

ISBN: 978-81-953600-9-3

# COVID 19: Impact and Response Volume III

**Editors:**

**Dr. Saroj Mahajan**

**Dr. Tejendra A. Rajput**

**Prof. Neha Sharma**

**Dr. Pollobi Duara**



*Bhumi Publishing*

**Bhumi Publishing**

**First Edition: 2021**

# COVID 19: Impact and Response

(Volume III)

(ISBN: 978-81-953600-9-3)

## Editors

**Dr. Saroj Mahajan**

Department of Botany,

Mata Jijabai Govt. Girls P.G. College,

Moti Tabela, Indore (M.P.)

**Dr. Tejendra Amrut Rajput**

Department of Chemistry

Art's, Commerce and Science College, Onde,

Vikramgad, Palghar, Maharashtra

**Prof. Neha Sharma**

Department of Commerce and Management,

Adv. S. A. Baheti College,

Jalgaon, Maharashtra

**Dr. Pollobi Duara**

Department of Zoology,

Majuli College,

Assam, India



*Bhumi Publishing*

**2021**

***First Edition: 2021***

***ISBN: 978-81-953600-9-3***



**© Copyright reserved by the publishers**

Publication, Distribution and Promotion Rights reserved by Bhumi Publishing, Nigave Khalasa, Kolhapur  
Despite every effort, there may still be chances for some errors and omissions to have crept in  
inadvertently.

No part of this publication may be reproduced in any form or by any means, electronically, mechanically,  
by photocopying, recording or otherwise, without the prior permission of the publishers.

The views and results expressed in various articles are those of the authors and not of editors or  
publisher of the book.

Published by:

Bhumi Publishing,

Nigave Khalasa, Kolhapur 416207, Maharashtra, India

Website: [www.bhumipublishing.com](http://www.bhumipublishing.com)

E-mail: [bhumipublishing@gmail.com](mailto:bhumipublishing@gmail.com)

Book Available online at:

<https://www.bhumipublishing.com/books/>



## **Preface**

*The new respiratory pandemic disease i.e. COVID-19 has caused disruptions in the lives and customs of people with significant impact on the economies of nations. The outbreak of the disease is a global health emergency and of international interest. This global health challenge leads to the infection, morbidity and mortality of many people.*

*In the weeks since the World Health Organization manifest the corona virus (COVID – 19) episode a worldwide unstipulated wellbeing crisis, the COVID-19 pandemic has influenced 212 nations and forfeit increasingly than 400,000 lives. Still today there is no successful remedy to lockup the spreading of this infection. The pandemic is developing prior disparities, uncovering vulnerabilities in social, political and financial frameworks which are thusly intensifying the effects of the pandemic.*

*Governments of various nations adopted restrictive measures involving both within the countries and at international borders as effective response to the corona virus pandemic. These measures includes confinements of workers and order to work from home, banning of social and religious gatherings, closure of market places, closure of workplaces including airports, building or creation of testing and isolation centers, quarantining/isolation of suspected persons, self-imposed isolations, and the use of face masks whether surgical or cloth type in situations where there is a cogent reason to defy the restriction.*

*Academic communities were not left out as institutions of learning were requested to close in many countries since it is very easy to spread the virus among students and youths in tertiary institutions where socialization is an essential part of their lives.*

*To address the various issues related with the COVID – 19 we have published the present book. The interdisciplinary approach of the book will make the book useful and informative to the students, teachers, researchers, scientists and policy makers in India and abroad.*

*We thank all contributors, publishers and all our well-wishers for their blessings, without which this book would not have come into existence.*

