Guérin (BCG) vaccine to check their effectiveness in COVID-19). Table 2 gives a detail of the therapeutic process from computation to practice.

Table 3: Therapeutics for COVID-19: from computation to practices

Molecular clamp vaccine	CSL and The University of Queensland)
Ankara virus-like particles	Geovax and Bravovax
COVID-19 S-Trimer	GlaxoSmithKline
gp96-based vaccine	Heat Biologics
Plant-based vaccine	Institute Pasteur, Themis Bioscience, University of Pittsburgh, Johnson & Johnson, Medicago
BNT162	Merck, Novavax, Peter Doherty Institute for Infection and Immunity, Pfizer and BioNTech
DNA-based vaccine	Takis Biotech
Formalin-inactivated and alum-adjuvanted candidate vaccine	Sinovac

Source: Ojha et al. 2021

2a. Death Rates from Different Parts of the World Caused due to Coronavirus

Novel Coronavirus cases increased tenfold in less than a month, from 100,000 in the first week of March to more than one million on April 02, 2020. According to WHO (May 3, 2020), the world had already witnessed 3356205 cases, among which 238730 deaths were reported. The virus, since its emergence, had continuously mutated and changed its characteristics. Although it was earlier thought that the virus was more deadly to older patients with pre-existing comorbidities, doctors were now forced to revisit their presumptions. The Washington Post (April 22, 2020) reported that American doctors had observed unexplained blood clotting, even in patients taking anticoagulants. Accordingly, it had been revealed that hundreds of microclots were found in the patients' lungs after autopsies were done.

The World Health Organisation (WHO) had declared the COVID-19 outbreak a worldwide pandemic on March 11. The US also acknowledged the outbreak as a public health emergency on February 1, and for the time being,

banned travel from European countries to the US. The world’s most affected countries due to the Coronavirus were the European Union, the US, Japan, South Korea, Taiwan, and Vietnam, according to UNCTAD’s preliminary estimates of trade impact. Figures 5 to 10 show death rates⁷ due to novel Coronavirus in different countries for different continents. Figure 8 gives the percentage share of death rates due to COVID-19 for different continents.

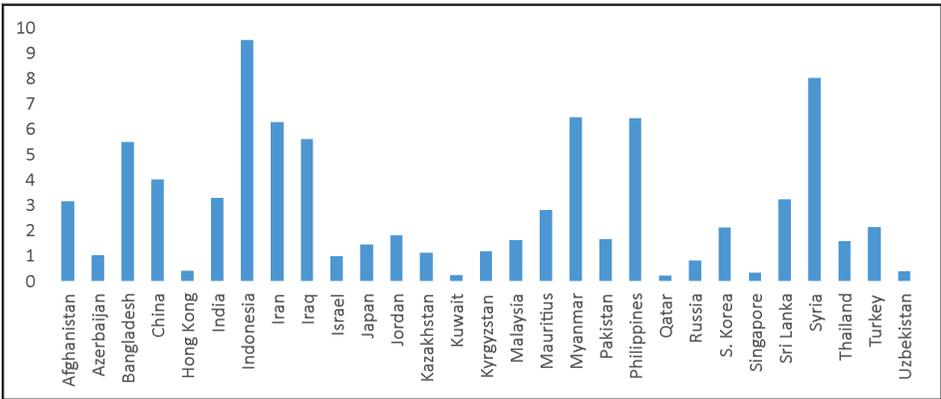


Figure 5: Death Rates of Different Asian Countries due to COVID-19

Source: WHO (2020), Authors’ calculation

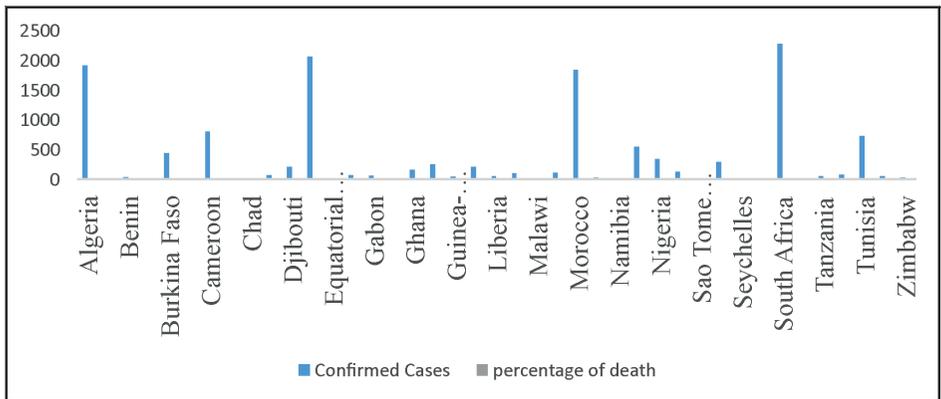


Figure 6: Death Rates for different African Countries due to COVID-19

Source: WHO (2020); Authors’ Calculation

2b. Graphical Explanation

From the above figures, it is evident that some countries were the worst affected due to COVID-19. For example, we can see from Figure 3 that the death rate

