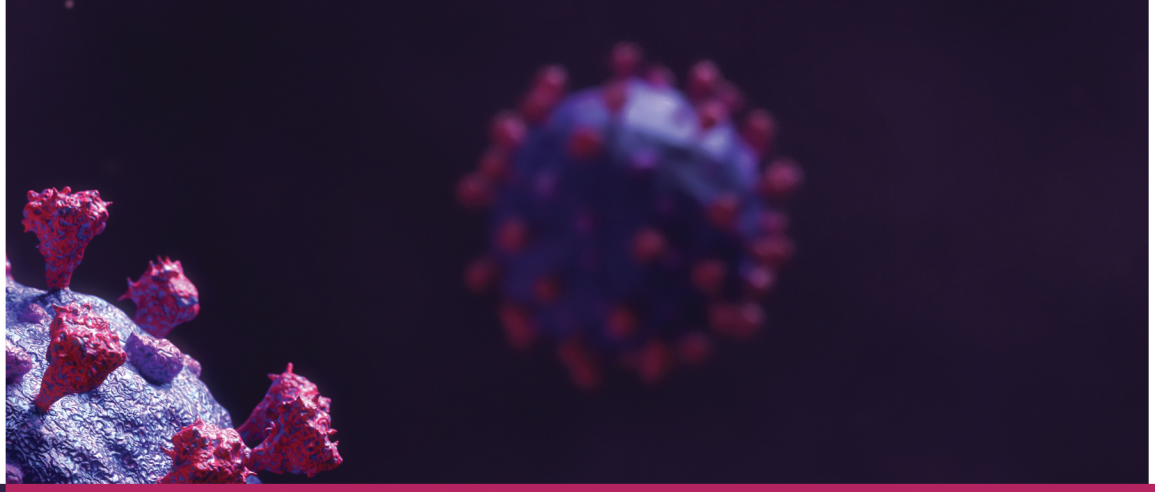
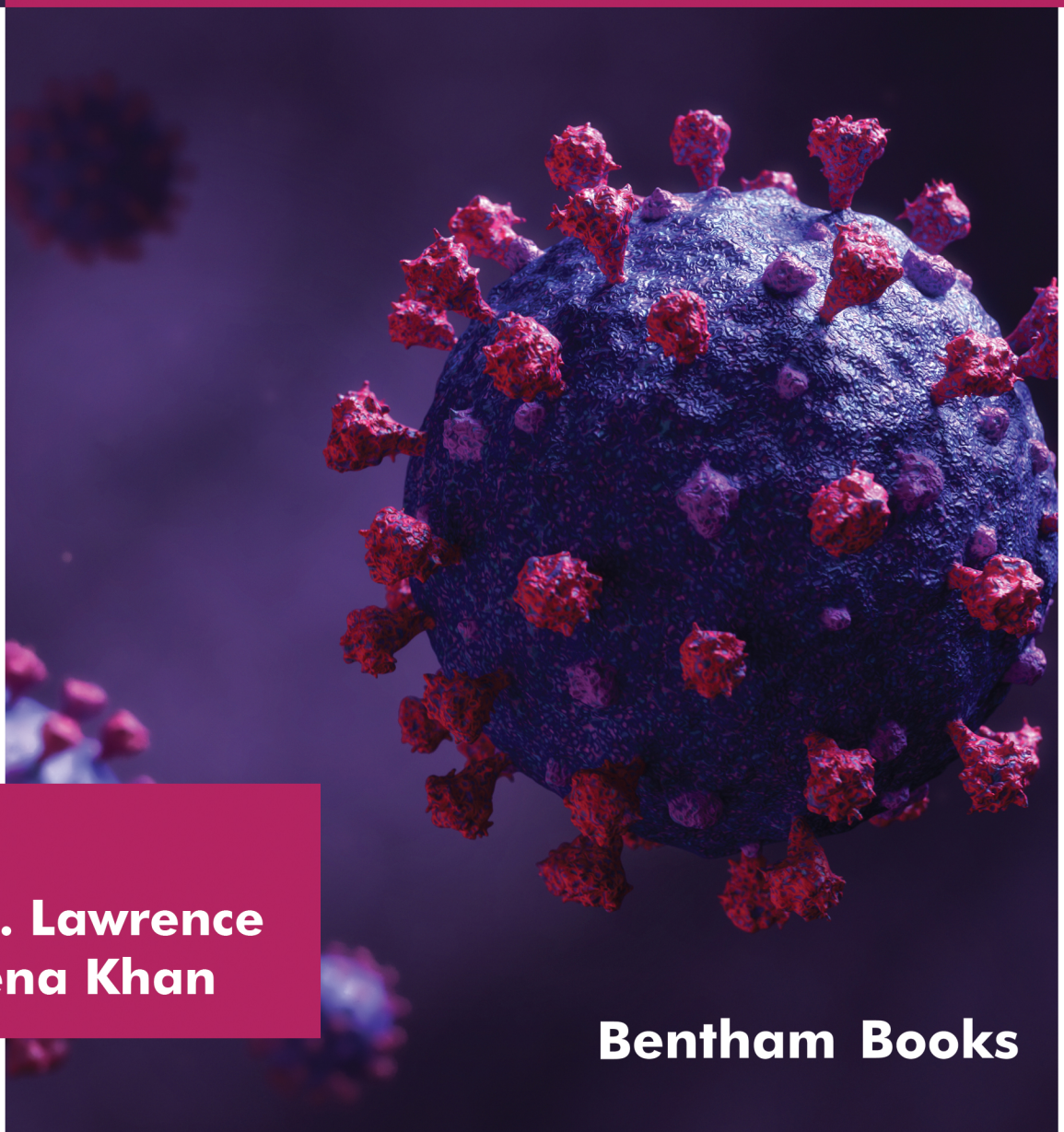


COVID-19:
ORIGIN, IMPACT AND MANAGEMENT
PART 1



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COVID-19: Origin, Impact and Management

(Part 1)

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CONTENTS

FOREWORD

The editors and authors of this book have successfully undertaken a noble and Herculean task to produce a timely guide to the coronavirus (COVID-19) pandemic that is engaging, succinct, and above all, useful to its readers. Unlike many other books about the pandemic, this book brings together experts from different fields from leading Indian and American academic institutions to provide a holistic picture of the origin, impact, and management of one of the worst pandemics humankind has ever had faced.

Such interdisciplinary thinking makes this book unique as it covers not only the science behind the origin of the virus and the development of new vaccines and drugs to fight COVID-19 and its variants but also provides us with the socioeconomic impacts of this deadly pandemic. Even though we have all been impacted by the hardship and heartbreak caused by the pandemic directly or indirectly, this book highlights the heterogeneous effect of the pandemic, particularly on developing economies and women.

I am delighted to see that each chapter in this book is devoted to a different aspect of the COVID-19 pandemic, providing the reader in a single volume with evidence-based research that will help debunk some of the misinformation and disinformation that threaten our understanding of the science behind the disease.

I do not doubt that this book will prove to be an in-depth resource for scientists, academics, researchers, students, and policymakers worldwide for years to come and help us prevent and prepare better for the next pandemic.