**- Editorial Team**

**COVID 19: Impact and Response Volume III**

**(ISBN: 978-81-953600-9-3)**

## *Index*

<b>SR. NO.</b>	<b>CHAPTER AND AUTHOR(S)</b>	<b>PAGE NO.</b>
1	<b>CURRENT STUDY OF CORONA VIRUS DISEASE SARS COV- 2: AN OVERVIEW PRANAY MISHRA AND NARAYAN D. TOTEWAD</b>	1 – 16
2	<b>TEST ANXIETY LEVELS DURING UNSUPERVISED EXAMINATIONS IN THE CONTEXT OF ONLINE TEACHING- LEARNING DUE TO ONGOING COVID PANDEMIC- A STUDY ON UNDERGRADUATE STUDENTS OF DISPUR CONSTITUENCY, ASSAM, INDIA DHUNUMONI DAS AND SUDESHNA NATH</b>	17 – 28
3	<b>PSYCHOSOCIAL ASPECTS OF COVID-19 PANDEMIC: AN OVERVIEW DEEPAK MALIK AND V. N. YADAV</b>	29 – 38
4	<b>SPATIO-TEMPORAL PATTERN OF COVID-19 AND ITS IMPACT ON ECONOMY OF INDIA PAHARI DOLEY</b>	39 – 51
5	<b>EFFECTS OF HAND SANITIZERS ON HUMAN BEING IN COVID-19 PANDEMIC U. W. FULE</b>	52 – 56
6	<b>CASE STUDY OF ASSESSMENT AND OCCURRENCE OF COVID 19 IN ENVIRONMENT SARATH CHANDRA KOPPOLU, PRAVEEN KUMAR M AND NOOPUR SINGH</b>	57 – 67
7	<b>COVID-19 IMPACT ON FISHERIES AND AQUACULTURE IN INDIA KHAN RUMANA SHAHIN AMANULLAH</b>	68 – 72

8	<b>IMPACT OF SOCIAL MEDIA IN TEACHING-LEARNING</b> HUMAIRA BADRUZZAMA	73 – 77
9	<b>HISTORY OF PANDEMIC DISEASE AND SOCIAL AWARENESS</b> U. W. FULE AND S. S. NIMGARE	78 – 82
10	<b>SOCIO-ECONOMIC IMPLICATIONS OF COVID-19</b> S. VIMAL DOLLI	83 – 87
11	<b>POSITIVE AND NEGATIVE IMPACT OF COVID-19 ON EDUCATION</b> A. SAMEEMA	88 – 91
12	<b>SOCIO-ECONOMIC IMPACT OF COVID-19 IN INDIA</b> NAFEESA BEGUMA ND SHAILA M	92 – 101
13	<b>MUCORMYCOSIS: A NEW EMERGING CONCERN IN THE TREATMENT OF COVID-19</b> MUNMI GOGOI AND BIJIT SENSUA	102 – 110
14	<b>CURRENT MANAGEMENT STRATEGIES OF COVID-19</b> MAYURESH A. BURHADE, SANJAY J. KSHIRSAGAR AND UMESH D. LADDHA	111 – 125
15	<b>BIOSKETCH OF SARS-COV-2 AND ITS REALISTIC SOLUTION THROUGH VACCINATION</b> PRAVIN DESHMUKH AND YASHWANT CHAUKATE	126 – 139
16	<b>VACCINATION: AN EFFECTIVE TOOL TO CURE COVID-19</b> P. M. KAHATE	140 – 146
17	<b>HANDLING ETHICAL ISSUES AND DOCUMENTS IN ICU FOR COVID 19 PATIENTS</b> DEBAJANI NAYAK	147 – 160

---

18	<b>FUNCTION OF MEDIA IN COVID-19 AWARENESS: ROLE, TRENDS, CHALLENGES, PROSPECTS, CAMPAIGNS</b>	161 – 169
	ABHISHEK ROY	
19	<b>FLUCTUATIONS OF WEST TEXAS INTERMEDIATE (WTI) OIL PRICE – PRE AND DURING COVID-19 TIMES: AN EVENT STUDY</b>	170 – 177
	G. CHANDRAKALA AND P. SATHISH	
20	<b>SCOPE OF LIBRARIES DURING COVID-19 PANDEMIC</b>	178 – 183
	PRATIBHA PANDEY	
21	<b>HISTORY OF EPIDEMICS AND PANDEMICS IN INDIA</b>	184 – 189
	S.S. NIMGARE AND U.W.FULE	
22	<b>GOOD ABOUT COVID-19</b>	190 – 195
	PALLAVI KISAN PANTAWANE AND BHUNESHWARI A. MEHERE	
23	<b>IMPACT OF COVID-19 ON MENTAL HEALTH</b>	196 – 203
	APURBA BISWAS	

---



## CURRENT STUDY OF CORONA VIRUS DISEASE SARS CoV- 2:

### AN OVERVIEW

Pranay Mishra and Narayan D. Totewad\*

Department of Microbiology,

B. K. Birla College of Arts, Science and Commerce (Autonomous),

Kalyan-421304, Maharashtra, India

\*Corresponding authors E-mail: [ndtmicro2013@gmail.com](mailto:ndtmicro2013@gmail.com)