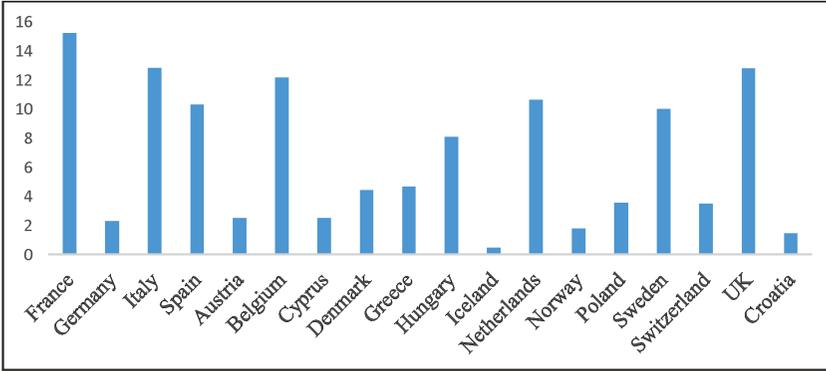


Figure 7: Death Rates for Different European Countries due to COVID-19

Source: WHO (2020); Authors' Calculation

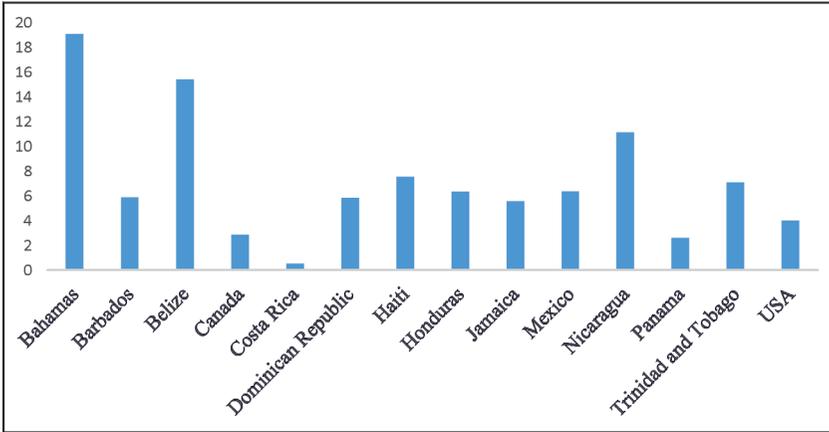


Figure 8: Death Rates for Different North American Countries due to COVID-19

Source: WHO (2020), Authors' Calculation

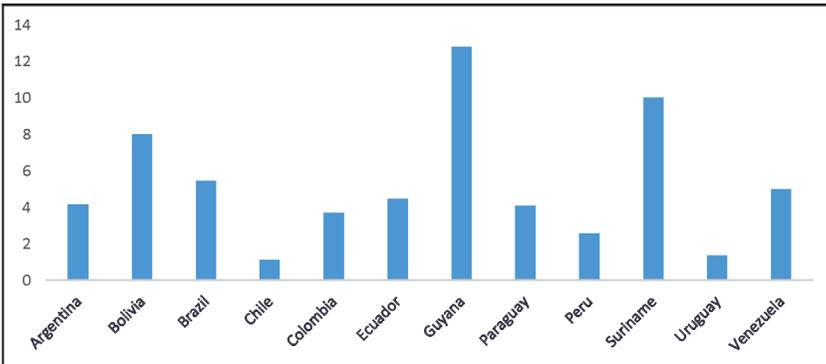


Figure 9: Death Rates for Different South American Countries due to COVID-19

Source: WHO (2020), Authors' Calculation

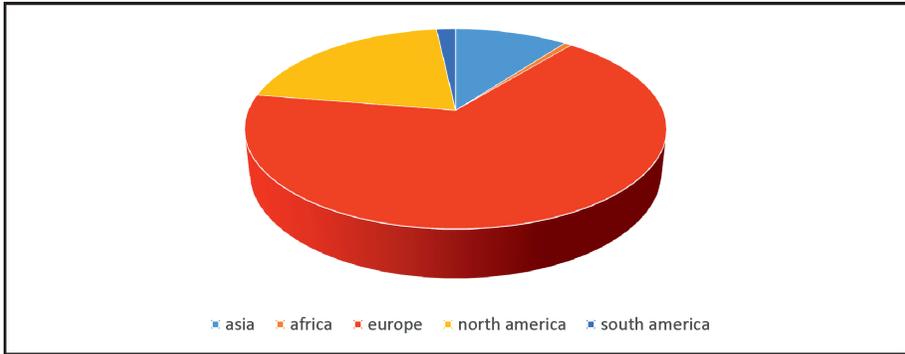


Figure 10: Percentage of Death Rate in Different Continents due to COVID-19

Source: WHO (2020); Authors' Calculation

is quite high for some Asian countries like Indonesia, Myanmar, Philippines, Syria, Iran, Iraq, Bangladesh and China. In the case of African countries, Algeria, Egypt, Morocco, and South Africa had confirmed high death rates (Figure 6). Figure 7 shows that Europe has been the hardest hit, and among the total global deaths caused due to this virus, 60% cases were reported here. Among the European nations, France, Italy, Spain, Belgium, Hungary, the Netherlands, Sweden, and the UK were the worst-affected areas. While the USA had reported a huge number of absolute number of deaths, countries like the Bahamas, Belize, Nicaragua, Mexico and Haiti had witnessed a huge percentage of death rate among the confirmed cases. The severe damage had been done in countries like Argentina, Bolivia, Brazil, Guyana, Suriname, and Venezuela.