Dr. Arup Ganguly
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PREFACE

Since the origin of the SARS-CoV-2 outbreak, the viral disease has spread like wildfire across the entire globe, hampering the quality of human life at multiple levels and causing irretrievable loss of human life. There are many aspects like psychological well-being, loss of jobs, pay cuts, loss of education and unpaid caregiving, emerging as other important consequences of the pandemic. As educators, we need to educate and provide our students with first-hand information about the ongoing crisis. This innovative book is intended to cater to scientists, academicians and students from science, humanities and commerce backgrounds to understand the pandemic from a microscopic view and how it has touched our lives at different levels. The unique special point of this book is its interdisciplinary nature making it useful for people belonging to different academic streams. A collection of topics has been explored through dedicated chapters authored by expert scientists, academicians and research scholars from leading and premier institutions. The chapters range from the very origination of the virus and factors that may facilitate its spread, like air pollution, along with the impact on nutritional, mental, psychological, and educational aspects. Mortality was not only caused by the virus, but problems like domestic violence, job cuts and suicides due to financial crunch also caused loss of lives, and these aspects are being explored by experts. The book would also provide the necessary information about the management strategies to deal with the peril caused by the COVID pandemonium. Another interesting feature of the book is the inclusion of case studies conducted with different groups like women and children to know how their lives were impacted by the pandemic and how they are coping with the situation. Another distinguishing point of the book is that the majority of the authors are women belonging to different educational backgrounds and reputed academic and research institutions. The book will prove to be of use not only to degree students and academicians but will also provide topics of interest to the common person looking to gain survey-based information on the pandemic.

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CHAPTER 1

The Outbreak of COVID-19 Coronavirus and Associated Facts and Factors

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Abstract: COVID-19 is a global pandemic resulting in devastating impacts that spread through a virus and are even more contagious than influenza, as evident from the frequent reporting of cluster outbreaks. Although the key problem is that the symptoms are often similar to other common illnesses, such outbreaks can be controlled if individuals with initial symptoms are tested, and further contact tracing is done. The concept presented here discusses the order in which symptoms appear to differentiate it from other respiratory disorders, however, this crucial information is mostly missing. To determine the most likely order of detectable symptoms in COVID-19 patients, we apply a Markov Process to a graded partially ordered set based on clinical observations of COVID-19 cases. A comparison was made between the evolution of these symptoms in COVID-19 and influenza, SARS, and MERS to see if they were present differently. Influenza, according to our hypothesis, begins with a cough, whereas COVID-19 and other coronavirus infections begin with a fever. COVID-19, on the other hand, varies from SARS and MERS in terms of the order of gastrointestinal symptoms. As facilities begin to reopen following the 2020 spring outbreak, our findings support the idea that fever should be used to screen for admission and that appropriate clinical practice should include noting the order of symptoms occurrence in COVID-19 along with other diseases. If this type of systemic clinical approach had been routine, the move from a local to a worldwide pandemic might not have happened.

Keywords: Clinical approach, COVID-19, Fever, Infections, Markov Process, MERS, Pandemic, SARS, Variants.

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INTRODUCTION

COVID-19

For the initial novel coronavirus-infected pneumonia (NCIP) cases in Wuhan, Hubei Province, China, we analysed the data of the first 425 confirmed cases to determine the epidemiologic characteristics of NCIP. Most avian influenza A (H7N9) cases in mainland China during the spring of 2013 were reported by pneumonia of an unknown aetiology (PUE) surveillance system. For assessing the role of surveillance bias and possible underreporting in the assessment of the epidemiology of subtype H7N9 cases and the effects of poultry market closures, all PUE cases were analysed, which got reported from 2004 to May 3, 2013 [1].

PUE reporting was inconsistent and was biased towards A (H7N9) affected provinces. No evidence was found that the older ages of persons with A (H7N9) resulted from surveillance bias. The decline in PUE cases after poultry market closures indicates outbreak control [2].

On March 31, 2013, China reported the first human infection of the A (H7N9) virus to the WHO, and as of May 3, 2013, a total of 127 cases resulting in 24 deaths had been reported. The median age of the case patients was 62 years, with 71% of them being males [3].

The first COVID-19-reported individuals who showed symptoms as early as 8th December 2019 were among the stallholders of the Wuhan South China Seafood Market, after which it was closed down on Jan 1. After performing the gene sequencing on Jan 10, it was confirmed to be a novel coronavirus, related to the MERS-CoV and SARS-CoV however, its mortality and transmissibility are still unknown, which are likely to differ from the prior ones [4]. A detailed image of the COVID-19 virus is shown in (Fig. **1**).

People who got infected and travelled abroad are the carriers of the virus and the initiation of a global outbreak was marked. 13th January 2020 was the first internationally reported case from Thailand outside China [5].

Fig. (1). Digital image of COVID-19 Virus.

On January 22, 2019, the WHO emergency committee discussed whether to declare it a public health emergency of international concern (PHEIC) under health regulations, but went undecided in the absence of full-proof information [6].

On 23rd January 2020, Wuhan suspended all public transport and air travel and placed residents under quarantine. Screening of people in public places, along with the railways and airways places, was extensively carried out globally [7].

Dashboard for Geographic Information Systems (Updated April 27, 2020)

In light of the current public health crisis, we created an interactive web-based dashboard that was hosted by John Hopkins University's Centre for System Science and Engineering (CSSE) for the visualisation and tracking of cases reported in real-time. On 22nd January 2020, it was publicly shared, illustrating the places and the number of recorded COVID cases, deaths, and recoveries, as well as their locations (Fig. **2**). This user-friendly application was created for researchers and health authorities to use as a reference tool, as well as to assist the general public in keeping track of the occurrence. Its data is publicly available and is now shown in the ESRI Living Atlas.

As the manual reporting process becomes difficult with the accelerating of cases being reported globally, we decided to embrace it. A semi-automated living data stream strategy was implemented. DXY, an online platform run by members of the Chinese medical community, was our primary data source initially, but then as time went on, we created a series of data sources which included US county and

CHAPTER 2

Hypothetical Study on Organophosphates and SARS-CoV-2 Collaborating in Causing Several Respiratory and Immune Diseases for Future Generation: A Review

Nitya Dubey[1,*], Tahmeena Khan[2], Pavan Kumar Nagar[1], Brijesh Singh[1] and **Anju Verma[1]**

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Abstract: Increasing population and increased intensity of crop production led to the invention of pesticides, among which organophosphates are extensively commercialized and used as commercial pesticides. Their toxicity leads to millions of deaths every year. The insecticide enters the food web and inhibits acetyl-cholinesterase enzyme production, which upturns into respiratory dysfunctioning and immuno-toxic production. SARS-CoV-2, a natural micro immuno-toxin, serves a similar mechanism over our body. It affects both the respiratory system and autoimmunity. The scope of this review article is to brief and explain the mechanism and relation between these two co-partners and their futuristic impact on the world. Henceforth, it is also recommended to utilize cost-effective homemade natural pesticides and integrated farming practices to provide secure and healthy food production and curb the future health hazards caused by SARS-CoV-2 and organophosphates.

Keywords: Immune-toxins, Natural Pesticides, Organic Farming, Organophosphates, Pesticides, SARS-CoV-2.