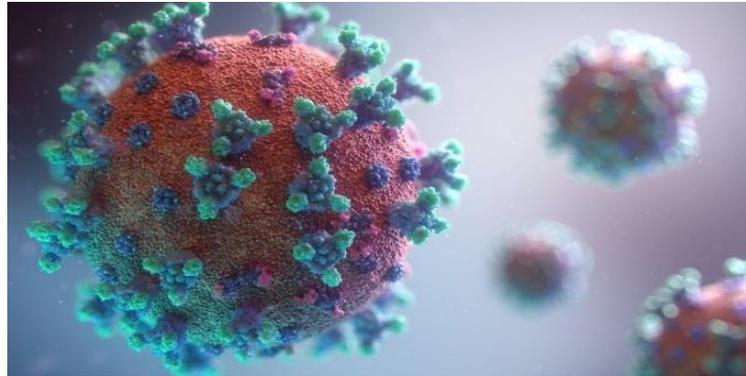
---

#### Introduction:

An epidemic whose manifestations is seen throughout the globe is termed as pandemic and many pandemics affected humankind. If we consider the history, “The Plague of Justinian” which occurred in Egypt had devastating effects on the Eastern Roman Empire and about 100 million deaths have been estimated. Another one called “The Black Death” was infected in Central Asia and Europe and 200 million people perished. Seven Cholera pandemics have occurred and killed a sizeable population. In the last century, Spanish flu of 1918-1919 caused the death of 50 million people and approximately 500 million were infected. A W-shaped mortality curve was shown by the pandemic. In the present century, SARS-CoV pandemic was happened in China in 2003, and approximately 8,347 probable cases were reported with 813 deaths. Another epidemic, MERS-CoV was reported in Saudi Arabia in year 2012 with 2,519 confirmed cases during the period of 2012-2020 and about 866 fatalities were reported in 27 countries (Piret and Boivin, 2021). Now, we are currently facing a fifth pandemic in sequence after the 1918 Spanish Flu is SARS CoV-2 (Covid-19) pandemic which is catastrophe of this century across the world. As on 3rd June 2021, due to Covid-19, 171 confirmed cases and 3.68 million death cases found as per record of WHO Covid-19 Dashboard.

The virus has spread throughout the globe within a period of four months, after emerging in China. The most affected countries include USA, India, Brazil, Italy, UK among the others. On 11 March 2020, WHO declared that SARS CoV-2 is now a global pandemic ([www.who.int](http://www.who.int)). The virus officially named as the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses based on phylogenetic analysis data. It has been found that the source of corona viruses due to the outbreak of Middle East respiratory syndrome (MERS) in 2013 and SARS in 2002. Spill over of an

animal coronavirus and which later adapted the ability of human-to-human transmission is the origin of this virus in Wuhan, China. Almost all the 222 nations are currently facing its wrath (Liu *et al.*, 2020; Vara, 2020).



**Creative illustration of SARS-CoV-2 ([unsplash.com](https://unsplash.com))**

### **Origin of the Virus:**

A pneumonia of unknown origin which broke out in Wuhan, Hubei Province in China was the inception of the virus where at the beginning Huanan Seafood Wholesale Market was linked to most of the cases. Between the Wuhan Huanan seafood Market and the arrival of early cases, an association was established in the primary course of epidemic in Wuhan as cases in sellers and vendors of the markets were initially reported (Ciotti *et al.*, 2020). The market was initially considered as the epicentre of the epidemic with a suggestion of human-animal interface as market dealt in aquatic products along with some animal products. Further investigations diagnosed additional cases of the same disease with the onset of disease in December, 2019, and not all cases had a confirmed association with the Huanan market. Though Pangolins were initially thought as the intermediate hosts for the virus, later epidemiological data did not support the argument. Bats have been known to be the reservoir of many corona viruses and in addition to that of other viruses like Nipah, Hendra with considerable genetic diversity. Initial analysis threw light on the fact that the genomic sequence of SARS-CoV-2 with corona virus that caused the outbreak in 2002 showed greater homology. As SARS-CoV-2 may be asymptomatic or only have mild symptoms, many people could be infected at the time of detection of early cases and transmission could have been occurring in the community prior to that point is probable. A broad tissue tropism, particularly, binding through its spike protein to Angiotensin-converting-enzyme (ACE2) is shown by SARS-CoV-2 (WHO, 2021).