We have tried to assess the cause of the varying death rates in different countries by calculating Spearman's Rank Correlation Coefficient⁸ (between percentage death rates for different countries with variables like most recent health expenditure as a percentage of GDP, urbanisation (percentage of urban population to total population), net migration as a percentage of total population and net inflow of FDI as a percentage of GDP. It is expected that an increasing health expenditure will have a negative impact on the death rate (in general) and vice versa. On the other hand, increased urbanisation and increased net immigration will increase the cluster of people, thus increasing the spread of disease and would, therefore, increase the death rate. Lastly, a net inflow of foreign capital in the form of FDI can improve the health and

hygienic facilities and thus will play a positive role in controlling the spread of disease, thus causing fewer deaths.

What is Vaccine Hesitancy?

The World Health Organisation (WHO) defines vaccine hesitancy as the delayed acceptance or refusal of safe vaccines despite their availability. There can be numerous causes of vaccine hesitancy, and these causes may be related to various context-specific matters that change according to place and time and according to the type of vaccines. Vaccine hesitancy can also be influenced by socio-demographic features. However, according to the guidelines of the WHO, the causes of vaccine hesitancy are related to satisfaction, accessibility, and assurance. With the COVID-19 pandemic, hesitancy in the acceptance of the vaccine has become very much predominant. In individualistic societies, this confrontation is very much predominant. Therefore, the policymakers should have a positive interference, and it is very much necessary to understand the aspects that contribute to vaccine hesitancy.

3a. How Common is Vaccine Hesitancy?

So far, there is no uniform tool to measure vaccine hesitancy. However, the concern about vaccine hesitancy had been measured by different cross-sectional surveys. Accordingly, 50% to 60% of the respondents worldwide were willing to take the vaccine; however, there was a wide variation across countries. It has been observed by the UK Household Longitudinal survey conducted in November 2020 that the response varied among different ethnic groups, and the rates became amplified in rural areas. Black ethnicity showed a 72% hesitancy, South Asian showed 42% and mixed ethnicity showed 32% hesitancy. On February 2 (2021), an attempt was made by the WHO to address any misinformation and fake news regarding vaccination. Socio-economic factors being one of the potential causes for vaccine hesitancy, the Indian Ministry of Health and Family Welfare attempted to focus on protecting people, particularly the poorest sector.

3b. The Determinants of Vaccine Hesitancy:

There are 5 main determinants—confidence, complacency, convenience, risk calculation and collective responsibilities. CSS survey has explored the reasons

for hesitancy for taking COVID 19 vaccine as concerns for side effects (38%), waiting for others to get it first (49%), other people need it more than me (25%), vaccine won't be beneficial (31%) mistrust in vaccine (12%), cost of vaccine (5.4%), and religious beliefs (3.5%).

Religious Ground

The Muslim communities showed significant hesitancy during the 3rd phase, as it occurred during their Ramadan season. This was experienced in states like Jammu and Kashmir, Uttar Pradesh, etc., where the vast majority of the population is Muslim. Another important cause of hesitancy among these states was the concern about the vaccine product's Halal status and potential harm. This inhibited acceptance of the vaccine. Indian Muslim clerics called for action to overcome vaccine hesitation during Ramadan. Lucknow-based Imam stepped up a campaign through the mosque and madrasa network. The UP government was requested to extend the time for vaccination. With the initiative of the Health, Medical and Education department, the SNA (Swastha Nagrik Abhiyan) team, Development partners and officers at MoHFW, the International Electrotechnical Commission in the states and Union Territories were effectively taking forward the strategic connection. The chief secretary of state engaged in sharing accurate and transparent information.

Backward States

Evidence of vaccine hesitancy was also experienced in states where the majority of the population comprises backward communities. Literacy rate is absolutely correlated with vaccination rate, and as a result, districts having higher illiteracy showed higher hesitancy. The linguistic barrier had strengthened this relationship since the registration for booking the vaccination slot was through an online app in English. According to the 2011 Census survey, only about 10% of the total population in India uses English as their 1st, 2nd or 3rd language and that too mostly among the urban population (Indian English, January 2019). The marginalised groups comprising SCs and STs have a past history of exclusion, which has resulted in improper access to the health system and a lack of confidence.

In this situation, local language and culturally relatable COVID-19 vaccine awareness campaigns were recommended by the WHO and India's Health Ministry. This gained confidence among the tribal dominated regions like Maharashtra, South Rajasthan, etc. The government officials initiated mandatory COVID-19 testing, coordinating with private hospitals. Next came the video series to mobilise country support. Different NGO workers played the audios in village after village.