INTRODUCTION

Pesticides, an ingredient that prevents, destroys, repels, or mitigates any pest, are classified as Herbicides, Rodenticides, Fungicides, and Bactericides used to control pest-induced diseases and improve crop yields. These dominant factors are the leading cause of using pesticides. But, after the famous identification of Bernardino Ramazzini that farmers are prone to Ramazzini's syndrome (an acute

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pulmonary disease of farmers related to threshing grain), it is comprehensible that pesticides would provide the same results due to their toxic chemical composition [1]. In 1952, India established the production plant for the production and manufacturing of BHC in Calcutta. It was being reported that in 1958, the production rate was 5,000 metric tons, and in 1998, 102, 240 metric tons. As the demand for pesticides increased in 1996-1997, the estimated value reached Rs. 2 billion, *i.e.*, 0.5 billion USD. This was two percent of the total world market. Unfortunately, due to different usage patterns, extensive production and exposure to pesticides have created "a pesticide-based disease havoc" worldwide [2]. Pesticides are also exposed to children through various routes from prenatal to post-development stages that result in severe respiratory illnesses. Many studies [3] have reported that 79% of cases are found to be positively linked to pesticide vulnerabilities and cause respiratory infections (*e.g.*, asthma, coughs, wheezing, acute respiratory diseases, eczema, rhinitis, lung function impairments, and chronic phlegm). An anti-cholinesterase insecticide named organophosphate (OPs) (Fig. **1**) has become a global threat today. The use of diazinon ruins the mechanism of the acetylcholinesterase enzyme in the body and destroys the proper functioning of nerve signaling. It damages the mechanism of the human nervous system and harms the anatomy of tiny organisms like insects, which eventually pass to humans through the food web [4].

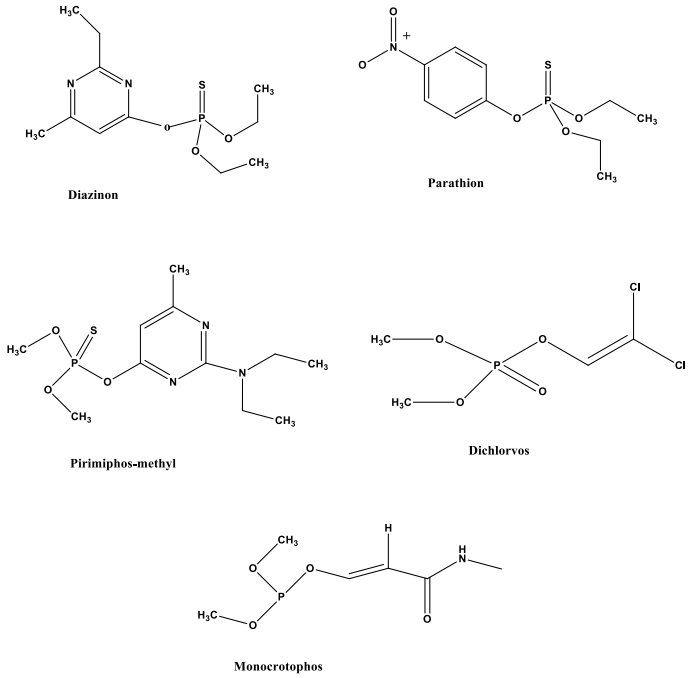
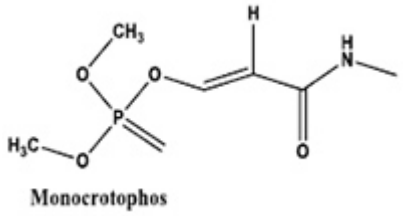
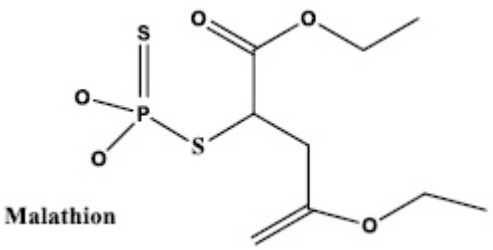
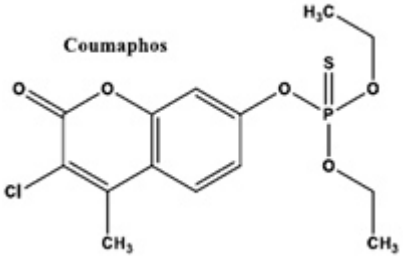


Fig. (1). Types of organophosphates and their structures.

A study conducted in Madhya Pradesh, Bhopal, and Faizabad showed the overuse of pesticides like HCH isomers, Malathion (Table **1**), endosulfan, chlorpyrifos, and methyl-parathion were responsible for degrading the mother's milk which is conceivably harmful to the infants [5, 6]. Consumption of OPs like endosulfan (8.6 times) by newborn babies *via* breast milk and Malathion (4.1) crosses the excessive set consumption limit by World Health Organization in a different area. It implies that the use of endosulfan is more than Malathion, and sincere attention is needed to avoid respiratory infection. The nervous system damaged by endosulfan and other OPs is more inclined to immuno-toxicant spreading among human beings and non-targeted species [5].

Table 1. Examples of pesticides causing acute respiratory infections in humans.

Pesticides	Structure	Toxicity Effect	References
Monocrotophos	 Monocrotophos	Acute exposure responsible for a decrease in the consumption of oxygen.	[7]
Malathion	 Malathion	Famous for the inhibition of acetylcholinesterase enzyme, damages DNA, destroys the cellular activities responsible for antioxidant defense mechanism and facilitates the destruction of apoptotic cells.	[8]
Coumaphos	 Coumaphos	Allergic asthma was caused by Coumaphos (OR 2.34; 95% CI 1.49–3.70)	[9]

CHAPTER 3

Air Quality Variation Associated with Particulate Matter in Major North Indian Cities During Diwali 2020: Susceptible Vehicle for SARS CoV-2 Transmission

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Abstract: Air pollution is presumed to exacerbate the COVID-19 pandemic. Previous studies have emphasized that particulate matter in the air increases the virus' infectivity and disease lethality. A study was undertaken to inspect if short-term exposure to pollutants during firecracker burning on Diwali, 2020, contributed to COVID mortality rates. Here, air quality variation was monitored concerning $PM_{2.5}$ and PM_{10} from 4th-21st November 2020 in the six most polluted cities of North India *viz.* Delhi, Lucknow, Greater Noida, Bulandshahr, Ghaziabad and Muzaffarnagar; Focussed largely on measuring pollutants' concentration pre, post and during the Diwali period, significant short-term variation in the AQI was observed during the night of Diwali which remained constant until the next day. The hazardous values recorded for AQI during the Diwali period indicated non-compliance with the ban imposed by the government on burning firecrackers in 2017. The study established a weak positive correlation between temperature and AQI, whereas a negative correlation was established between AQI and humidity. In the aftermath of the COVID-19 pandemic, short-term variations in air quality may prove to be critical.

Keywords: Air Pollution, Air Quality Variation, AQI(Air Quality Index), Correlation, COVID-19, Covid Mortality, Disease Lethality, Diwali, Exacerbate, Firecrackers, Firecracker Burning, Hazardous, Infectivity, Inspect, North India, Particulate Matter, Pollutant, Short-term Variation, Study, Virus.