**Structure of SARS CoV-2:**

*Coronam* is a Latin term used for crown. These viruses have, a resemblance of a crown when viewed under the electron microscope, due to the presence of spikelike projections of glycoprotein on their surface; as a reason why, they are referred to as corona viruses. In corona virus family, this virus is the seventh member which having an ability to infect humans. Corona viruses are large, enveloped, positive-stranded RNA viruses and in a wide variety of mammalian as well as in avian species, these are responsible for causing disease. The subfamily *Orthocoronavirinae* of the *Coronaviridae* family (order *Nidovirales*) divides into four genera of CoVs:

1. Alphacoronavirus (alphaCoV),
2. Betacoronavirus (betaCoV),
3. Deltacoronavirus (deltaCoV),
4. Gammacoronavirus (gammaCoV).

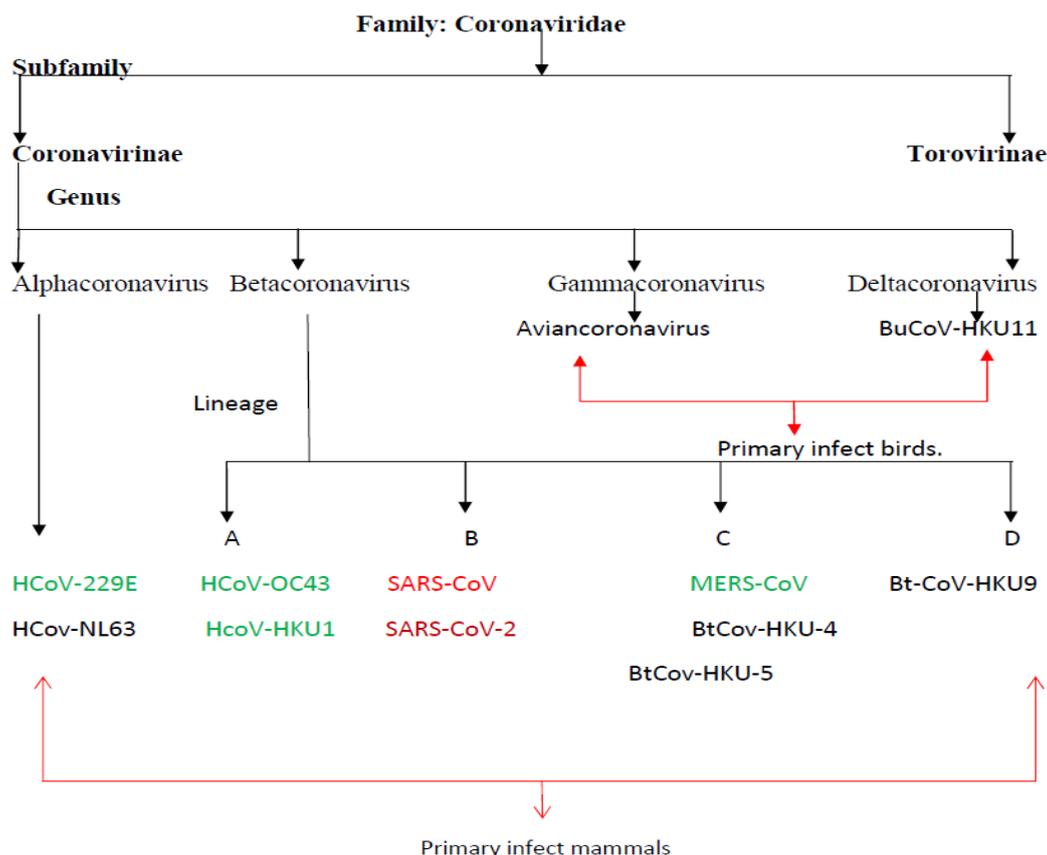
Genus Beta-CoV is further divided into five lineages sub-genera. Bats and rodents are the probable source of alpha and betaCoV has been shown by Genomic characterization. On the opposite to that, avian species seems to represent the gene source of delta and gamma CoVs. With a diameter of approximately 60-140nm, the virus has a round or elliptical and often pleomorphic form. It is sensitive to ultraviolet rays and heat, like other CoVs. It appears that the virus can be inactivated at about 27° C (Cascella *et al.*, 2020). The genomic size of corona virus ranges between 26-32 kB in length. The corona virus genome is largest among RNA viruses; at this size (Mittal, Manjunath *et al.*, 2020). Few variants are considered as the variants of concern (VOC) among several variants of SARS-CoV-2 (Mittal *et al.*, 2020).