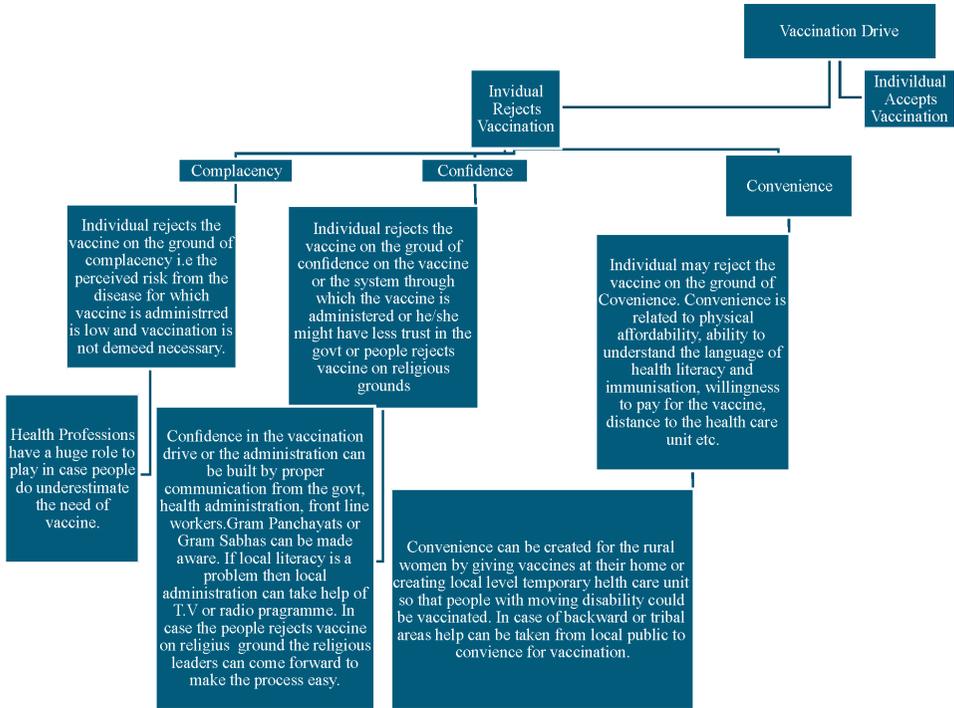
Urban- Rural Divide

This division resulted in vaccine hesitancy as a result of mind-boggling general mistrust. The message regarding the vaccine was injudicious from the start. Another cause is that it ran into shortages when the second wave hit. Then the government tried various means of persuasion, including through the religious leaders and the tribal chiefs. The drive was to locate the traditionally vaccine-hesitant groups and then devise location-specific and community-specific strategies, as out of a 900 million population 65% live in rural areas. Granular meetings were the only way to recapture faith. In a key public health intervention PHC councillor took a lot of initiatives for the people to get tested and vaccinated. Public health experts flagged long-standing challenges of delivering health services in the remotest areas.

Male: Female Vaccination Ratio

Males are found to be willing (76.5%) than females (73.6%) to be vaccinated. Male – Female vaccination ratio was worse than the sex ratio of their population, as evident in Central Delhi, Gurugram, Noida, etc., where 62 women received a vaccine dose for every 100 men in their districts. It is prevalent in states like UP, Bihar, Maharashtra, and Jharkhand, where women's health is not given importance in most of the rural households. The government needed to do more at this level to generate awareness about the benefits of vaccination. The women needed to be provided with the vaccine at their doorstep. They were the caregivers for their families, and travelling long distances to vaccination sites became very difficult.

Proposed Model of Vaccination Strategy for Developing Countries



Source: Designed by Authors

Global Scenario of Vaccination

Focusing on the global scenario, there was one significant difference between the developed and the developing countries with respect to vaccine hesitancy. There existed a significant difference in the level of wealth, economic development, income inequality, economic and political freedom, democracy, etc. between the global North and global South countries. It has been a common inference that the developed countries are far wealthier and less unequal compared to the global South, which is generally poorer with fragile democracies. Now that the complex phenomenon of vaccine hesitancy had been causing increasing global concern, the WHO had recommended the same parameter for vaccine hesitancy as applied to global North for global South countries⁹.

We can here refer to the different situations in various countries in the context of vaccine hesitancy. In the context of the studies conducted in Nepal, it was found that about two-thirds of the participants were afraid of the adverse effects of the Covid-19 vaccine, while more than half of them hesitated due

to a lack of enough information about the Covid-19 vaccine. There was an investigation into the willingness of the vaccine in the Democratic Republic of Congo. The data, based on August -September 2020, showed that one-fourth were convinced that COVID-19 didn't exist. About 55.9% suggested that they were willing to be vaccinated. Out of a population of 108 million, only 6.1 million vaccine doses had been administered. Thus, convincing people was a big challenge. With only 5.1% of the population fully vaccinated against COVID-19, Tanzania had one of the lowest vaccination rates in the world. Vaccination willingness differed significantly based on gender, age, educational attainment, and religion. According to the survey held in September 2021 in South Africa, less than 45% were fully vaccinated. The key factors influencing the uptake were race, risk perception for Covid-19, trust in the government's ability, interactive critical vaccine literacy, etc. Respondents who had no trust in the government's ability were 13 times more hesitant compared to those who had trust. Thus, gaining the trust of the population was one of the key factors. Surveys conducted in Papua New Guinea revealed that 53% didn't trust the vaccine at all, 23% said they didn't think that the vaccine would work, and thus 31% had not received any vaccine at all.

Poor or misguided communication can have an immense impact on vaccine hesitancy. While it is not seen as a determinant, but communication gap can shape the overall efficacy of the vaccination program. The vaccine hesitancy determinant matrix recommended by the Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy is shown in Table 4. For example, the underlying reason to minimise the preservative in some vaccines in the USA was not properly communicated, and consequently, the entire vaccination programme was jeopardised, and the public confidence in the vaccine system fell, resulting in increased vaccine hesitancy. In the above case, asymmetric information on the vaccine limited the capacity to counter negative information about the vaccine, and therefore, the community support for the vaccination programme was not achieved. The WHO suggestion in this regard was to achieve a better degree of engagement from all targeted groups and to set up of wide variety of communication channels in both rural and urban areas. Trust in the Government and scientific authorities in this respect helps the vaccination target¹⁰. One of the best-known challenges the medical practitioners faced was trust in vaccines, and this underscored the importance

of culturally sensitive health communication strategies. Survey was conducted in 23 countries (Canada, Brazil, Ecuador, China, France, Germany, Ghana, India, Italy, Kenya, Mexico, Nigeria, Peru, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Turkey, the United Kingdom and the United States) and among the 23,000 respondents willingness to vaccine hesitancy increased to 79.1% in July 2022 which was a rise by 5.2% from June 2021 (see Lazarus et al., 2023). Hesitancy increased in eight countries, ranging from 1.0% (United Kingdom) to 21.1% (South Africa) (Lazarus et al., January 2023). Almost one in eight (12.1%) were hesitant about booster doses. Reluctance in the parents led to a fall in the vaccination of children under 18 years. Respondents paid less attention to new COVID-19 information than before, and support for vaccination mandates also declined. September 2021 to January 2023 saw a decline in healthcare professionals’ recommendations to their patients. Trust in the Centres for Disease Control and Prevention also decreased from 79% to 73%.