INTRODUCTION

As per WHO statistics, exposure to polluted air accounts for around 4.2 million deaths every year, making it the biggest environmental health hazard. Only 1% of

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Alfred J. Lawrence & Tahmeena Khan (Eds.)

the global population breathes air that is "good enough" in terms of quality. According to Johnson *et al*., "Air quality is a measure of the condition of air relative to the requirements of one or more species and/or to any human need or purpose" [1]. In practice, it is estimated by the levels of major pollutants in the air *viz*. particulate matter (PM)- PM_{10}, $PM_{2.5}$, Ozone (O_3), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Carbon monoxide (CO), lead (Pb) and ammonia (NH_3). Air Quality Index (AQI) is a cumulative parameter for the level of these pollutants. Fig. (**1**) shows the five categories of AQI with associated health impacs. The Central Pollution Control Board (CPCB) is an organisation under the Ministry of Environment, Forest and Climate Change that routinely monitors AQI throughout India. AQI can only be calculated if sufficient data is collected; at least 6 hours of data should be available for a minimum of three pollutants. Since PM poses the most health risk, data for either PM_{10} or $PM_{2.5}$ is a mandate for this calculation. The CPCB website reports hourly AQI readings for various monitoring stations in India. The quality of air in North-Indian states has been recorded to be consistently poor, especially in the winter months. The Indian festival of Diwali falls at the onset of winter and is celebrated fervently with extravagant fireworks. The burning of firecrackers contributes to short-term spikes in AQI. Many North-Indian cities, especially in the NCR, have recorded poorly to severe AQI levels during Diwali.

AQI category	Associated Health impact
Good (0 to 50)	Minimal impact
Satisfactory (51 to 100)	May cause minor breathing difficulties
Moderately Polluted (101 to 200)	May cause discomfort to people with cardiopulmonary disorders, children and the elderly
Poor (201 to 300)	May cause respiratory illness to people on prolonged exposure and difficulties in people with heart conditions.
Very Poor (301 to 400)	May cause respiratory illness to people on prolonged exposure. The effect may be more pronounced in people with lung and heart diseases.
Severe (401 to 500)	May cause respiratory effects even on healthy individuals and serious health impacts on people with heart/lung diseases.

Fig. (1). Health impacts of increasing AQI values in the atmosphere.

The study of ambient air quality has become increasingly pertinent, given its implications on the COVID-19 pandemic. Numerous studies have suggested that viral transmission and COVID-19 disease progression are aided by pollutants in the air. Poor air quality not only contributes to co-morbidities in COVID-19 but also increases the risk of mortality. This chapter highlights the relationship between air pollutants and the pandemic with a special focus on particulate matter emission during the Diwali season, particulate matter *viz.* $PM_{2.5}$ and PM_{10} pose the greatest risk to health owing to their small size and deeper penetration in the lungs.

PARTICULATE MATTER: ROLE IN COVID-19

PM Exposure Increases the Risk of Developing COVID-Associated Morbidities

The pre-existence of co-morbidities significantly increases the patient's risk profile for COVID-19 infections. These include chronic cardiopulmonary disorders that are worsened by air pollution. Long-term exposure to air pollution leads to asthma, Chronic Obstructive Pulmonary Disorder (COPD), or lung fibrosis [2]. While short-term exposure may affect the respiratory system through inflammation or oxidative stress response [3]. Children are more vulnerable to these adverse effects as their lungs are still undergoing development. Their lung epithelium is also more permeable to pollutants. Poor lung development can, in turn, lead to complications in not only COVID-19 but any pulmonary disease. Overexposure to particulate matter (PM) can cause the translocation of PM into the bloodstream, where it can alter the coagulation pathway and even damage blood vessels. Reactive oxidative species (ROS) produced as a stress response have been associated with atherosclerosis, vascular dysfunction, cardiac arrhythmias and myocardial injury. The listed PM-associated comorbidities can be high-risk factors in COVID-19 patients [4].

PM can be a 'vehicle' for SARS-CoV-2 Transmission

SARS-CoV-2 is known to spread by close contact or airborne transmission. The former involves the expulsion of pathogens by infected individuals and its inhalation by the potential host. These are only effective for transmission at short distances. Another method is *via* indirect contact with infected surfaces. On the other hand, airborne transmission of the virus occurs in aerosols. Aerosol is a suspension of solid or liquid particles in the gas phase. These can be readily propagated via air currents and thus can spread infections across longer distances.

Existing research suggests that atmospheric pollutants enhance the viability of airborne pathogens [5, 6]. A study observed the spread of the avian influenza

CHAPTER 4

COVID-19 and Moderating Effects of Government Stimulus

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Abstract: In this paper, we study the impact of the COVID-19 pandemic on the economic conditions and the stock markets of countries across the world. We find that an increase in contagion and death rate due to the pandemic inversely affects both the country's GDP and its stock markets. Next, we study the impact of government stimulus on the economic conditions and the stock markets of each of the countries in our sample. We find that the government stimulus moderates the effect of COVID-19 on the real condition of economies as we find that GDP is not affected by COVID-1--related death in the post-stimulus period. The stimulus alleviates the negative impact of pandemic concerns on the stock markets, where the increase in contagion and death rate due to COVID-19 positively correlates with the performance of stock markets in the post-stimulus period.

Keywords: COVID-19, Government Stimulus, Pandemic, Post-stimulus, Stock Market Performance.

INTRODUCTION

COVID-19 pandemic started spreading worldwide early in the year 2020, and countries faced the dilemma of closing day-to-day activities to minimize social interactions to contain the contagion and death rate and suffer economic suicide or continuing social activities to protect their economies. The increased death rates due to COVID-19 consequently imposed social distancing measures in most of the countries in order to control the spread and death due to COVID-19. In this paper, we study the impact of pandemic contagion and death rates on the real economic conditions of countries and their stock markets. We find that increase in contagion and death rate due to the pandemic inversely affects both, the stock markets as well as the country's GDP.

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To alleviate the economic fallouts, countries across the world enacted laws providing a significant amount of money in their economies. We study the impact of government stimulus on the economic conditions and the stock markets of each of the countries in our sample. We find that stimulus alleviates the pandemic concerns for the stock markets, where an increase in contagion and death rate due to COVID-19 has a positive correlation with the performance of stock markets in the post-stimulus period. The government stimulus moderates the effect of COVID-19 on real economic conditions as well. We find no relationship between the GDP and the increase in contagion and death rate in the post-stimulus period.

The literature on the effect of COVID-19 on global economies is in a developmental stage where several researchers have shown a negative effect of COVID-19 spread on the global economies and their stock markets. A study [1] conducted in the early days of the pandemic from January 22 to April 17, 2020, found that an increase in COVID-19 cases and deaths has a negative effect on stock prices across the world. They find that the stock market reaction is more severe for the increase in the number of cases than the number of deaths. Another study by the same author [2] finds that government social distancing measures in response to COVID-19 have a direct negative effect on stock markets across the world due to their adverse effect on economic activities. Erdem (2020) [3] found that COVID-19 has a significantly negative effect on stock markets across the world, but the adverse effect on stock markets are less severe in freer countries. Zhang *et al*. (2020) [4] analyze country-specific risk and systematic risks of the global financial markets in response to COVID-19 and discuss the potential consequences of governmental response to mitigate COVID-19 spread. They find a negative effect of COVID-19 spread on global stock markets. Haroon *et al*. (2020) [5] find an increase in stock market volatility due to the COVID-19-related news. Mazur *et al*. (2020) [6] investigated the performance of the US stock market during March 2020 and found that negative response is severe in petroleum, real estate, entertainment and hospitality sectors, whereas food, healthcare and technology stocks show positive returns in the COVID-19 crisis. Goodell (2020) [7] provides an agenda for future research related to COVID-19 and finance. Our paper investigates two of the six research areas suggested by Goodell (2020) [7]. He points out the need for research to explore the economic impact of the pandemic and to study the impact of pandemics on financial markets.