**Spike proteins of SARS CoV-2:**

Several structural and non-structural proteins are encoded by the corona virus genome. The infection of the host, membrane fusion, viral assembly, morphogenesis, and the release of virus particles, are due to the structural proteins and replication and transcription is facilitated by non-structural proteins (nsps). The membrane (M), the envelope (E), and the spike protein(S) constitutes the structural proteins of the virus. The S-proteins are of the shape of clove, and consists of 3 segments i.e., a large ectodomain, a single-pass transmembrane, and an intracellular tail and are type-1 transmembrane proteins. The ectoproteins consists of the SI

subunit, containing a receptor-binding domain (RBD), and the membrane fusion subunit (S2). The initial step of viral replication is the host-cell receptor recognition by the RBDs on the S proteins, and one of the most critical factors for host range and inter-species transmission is the binding interactions between the corona viruses spike and its receptor (Mittal et al, 2020).

**Flow chart depicting classification of Corona viruses**



**Classification of Corona viruses (HCoV-229E-like viruses that are shown in red bind to the host receptor ACE2) (Mittal, Manjunath et al, 2020 ).**

Human corona virus recognises a variety of host receptors: particularly, HCoV-229E recognizes human amino peptidases N (Hapn), MERS-CoV binds dipeptidyl peptidases-4(DPP4), SARSCoV-2 recognises angiotensin-converting enzyme2 (ACE2). Recent structures have shed light, along with functional studies on the fact that SARS-CoV-2 S proteins utilize ACE2 and Transmembrane Serine Protease2 (TMPRSS2) for the host cell entry which is like the method taken by SARS-CoV. The major target for evoking antibodies is the S proteins, which are common among corona viruses. For camouflaging them, the spikes are covered with molecules of polysaccharide and helps evading the surveillance of the immune system of host during

entry. The SARS-CoV-2 S is 1273 amino acids long and contains a single peptide which is 1-13 amino acids long located at the N-terminus, the S1 subunit (14-685 residues), and the S2 subunit (686-1273); for receptor binding and membrane fusion the last two regions are responsible. The CoV S protein is present as an inactive precursor in its native state. The precursor is converted to an active form during viral infection, by the target cell proteases by cleaving it into S1 and S2 subunits, which is critical for activating the membrane fusion domain post viral entry into target cells (Huang *et al.*, 2020).

#### **SARS-CoV-2 RNA-dependent RNA polymerase complex:**

For fulfilling the purpose of replication of their genome and gene transcription corona viruses employ a RNA-dependent RNA polymerase (RdRp) complex. The RdRp complex is made up of a catalytic subunit nsp12 and in addition two accessory subunit nsp7 and nsp8, due to which RdRp template binding and also processivity is accelerated.

#### **Incubation period of SARS-CoV-2:**

The entire duration of time from the possible earliest contact of the infection from the transmission source to the earliest recognition of the symptoms is called as incubation period. For effective contemporary public health measures to be taken in order to contain the spread, correctly estimating the length of the incubation period is critical. If health authorities have an idea of the incubation period, then they will know how long monitoring of healthy person has to be done and their movement needs to be barred (quarantine period) (Zaki and Mohammed, 2021). The incubation period of COVID-19 is believed to be 14 days, having a median time of 4-5 days from initial contact of infection to the onset of clinical symptoms. One study reported that 97.5% of people infected with COVID-19 who have symptoms will do so within 11.5 days of SARS-CoV-2 infection ([www.cdc.gov](http://www.cdc.gov)).