Table 4: Vaccine Hesitancy Determinant Matrix Recommended by the Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy

<i>Determinants of Vaccine Hesitancy</i>	<i>Variables</i>
Contextual Effects	<ol style="list-style-type: none"> 1. Sex 2. Age Group 3. Education Qualification 4. Monthly Household Income 5. Income Loss During the Pandemic 6. Type of Profession
Individual and Group Influencers	<ol style="list-style-type: none"> 1. Flu Vaccine Acceptance Intention 2. Awareness of the health position 3. Number of comorbidities 4. Self-Stated Diabetes 5. Self-Stated Respiratory disease 6. Self-stated autoimmune disease 7. Having school-age children

<i>Determinants of Vaccine Hesitancy</i>	<i>Variables</i>
COVID-19 Disease-Specific	<ol style="list-style-type: none"> 1. Assurance in the capacity of health services to respond to the pandemic 2. View on the info provided by health specialists. 3. Insight into the suitability of measures applied by the government 4. Self-perceived risk of getting COVID-19 infection 5. Self-perceived risk of developing severe disease following COVID-19 infection 6. Frequency of tension, dejection, or anxiety due to the physical distancing events
COVID-19 vaccine-specific	<ol style="list-style-type: none"> 1. Assurance in the efficacy and safety of COVID-19 vaccines being developed. 2. Period of the survey

Source: Vaccine hesitancy determinant matrix recommended by the Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy

THE INDIAN SCENARIO

India witnessed its first case of COVID-19 on January 30, 2020. Two more were reported in the next month, and subsequently, more were reported in the latter half of April (2020). By June 9, a total of 266598 confirmed cases were reported from the 32 states or union territories (Ministry of Health and Family Welfare, MoHFW). States like Maharashtra, Tamil Nadu, Delhi and Gujarat suffered the most. According to the estimate by the MoHFW (April 6, 2020), 76% were male among the total number of confirmed cases. 63% deaths occurred in people aged 60 years and above, and 86% of the deaths occurred in people with comorbidities.

India's response to the situation was quite prompt. The international borders were sealed, and the nationwide lockdown was imposed since March 25¹¹. In India, frontline workers played an immense role in the vaccination programme, and the citizens had a one-to-one contact with them and were encouraged to get vaccinated. Due to timely measures, the spread has been controlled. The COVID-19 testing rates in India markedly improved from 0.02/1000 people in late March to 3.28/1000 people as of June 7. As of June 2020, 4916116 samples had been tested. A rapid antibody test was done, and the testing process was scaled up by using 553 government and 231 private

laboratories all over the world. In addition to the above, the Government established over 600 COVID-19 dedicated facilities all over the country, and these measures were associated with Indian Railways, which converted 375 coaches into isolation wards. To improve appropriateness, the state and the central government adopted measures so that the distribution of the vaccine could be optimised. To improve confidence, the development of an after-care service along with the vaccine delivery was suggested by the central government.

India took up the vaccination programme on January 16, 2021. The nationwide vaccination drive started with the Covishield adenovirus vector vaccine from AstraZeneca and Covaxin from Bharat Biotech. India was one of the worst-affected countries due to the COVID-19 pandemic. By August 2021, 30 million people were infected, and more than half a million died of COVID-19 infection. Almost 70% of the population had concerns regarding the effectiveness of the vaccine. The difference in awareness was based on age, educational qualification, and employment status. Thus, it was essential to plan the strategic measures to enhance the rate of vaccination. The trend that continued across the world initially saw greater demand and lesser supply of the COVID-19 vaccine, followed by greater supply and lesser demand due to vaccine hesitancy. In January 2021, the Government of India had the world's largest vaccination program to vaccinate a population of 1.3 billion. However, by October '21, only 30% of the population (291 million) had been fully vaccinated, and 707 million had received the first dose. This suggested the likelihood of refusal and indecision towards the vaccine. Data indicated that more than a third, i.e., 37% of the total population, was either not sure about or refused to obtain the COVID-19 vaccine. This was highly alarming given the threats of future variants. It has to be understood that a significant proportion of the population consists of rural individuals without formal education. This hesitancy prolonged the process to return to normalcy¹².