In this paper, we contribute to the literature by formally testing the impact of government stimulus on the real economic conditions and the stock market performance of countries across the world. Using the stock market index and GDP data for a sample of 18 countries, we confirm an inverse relation between COVID-19 cases and death rates on the stock markets across the world. Our

choice of countries depends on the availability of index-related data on yahoo finance. Our empirical analysis shows that the negative effect of COVID-19 cases and deaths on the GDP and stock markets is alleviated by the government stimulus.

DATA AND METHODOLOGY

We use Yahoo finance for daily stock market index data which is available for 18 countries (see Appendix 1). When multiple index data is available for a particular country, we choose only one major stock index from the sample country. We use the data of daily COVID-19 confirmed cases and deaths for each country from the John Hopkins University, Coronavirus Resource Centre website. The GDP data is from the OECD website. Our sample period is from January 23 to August 18, 2020, which allows us to adequately cover the period from the start of COVID-19 in each sample country to the post-stimulus period. To capture the effects of culture, we use Hofstede's (2001) [8] six dimensions [https://geerthofstede.com/research-and-vsm/dimension-data-matrix/] and to capture the role of institutions, we use the latest scores from the International Country Risk Guide (ICRG)[https://www.prsgroup.com/explore-our-products/international-country-risk-guide/]. For economic activity measurement, we collect quarterly GDP data for the first and second quarters of 2020. We have 34 observations for the first and second quarters for GDP analysis. To study the impact of COVID-19 on GDP, we use the following model.

$$GDP\_Change_{c,q} = \propto_c + \beta_1 COVID19_{c,q} + \beta_c Country_{FE} + \varepsilon_{c,t} \quad \textbf{(1)}$$

Where c and q subscripts represent the country and quarter, respectively. α_c is the constant term, and $E_{c,g}$ is the error term. $COVID19_{c,q}$ represents $COVID19\_Cases_q$ *per million* and $COVID19\_Death_t$ per million in separate models. To test the moderating effect of fiscal stimulus, we use the following model.

$$GDP\_Change_{c,q} = \propto_c + \beta_1 COVID19_{q,t} + \beta_2 Fiscal\ Stimulus\ Dummy_c + \beta_3 COVID-19_{q,t} * Fiscal\ Stimulus\ Dummy_c + \beta_c Country_{FE} + \varepsilon_{c,t} \quad \textbf{(2)}$$

Where *Financial Stimulus Dummy* takes a value of one for the post-stimulus period (quarter 2 of 2020) for each of the countries in our sample and zero

CHAPTER 5

Psychological Distress and Consequences of COVID-19 Pandemic on Different Groups

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Abstract: The novel coronavirus 2019 (COVID-19) is extensively spreading all over the world, causing unprecedented hazards to mental health globally. The global pandemic of COVID-19 has been strongly impacting humanity and continues to influence all segments of the population since its origin. While dealing with such a public health crisis, past experiences have witnessed generalised public fear and anxieties due to uncertainty, causality and lack of public health preparedness. Therefore, it is important to acknowledge the detrimental effect of COVID-19 on the mental health of individuals of different age groups. This chapter aims to explore the impact of this unprecedented atmosphere on the mental health of the elderly, healthcare workers, children, adolescents and young people, pre-existing mental health conditions, post COVID-19 patients, women, homeless people and refugees. The chapter presents the direct and indirect psychological impact of COVID-19 on the genera at the individual, societal and public health levels. It will discuss at length some emerging concepts of the causal routes of mental disorders and suggest some strategies to prevent and promote mental health problems in individuals during this crisis. For the general population at large, just like physical effects, it is important to address the impact of COVID-19 on mental health effects as well. Various studies reported that mental problems such as anxiety, depression and fear of getting infected were common among people of all age groups who responded to COVID-19. The important lessons to be learned so far can help to devise individual mental health recommendations, as well as improved interventions and preventions of public health approaches.

Keywords: Anxiety, Adolescent, Children, Covid-19, Depression, Elderly, Healthcare Workers, Homeless, Impact, Mental Disorder, Pandemic, Pre-existing Mental Condition, Post-traumatic Stress Symptoms, Refugees, Stress.

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Alfred J. Lawrence & Tahmeena Khan (Eds.)

INTRODUCTION

The World Health Organization (WHO) on 11th March 2020 identified the Coronavirus disease 2019 (COVID-19) caused by the novel severe acute respiratory problem coronavirus-2(SARS-CoV-2) as a pandemic [1]. COVID-19 has created a worldwide crisis. Lockdowns, lack of known schemes for controlling this pandemic, loss of work and jobs, overflow of patients in hospitals, closure of educational institutions and more such disruptions have led to a vast impact on every aspect of human life across the globe.

These aspects include work culture, change in the pattern of education, fear of death, physical and mental health conditions, family gestures and relationships. Daily such effects were being discussed on news channels and social media, but issues related to the impact of COVID-19 on mental health were least discussed.

WHO, on 18th March 2020, published a report on the introduction of mental health and psychosocial considerations for humans, addressing the impact of this health emergency on the mental health of the population [2]. As compared to recent pandemics or medical emergencies, the COVID-19 outbreak is larger in scale; their consequence is unprecedented and thus, makes it more unpredictable. To control the outbreak, serious measures have to be taken on the mental health of the community [3, 4].

The pandemic made a big impact on the mental health of people in both positive and negative ways. The work-from-home culture during the lockdowns has given people an opportunity to spend more time with their family and relatives. This, in turn, upgraded the feeling of contentment and psychological well-being. But this was limited to a smaller fraction of the population.

A strong negative and adverse impact on mental health is on the larger population due to COVID-19. Due to this pandemic, locked-down were implemented in many countries for a longer period. Rise in insecurity in jobs, and economic hardship [5, 6], domestic conflict [7, 8], substance abuse [9], and media consumption [10, 11] are considered major factors affecting mental health. In this current pandemic, various studies [12 - 14] confirm the rise in the number of cases of stress, depressive symptoms, anxiety, sleep disorders and suicidal tendency. Often, patients of COVID-19 suffer from anxiety, depression and also post-traumatic stress disorder. Medical practitioners were in fear of getting infected and also facing stigma from their family members and community. Due to the overwhelming workload, healthcare workers suffer from overtiredness anxiety and insomnia. Patients with non-infectious chronic diseases like diabetes, cancer, *etc*., were highest among the people who got anxiety, depression and distress. Similar was the situation for patients suspected of COVID-19 infection, people

who were under isolation due to precaution from COVID-19, and doctors and nurses also were highest among the people who got anxiety, depression and distress.

Mental health issues, like depression, anxiety and panic, were also found to be common in the general population due to confusion about the end of the COVID-19 situation, a question regarding the treatment of the disease which is still not in sight. Recently quoted mental issues combined with the delay in treatment of serious chronic diseases lead to the exacerbation of common pathologies and have activated somatic symptoms [15 - 18]. Furthermore, photos and videos around the media and social networking media of stressed and ill patients, increasing death count, dead bodies, *etc*., and messages from the community that they are not able to meet and even see their close ones dying in hospitals have caused great social distress [19].