DISCUSSION

History shows that recurrence of deadly disease in the form of an epidemic has caused sheer devastation to human life and the economic well-being of the human race. The Spanish flu of 1918 resulted in the death of nearly 50 million people in the earth and caused severe economic depression. The influenza pandemics of 1957 and 1968 instigated severe casualties. Although it is widely

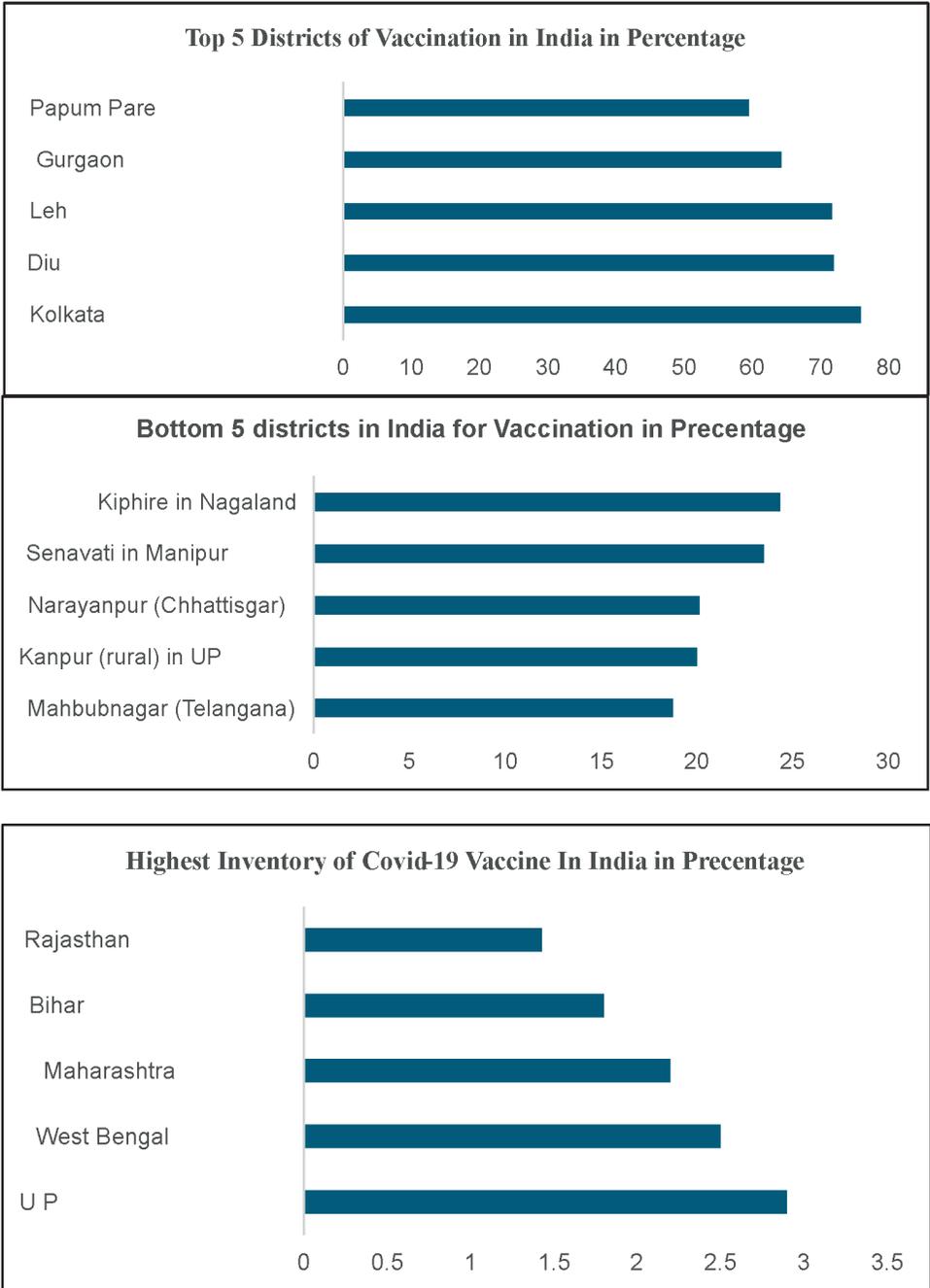


Figure 11: Vaccination Picture in India

accepted that vaccines are the most effective way of controlling the spread of communicable diseases, in most cases, the development of vaccines was delayed, which prevented the health care system from providing effective mitigation during the peak phases of the pandemics. Unfortunately, advancement of vaccines has not always been an area of priority as it is observed to deadly outbreaks like H1N1, Ebola, Zika and most recently COVID-19 (Ella, 2020).

Our first hypothesis is satisfied for Asia, North America and South America, where the Spearman's Rank correlation coefficient is negative between death rate and health care expenditure, which indicates for greater contribution of GDP towards the health care system. Our calculation shows the relation between death rate due to COVID-19 and health care expenditure as a percentage of GDP for Asia, North America and South America. It becomes surprising that despite investing a hefty sum of money from the GDP, developed nations like USA, UK, France, Italy, Spain, Germany, Sweden (most of these countries invests nearly 10% of their GDP in the health care sector; WHO, 2017) shows a high death rate due to COVID-19 that forces us to believe that there might be other parameters that were guiding their death rates in this regard apart from expenditures incurred in the health sector. Our second hypothesis is satisfied when we get a positive rank correlation coefficient between urbanisation and COVID-19 death rates for Africa and Europe. Our third hypothesis is satisfied for Africa, where we get a positive correlation coefficient between the net inflow of migrants and the death rate due to COVID-19. Our fourth hypothesis is satisfied for Asia, Africa and North America, where we have a negative correlation coefficient between net FDI inflows and death rate due to the pandemic.