It is also noted that the frontline workers and COVID-19 patients faced noticeable challenges, while the challenges and issues faced by the general population were unnoticed and not even addressed. Many studies show that among the general population, there were mental health issues like psychological stress, depression, anxiety, stress, the loneliness, which have emerged progressively during the period of COVID-19. Isolation during the lockdown and quarantine triggered the increase in the number of suicide and suicide attempts, specifically among the youth, which was the main concern. Besides this, the strict quarantine measures were very much unfamiliar [20] and infringed on the freedom of the person [21, 22]. Uniting with this physiological problem, the economic crisis and unemployment influenced the stressors, such as the use of tobacco and drug, alcohol, potential addiction like gambling, and excessive use of mobile for gaming and surfing, and there was also an increase in the rate of sexual abuse and domestic violence [23, 24]. Taken together, there is an urgent call to generate awareness towards policies to assist people through this challenging time and public mental health.

In this chapter, we will discuss the impact and influence of COVID-19 on the mental well-being of the following categories.

- Healthcare workers (HCWs)
- People with previously known mental disorders
- People Infected with COVID-19
- Elderly Population
- Children, Adolescent and young people
- Women
- Refugees

CHAPTER 6

A Comprehensive Case Study Based On The Diversified Impacts Of COVID-19 On Children's Lives, Education And Overall Development

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Abstract: The impact of the COVID-19 pandemic on children is a developing worry. The United Nations and its agencies (the World Health Organization and UNICEF), the Indian Association for Child and Adolescent Mental Health, and India's National Institute of Mental Health and Neuroscience all warn of the pandemic's broader effects on children and call for immediate action to help children around the world. The pandemic had an impact on children's physical, mental, social, and psychological well-being in every way. The vulnerable group of children was severely deprived of nutrition and protection, and the pandemic's protracted stress-triggered mental health, which requires prompt intervention. Children who dropped out of school, particularly in rural regions, were at a higher risk of child marriage, child labour, and teen pregnancies. Based on the research, the current chapter highlights the influence of COVID-19 on the lives, education, and general development of children aged 4 to 17, in India. The authors were able to examine the pandemic's effects on children's lives using the snowball sampling approach in conjunction with peer-reviewed research, reports, and government publications published between January 2020 and November 2021. The findings revealed a negative trend in temperamental qualities such as sadness (82.5%) & nervosity (73.5%) that accelerated during the pandemic compared to pre-pandemic years. Also, children faced difficulties in receiving online education (53.6%). The chapter also highlighted the vulnerability of certain groups of children and presented numerous examples and recommendations that should be implemented as quickly as possible to mitigate the pandemic's negative impacts on children.

Keywords: Children, Child Labour, Child Marriage, COVID-19, e-Learners, e-Learning, Government, Impact, India, Mental Health, Neuroscience, Nutrition, Online Education, Pandemic, Psychological, Rural, Sadness, Snowball Sampling, Teen Pregnancies, Temperamental.

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Alfred J. Lawrence & Tahmeena Khan (Eds.)

INTRODUCTION

The World Health Organization (WHO) Director-General declared the outbreak of coronavirus disease (COVID-19) a Public Health Emergency of International Concern on 30 January 2020, followed by a loud and clear alarming declaration of COVID-19 as a global pandemic on 11 March 2020 [1]. The virus reported its early emergence from Wuhan, China, in late December 2019 [2]. The potential zoonotic formidable disease dispersed and expanded globally within a few months. In no time, the virus gripped its full potential and plunged economies into recession [3]. Stringent lockdowns and closure of all non-essential services were imposed throughout the globe. It becomes important to document the effects of the pandemic on the lives of the most vulnerable population, children. Forty-one per cent of India's population is under the age of 18, and the impact of a global pandemic on them cannot be underestimated [4]. The coronavirus illness (COVID-19) has a wide range of effects on children's physical, mental, social, and psychological health. These effects are not restricted not only to children's health and well-being; they also affect many aspects of their lives, including academics, protection, and security [5]. Many children have been deprived of physical contact with their friends, peers, and classmates as a result of the lockdown. Due to a lack of socialisation, they are more likely to lose their cool and become agitated and upset [5]. Children as young as five years old have had access to mobile phones for e-learning as a result of the shift in educational style [6]. The increased use of mobile phones and social networking sites increases the likelihood of becoming more absorbed in online amusement than academics [6]. Agencies have raised concerns that the pandemic's increased anxiety and stress on families may lead to an intensification of mental health problems in children [7]. COVID-19-positive children who are isolated, children of COVID-19-positive parents, and children who have lost one or both parents due to COVID-19 have a tough time coping with mental health concerns [8]. To feel a feeling of normalcy, such children must be helped by mental health service professionals, parents, and counsellors [8]. Furthermore, the pandemic's negative consequences are not distributed evenly. They are proven to be the most harmful to children in the poorest countries and neighbourhoods, as well as those who are already disadvantaged or vulnerable [9]. Also, no confirmed and tested vaccines are available to protect children from the fatal coronavirus [10]. the risk is amplified. Our comprehensive case study covers all the impacts faced by children due to this universal crisis. It is hard to fathom the exact prolonged effects but undoubtedly the pandemic has already affected the lives of children from almost all the spheres. With increased risks of exploitation, abuse and violence, deprivation from education, poverty driven lack of resources, upending physical and mental health, school closures, social isolation, uncertainty, fear and several other factors have bought up the lives of children to the shores of profound adverse experiences, consequences and impacts [11]. Long

term broad ranging socio-economic and humanitarian impacts of the pandemic on children is highly likely to occur [11]. If not directly, indirectly the rippling effects of several deprivations will continue to harm children for a long time from today. Urgent actions and policies are needed to put forward for children at the forefront of preparedness, prevention and response to COVID-19 to ensure overall growth, development and well-being of children for all today and for the long term.

Data And Methodology

A study was undertaken using an online questionnaire-based survey titled "COVID-19 in context with children's lives, education, and overall development" to learn about the many implications of the COVID-19 pandemic on children's (aged 4-17) lives, academics, and overall well-being. The questionnaire was created with the help of prominent teachers and students from various age groups to cover all aspects of the influence. The study was carried out following the Helsinki Declaration's guidelines. A questionnaire survey is a simple and inexpensive approach to collecting information from a specific group. Furthermore, the data gathered by the questionnaire is simple to interpret and evaluate. The study location was Northern India, but the questionnaire was disseminated openly on several social media sites to allow for snowball sampling. A total of 412 responses were approved because they met the criteria for inclusion, which was based on the age of the children (4-17 years). The survey's questions were created to acquire a sense of how the activity pattern, behaviour, and temperamental features, as well as the impact on schooling, changed during the COVID-19 pandemic compared to the pre-pandemic pattern. Children of various schools across India belonging to class groups 1-12 (Fig. **1**) actively participated in the survey.

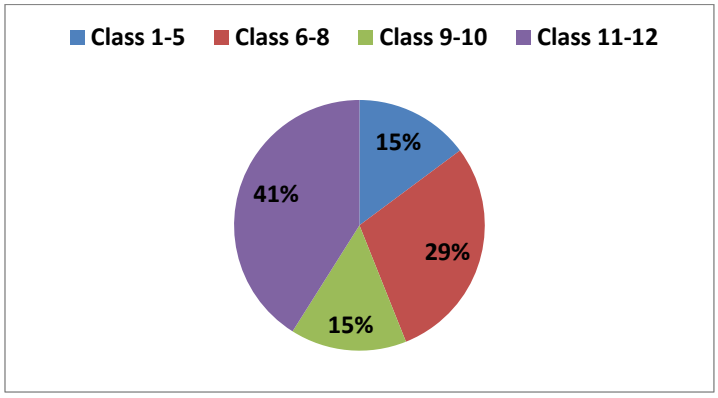

Fig. (1). % of children from various class groups who took part in the survey.

CHAPTER 7

COVID-19 Vaccines: A Brief Review

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Abstract: The advent of the COVID-19 pandemic in December 2019 was a defining moment in medical history that pushed the world into a state of uncertainty and fear. The virus was a new one, its effects on the human body were severe and its ever-growing spread across the globe soon became a major concern for everyone, drawing an extraordinary response from the scientific community, doctors, health workers and governments. The research was conducted on the structure and physiology of the virus as well as the human immune response to the virus, along with the development of testing, therapeutics, and vaccines occurring on an unprecedentedly short timescale. With support from governments and pharmaceutical companies, within a year of the worldwide outbreak of the disease, numerous vaccine candidates had emerged, and to date, eight World Health Organization-approved vaccines are being used on an emergency basis. In this concise review, the different types of vaccines have been described, along with the characteristics of the leading vaccines and a detailed discussion of the vaccines being used in India.

Keywords: Adenovirus, Adjuvant, Antibodies, Antigen, Approval, Attenuated, Covaxin, COVID-19, Covishield, Efficacy, Immune-response, Inactivated, mRNA, Pandemic, Pharmaceutical, Spike-protein, Sputnik-V, Vaccine, Viral-vector, Virus.

INTRODUCTION

While vaccines for several diseases, such as smallpox, measles, tetanus, influenza and polio, have been used worldwide for years, it is in times like the present, when the entire world is facing a novel pandemic for which no medicine is known yet, the significance of vaccines has increased manifold. Before discussing the different vaccines available for COVID-19, let us first understand what vaccines are and how they protect against diseases.

A vaccine can be defined as a suspension of weakened, killed, or fragmented microorganisms or toxins that is administered primarily to prevent disease [1].

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A vaccine helps our immune system to recognize a pathogen (bacteria, virus, *etc*.) and prepare an immune response in the form of antibodies so that if the pathogen attacks the body later, it would be able to quickly respond and fight and destroy the disease-causing pathogen. This acquired immunity protects the vaccinated person from the severity of the disease and reduces fatality.

Vaccines are of several types based on the method of their formulation and mode of action [2]. The major types of vaccines are briefly discussed below (Fig. **1**).

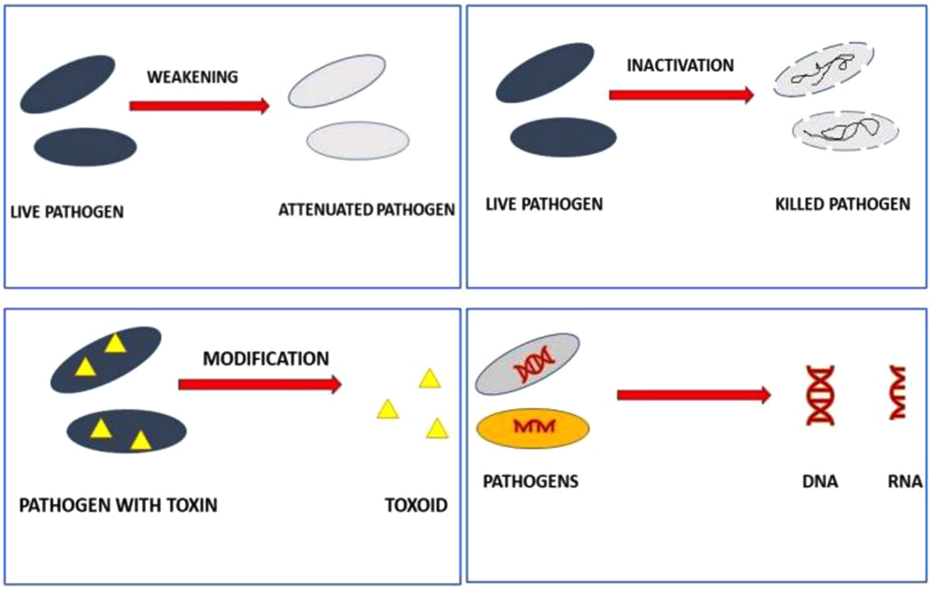

Fig. (1). Types of vaccines.

Live, Attenuated Vaccines

These use a weakened form of the disease-causing germs that have lost the ability to replicate in the body. This can be done by passing the virus through a series of non-human cell cultures, where it slowly loses its ability to replicate in human cells. When such a vaccine is taken, it cannot cause an infection as the virus cannot multiply, but being so similar to the actual pathogen, it can still cause an immune response. These vaccines are quite effective and provide longer-lasting immunity as they resemble the actual disease-causing pathogen the most. One concern regarding live vaccines is that they may undergo mutations and form a more virulent form of the pathogen [3]; although such an event is quite unlikely, it is kept in mind during vaccine preparation, and suitable steps are taken to avoid it. The disadvantage of such vaccines is that they cannot be given to people with a

weakened immune system as they contain the weakened but live pathogen. Also, they have to be kept refrigerated and become difficult to use where such facilities are lacking [4].

Examples: Measles, mumps, rubella (MMR combined vaccine), chickenpox, influenza, and rotavirus vaccines.

Killed or Inactivated Vaccines

In these vaccines, the pathogen has been killed or inactivated by heat or the use of chemicals, making them incapable of replication. Also, the pathogen cannot revert to a more virulent form by mutations, as in the case of attenuated vaccines. These vaccines also provide a strong immune response and also have no danger of possible mutations. However, the killing may cause some vital information to be lost. These vaccines provide a shorter period of protection and need booster shots for continued immunity.

Examples: Polio, Hepatitis A

Toxoids

These vaccines contain the inactivated form of the toxin (called toxoid) produced by the pathogen, which is responsible for the symptoms of the disease in the human body. For example, tetanus is caused by a neurotoxin produced by the *Clostridium tetani* bacterium. So, the vaccine is prepared using a particular neurotoxin instead of the bacterium. The toxin is inactivated by heat or chemical means. These vaccines are safer. Such vaccines also require booster shots for prolonged immunity.

Examples: Diphtheria, tetanus

Subunit and Conjugate Vaccines

These vaccines use pieces of the pathogen, which are sufficient to create an immune response in the body. Subunit vaccines may contain a specific protein from a pathogen, for example, acellular pertussis vaccine and influenza vaccine (in shot form). The pneumococcal polysaccharide vaccine contains sugars from the surface of the causative bacteria. Subunit vaccines can also be prepared by recombinant technology to create viral proteins. For example, the Hepatitis B vaccine and human papillomavirus (HPV) vaccine are made by this method.