China first saw the emergence of this virus in December 2019. Wuhan, the capital of Hubei province, is at the centre of the Chinese industrial heartland where the virus first appeared¹³. The occurrence of the Coronavirus crisis has already taken a toll on international relations. The Sino-American relations have hit a new low, and both countries are apparently in a public war against each other. The ongoing tussle between the two giants has jeopardised their bilateral ties and has further pushed the world population into the realm of disbelief, joblessness and widespread hunger. As the economic consequences of the lockdown prompted by the Coronavirus outbreak are becoming more prominent, American cities are witnessing an indiscriminate rise in anti-Asian sentiment. In the initial days, China floated a conspiracy theory and

blamed the US military officials who were in the Military World Games held at Wuhan in November 2109 for the spread of the virus. Attempts were also made on the part of the US to label COVID-19 as the 'Chinese Virus'. Leaders of both nations were desperately trying to malign each other's image and credibility in front of the entire world. However, the US seems to be winning its propaganda war against China; some experts were of the view that the world economic power might go against the USA, with the IMF/World Economic Outlook announcing forecasts that China will have a growth rate of 9.2 % in the year 2021, which is much higher than the projected 6.6%. Despite the ongoing trade war, Chinese small and medium enterprises continuously upgraded themselves in the value chain, and this is one of the reasons that China managed to maintain its global competitiveness in the specialised supply chain in different sectors. China is expected to provide stimulus packages to the smaller countries that were facing economic chaos due to the pandemic. It was projected by the IMF that the US was going to face a negative growth rate of 5.9% in 2020, and therefore, it should focus on mass production.

However, experts found that India might gain in terms of world business if it could adapt to this changing world scenario. Although China has lost its face value to its international customers due to suppression of facts regarding the first outbreak of the virus to the international community, many are helplessly dependent on the discretion of China for medical supplies. Amidst this scenario, Indian pharmaceutical companies have shown their courage to meet the international demand, along with their domestic demand, for medicines to control the pandemic, with serious supply chain disruptions and cash flow issues.¹⁴

CONCLUDING REMARKS

A recent study conducted in 2024 observed that infection-acquired immunity boosted with vaccination can remain high for more than a year after infection, and therefore, it was strongly recommended that all should take the vaccine to safeguard against the deadly infection. Emphasis was given towards more communication from the side of the Government to curb the negative attitude towards vaccination and reduce the tendency of vaccine hesitancy. The scientific community has to bear the responsibility to clearly communicate with the people and make the public aware of all the vaccines. Government

and relevant health authorities should tailor the vaccination programme for women so that they prioritise taking the vaccine for themselves and address their health concerns adequately.

Experts were of the opinion that after this outbreak, there is a high possibility that international investors will be eagerly looking for a country where there is enough press and media freedom, and the government is much more transparent in its actions. Unlike China, India, being a democratic country, practices much more transparency in its actions, and the media here enjoys enough freedom. Therefore, there is no doubt that India is expected to emerge as an investor's hub in Asia in the near future. However, Researchers are trying their level best to find out the causes that might have a significant contribution to the death rate in the developed countries, despite having good medical facilities. In this line, many researchers have given emphasis on population age distribution, pollution, industrialisation, weather conditions, etc., as major factors causing high death rates in the worst-affected countries. However, no consensus has been reached. There lies a future scope of research to analyse the role of institutional factors like governance, political lobbying, level of democracy, etc., both for the rich and poor nations, in analysing the mounting deaths caused due to COVID-19.

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ORCID ID of Chaitali Sinha <https://orcid.org/0000-0002-6668-6661>

Notes

1. The Reserve Bank of India cut the key interest rate by 75 basis points to make loans cheaper and provided Rs. 1 lakh crore of liquidity to the market. Also, a moratorium on repayment of loans for three months had been provided. Pakistan declared a Rs 1.2 lakh crore rescue package to help businesses and helpless people. In addition, the government decided to allocate Rs 7,500 crore for small and medium enterprises. On the other hand, Bangladesh announced a \$11.6 billion stimulus package with primary focus on the manufacturing, service sectors, agriculture and social safety nets. On a similar note, Sri Lanka's central bank declared a \$250 million refinancing facility for its banks. In addition to this, Sri Lanka had a currency

swap agreement with the Reserve Bank of India worth \$400 million to increase its foreign reserves and financial stability. A 2.5 billion Maldivian rufiyaa (\$161.8 million) stimulus package was announced by the Maldives govt. On a similar note, Nepal announced a plan that includes MVR 1.55 billion (\$100 million) in emergency loans for businesses to meet short-term working capital needs. The Afghan government allocated about \$25 million to deal with the crisis.

2. In the context of a study based on 23 countries conducted between June–July 2022 with emerging disease outbreaks like the Covid-19 pandemic, it was observed that willingness to accept vaccination was up about 5% from June 2021. Hesitancy increased in 8 countries, ranging from 1% in the UK to 21.1% in South Africa. Lower rates of Covid-19 vaccine acceptance were reported in the Middle East, Russia, Africa and several European countries, with the lowest in Kuwait (23.6%), Jordan (28.4%), Italy (53.7%), Russia (54.9%), Poland (56.3%), the US (56.9%) and France (58.9%).
3. The severe acute respiratory syndrome Coronavirus (SARS-CoV), H5N1 influenza A, H1N1 2009 and Middle East respiratory syndrome Coronavirus (MERS-CoV) cause acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) that lead to pulmonary failure and result in fatality.
4. The infection of MERS-CoV initiates from a mild upper respiratory injury, while development leads to severe respiratory disease. Similar to SARS-CoV, patients infected with MERS-CoV suffer from pneumonia, followed by ARDS and renal failure. Death rates are calculated by taking the percentage of death cases among confirmed cases of Coronavirus. Data has been taken from the WHO up to April 12, 2020.
5. Data for death rates due to Covid-19 has been taken from WHO bulletin up to April 12, 2020 and most recent data for other variables like health expenditure as a percentage of GDP, urbanisation (percentage of urban population to total population), net migration as a percentage of total population and net inflow of FDI as a percentage of GDP has been taken from World Bank.
6. See Maiti, Kar and Marjit (2007) for methodology regarding Spearman's Rank Correlation Coefficient. Spearman's Rank Correlation Coefficient between death rate and other variables has been calculated for a set of Asian, African, European, North American and South American countries. The list of countries is provided in the appendix.
7. The studies in global South brings up significant issues like access, cultural and religious concerns, reactions to government, reaction to vaccine tests on population etc. It has been found that, in general the higher income countries were least