CHAPTER 8

COVID-19 Vaccination Acceptance, Management and Concerns: A Survey-Based Study

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Abstract: The COVID-19 pandemic has had a significant impact, especially in the last 2 years, and inflicted a grave loss globally. The world came together to devise various protocols and preventive measures to battle this viral outbreak. The chapter explores the various immediate medicinal measures to cure COVID infections. The Government of India initiated the process of vaccine manufacture and distribution among the population. This was met by various hurdles, namely myths, misconceptions, misinformation and concerns regarding the vaccines and the disease itself. This was majorly reported in the rural regions of India where the vaccination was not successful in the desired results; this might have been due to various reasons, such as lack of awareness among the rural population or due to the difficulty faced in the transportation and storage of Corona vaccines. This chapter attempts to shed light on the acceptance of the COVID-19 vaccines by the Indian population and also discusses the same concerning the rural population and proposes plans to expedite the Corona Vaccines to such areas. The Government of India initiated a Co-WIN vaccine delivery management system to encourage people and create awareness to fight against this pandemic by opting for vaccination. An independent survey was conducted that consisted of a questionnaire addressing acceptance, management and concerns about the COVID-19 vaccination. Among 211 respondents, 19.6% (41 respondents) were either doctors or medical professionals. The survey provided insight into vaccine awareness among frontline workers and the general public of India.

Keywords: Coronavirus, COVID-19, India, Medicinal Measures, Misconceptions, Rural, Vaccination, Vaccine Management.

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Alfred J. Lawrence & Tahmeena Khan (Eds.)

INTRODUCTION

The novel beta-coronavirus SARS-CoV-2 is thought to have originated from bats in Wuhan, China last year in 2019. Crossing the species barrier, it entered human beings with the furtherance of infection through human-to-human transmission. The beta-coronaviruses have caused three zoonotic outbreaks, namely, SARS-CoV (2002-03), MERS-CoV (2012) and SARS-CoV-2 (2019- till date) in the last 2 decades [1]. Despite the greatest efforts of governments and the World Health Organization (WHO), the virus has spread to 188 nations and 25 territories across the world due to the virus's tremendous transmission capacity [2]. Those with any other co-morbid diseases are more likely to become infected and experience severe symptoms. The virus is believed to have a 5.1-day incubation period. Fever, dry cough, shortness of breath, chills and diarrhoea are some of the symptoms of the disease [3]. Coronaviruses are pleomorphic and have strange projections of S protein protruding from their surface. The genome of the new coronavirus is translated into a polyprotein, which is then processed into 16 non-structural proteins (NSPs) [4]. The non-structural proteins aid in genome replication, capping, and tailing, all of which are required for viral maintenance [5]. The SARS-CoV-2 virus also has four structural proteins encoded by the 3'end of the viral genome: spike (S), nucleocapsid (N), envelope (E), and membrane (M) [6]. The S glycoprotein, a multi-functional trans-membrane protein, is one of the four structural proteins that play an essential role in viral attachment and entry into the host cell [6]. The S protein is made up of two subunits, S1 and S2, that divide into distinct functional domains. The N-terminal domain (NTD) and the Receptor Binding Domain (RBD), both of which include a conserved receptor-binding motif (RBM), make up the S1 subunit [7]. COVID-19 vaccinations are often designed to produce S protein-neutralising antibodies. According to studies, there is practically no cross-neutralization between SARS-CoV and SARS-CoV-2 sera, indicating that people who have recovered from one illness are not immune to the other. More than 5,000 full-length genomes of SARS-CoV-2 have been obtained from various countries, defining the polymorphism in S and other viral proteins that are important for vaccine development. S protein has been used in the majority of COVID-19 vaccines produced [8]. The global effort to develop a COVID-19 vaccination that is both safe and effective is bearing fruit. Around the world, almost two dozen vaccines have been approved, with many more in work. As of 29th October 2021, a total of seven vaccines have been approved to use in India, and 13 vaccines are still under trial [9].

Medicinal Solution for Treatment of COVID-19 Disease

As the study of various aspects of the virus that causes COVID-19 disease was yet to be done for the development of effective medicine, seeing the speed of spread

of infection and the number of fatalities it was causing, there was the need for urgent treatment of the disease. For this, Allopathic, Unani and homeopathic treatment approaches were made.

Among Allopathic approaches was the use of oxygen therapy, intravenous fluid infusion with life support in dangerous cases, antiviral combination with antibiotic, convalescent plasma therapy, anti-fungal treatment and extracorporeal membrane oxygenation (ECMO) [10]. Researchers also evaluated that the already existing anti-viral medicines such as penciclovir, ribavirin, nitazoxanide, remdesivir (GS-5734), nafamostat, favipiravir (T-750) or Avigan, avermectins, dexamethasone, EIDD-2801, hydroxychloroquine, chloroquine, and convalescent plasma (CP) therapy were effective against the infection of SARS-CoV-2 [11].

The Unani and Ayurvedic treatments, which are on plant-based medicine, were also utilized for the treatment as parts of many plants are known to be effective against the various viral strains. Their decoction is used in treatment. Homeopathic treatments involved the use of Arsenic Album 30 for the treatment, though there was no clinical evidence for this medicine to be effective. As it was also seen that the deaths were more among the older person than young, it was suggested to use immune system boosters to prevent the spread of infection [12].

Development of COVID-19 Vaccine

Major biotech firms, namely, the Serum Institute of India, Bharat Biotech, Premas Biotech, and Zydus Cadila, have been engaged actively in the vaccine creation for COVID-19 disease. The Serum Institute of India collaborated with Codagenix, a major US pharmaceutical, and produced the Covishield vaccine, and other Indian institutes also collaborated with Oxford University for the production of the Oxford vaccine or ChAdOx1 nCoV-19 [13].

The Bharat Biotech, in collaboration with the Indian Council of Medical Research-National Institute of Virology, developed COVAXIN, India's indigenous vaccine. The Bharat Biotech, in partnership with Thomas Jefferson University, also entered the animal trial. Premas Biotech used a recombinant proteins development platform to develop the new vaccine against COVID-19 jointly with Akers Biosciences [14].

MATERIAL AND METHODS

The study was conducted between 16th September - 23rd September 2021, using an online questionnaire-based survey named “A survey on potential acceptance, management, and concerns related to COVID-19 Vaccines in India”, comprising 34 questions in total. The google form was divided into two sections; the first

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Alfred J. Lawrence

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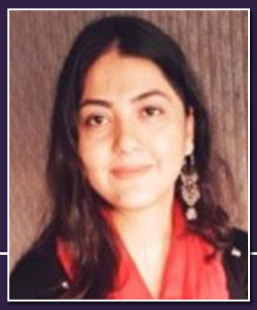

Tahmeena Khan

Dr. Tahmeena Khan is currently working as an assistant professor, in the Department of Chemistry, Integral University. She did M.Sc., and holds a specialization in inorganic chemistry. She did her M.Phil. in magnetic resonance spectroscopy and magnetic resonance imaging and worked on automated 3D structure determination of proteins for her dissertation. For her doctoral degree, she worked on mixed ligand-metal and mixed metal-ligand complexes of thiosemicarbazones and their therapeutic properties. She holds fifteen years of teaching experience and has published more than forty research papers and twenty book chapters. She also has two international books and two national books as editor and two books as author to her credit. Dr. Khan is also a life member of several academic bodies. She has keen interest in medicinal and environmental chemistry.