- certain about the vaccine safety while the majority of the people in lower income countries agreed that the vaccines are safe with the highest proportion seen in South Asia (95%) and Eastern Africa (92%) (Vaccines, Basel February 2021).
8. The acceptance of the COVID-19 booster dose was in 2023 declined to 71.6% compared to 87.9% as of 2022 (survey conducted on 23,000 adults in 23 countries in Oct 2023). 60.8% of the total stated that they were more eager to get vaccinated for diseases other Covid 19 due to limited knowledge while 23.1% reported being less willing.
 9. India took stringent measures compared to the United States, Germany, France, Italy, and the United Kingdom. Timely response helped India prevented the disease from spreading. According to a public health study (July 2022 to September 2022) 524 respondents (87.3%) were found to have one dose of COVID-19, while 76 respondents (12.7%) were yet to receive the vaccine at the time the survey was done. This led to identification of the factors that were responsible to vaccine hesitancy from a gendered lens i.e., from the viewpoint of an Indian adult woman, their acceptance, refusal, or hesitancy in the background of COVID-19 vaccines (Nature Medicine January 2023).
 10. Though vaccination is lowest among the LMICs for their reliance on other vaccine-producing nations, India is one of the few countries that developed and produced a vaccine at home. A nationwide study was conducted to understand the public's perception of the vaccine in December '20. From the survey, it was observed that about 70% of the population had concerns about the vaccine, depending on age, qualification, employment pattern, etc. In a large and diverse nation like India, this vaccine hesitancy could translate to millions of people, so it needed to be treated by the government and society.
 11. This city is located in the very middle of the "Industrial Square" of the country, the area bounded by Beijing/Tianjin, Chengdu/Chongqing, Macau/Hong Kong, and Shanghai. Hubei province is home to seven crucial economic zones: Hubei Jingzhou Chengnan Economic Development Zone; Wuhan East Lake High-Tech Development Zone (China's largest production centre for optical-electronic products); Wuhan Economic and Technological Development Zone; Wuhan Export Processing Zone; Wuhan Optical Valley (Guanggu) Software Park is in Wuhan East Lake High-Tech Development Zone; and Xiangyang New & Hi-Tech Industrial Development Zone.
 12. After reviewing the status of the Indian manufacturers' capacities, the government has released the order to export Hydroxychloroquine (HCQ) and Paracetamol to countries that needed the drugs most. India supplied HCQ tablets to over 50 countries including USA, Spain, Brazil, Germany, Russia, Bahrain, Nepal,

Bhutan, Bangladesh, Afghanistan, Maldives, South Africa, Seychelles, Mauritius, Dominican Republic, Kuwait, Antigua & Barbuda & Palau etc.

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APPENDIX**List of countries taken for calculating Spearman's Rank Correlation Coefficient**

<i>Asian Countries</i>	<i>African Countries</i>	<i>European Countries</i>	<i>North American Countries</i>	<i>South American Countries</i>
Afghanistan	Algeria	France	Bahamas	Argentina
Azerbaijan	Angola	Germany	Barbados	Bolivia
Bangladesh	Benin	Italy	Belize	Brazil
China	Botswana	Spain	Canada	Chile
Hong Kong	Burkina Faso	Austria	Costa Rica	Colombia
India	Burundi	Belgium	Dominican Republic	Ecuador
Indonesia	Cameroon	Cyprus	Haiti	Guyana
Iran	Central African Republic	Denmark	Honduras	Paraguay
Iraq	Chad	Greece	Jamaica	Peru
Israel	Democratic Republic of the Congo	Hungary	Mexico	Suriname
Japan	Djibouti	Iceland	Nicaragua	Uruguay
Jordan	Egypt		Panama	
Kazakhstan	Equatorial Guinea	Netherlands	Trinidad and Tobago	
Kuwait	Ethiopia	Norway	USA	
Kyrgyzstan	Gabon	Poland		
Malaysia	Gambia	Sweden		
Mauritius	Ghana	Switzerland		
Myanmar	Guinea	UK		
Pakistan	Guinea-Bissau	Croatia		
Philippines	Kenya			
Qatar	Liberia			
Russia	Madagascar			
Singapore	Malawi			
south Korea	Mali			
Sri Lanka	Morocco			
Thailand	Mozambique			
Turkey	Namibia			
Uzbekistan	Niger			
	Nigeria			
	Rwanda			
	São Tomé and Príncipe			
	Senegal			
	Seychelles			

	Sierra Leone			
	South Africa			
	Sudan			
	Tanzania			
	Togo			
	Tunisia			
	Uganda			
	Zimbabwe			