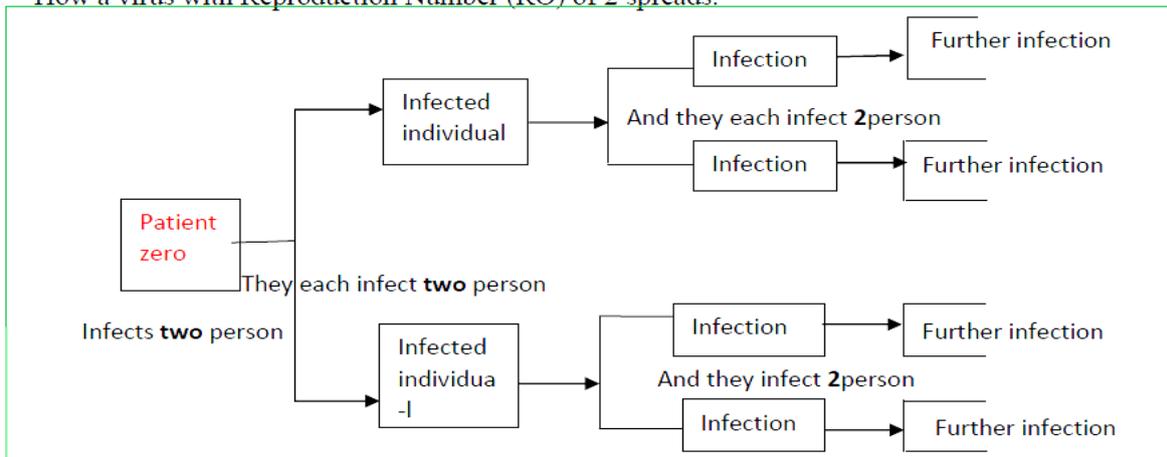
#### **Common signs and symptoms of COVID-19:**

The signs and symptoms of COVID-19 present at illness onset vary, but over the course of disease certain symptoms become common in many cases which include fatigue, fever and chills, cough, shortness of breath, diarrhea, muscle or body aches, head ache, sore throat, congestion or runny nose, nausea or vomitine, new loss of taste and smell, etc.

### Transmission of SARS-CoV-2:

- On the basis of the current evidence, it is found that the primary mode of transfer of SARS-CoV-2 is by taking the respiratory droplets route from infected person to another non-immune person (<https://search.bvsalud.org>).
- Blood can also be a potential source of virus as viremia i.e. blood-borne transmission is seen in COVID-19, this has a clear indication that virus can be present in blood even though no confirmed cases have been found.
- The transplantation of organs can also be a route of COVID-19 transmission, but investigative data is required (Wiwanitkit, 2020).
- Transmission by fomites of SARS-CoV-2 has been found of significant risk according to studies. The virus survived for six days on to the surfaces being tested (Tudela *et al.*, 2020).
- Epidemiological data from several case studies also reported feasible fecal-oral transmission.
- A meta-analysis showed that out of 936 neonates having mothers infected with coronavirus disease-19, only a meagre number of neonates (27) came with a positive result showing vertical transmission is very infrequent (Kotlyar *et al.*, 2020).
- Another mode of transmission of COVID-19 would be in processes like dentistry because it generates considerably high amounts of droplets as well as aerosols thereby creating potentially increased transmission of infections (Ge, Yang *et al.*, 2020).
- The method of GI endoscopy has become a very high-risk procedure in regard to COVID-19 transmission because of the characteristics of stability of virus as well as its varied modes of transmission (Rana, 2020).
- A potential source of transmission of COVID-19 is through the conjunctiva as a route as well as the being the source of infection (Dockery *et al.*, 2020).

How a virus with Reproduction Number (RO) of 2 spreads.



### Pathogenesis of SARS-CoV-2

#### Pathogenesis of SARS-CoV-2- induced pneumonia:

As SARS-CoV-2, predominantly targets the respiratory system, COVID-19 is principally considered a viral respiratory illness. The early phase and the late phase are the phases through which the pathogenesis of SARS-CoV-2. The early phase results in direct virus-mediated tissue damage, and late phase follows it in which when the infected host cell starts an immune response with the recruitment of T lymphocytes, monocytes, and neutrophil recruitment that releases cytokines like tumor necrosis factor-  $\alpha$  (TNF-  $\alpha$ ), granulocyte-macrophage colony-stimulating factor (GM-CSF), interleukin-1 (IL-1), interleukin (IL-6), IL-1 $\beta$ , IL-8, IL-12 and interferon (IFN)- $\gamma$ . 'Cytokine storm' which occurs due to the over activation of the immune system is characterized by the release of high levels of cytokines, mainly IL-6 and TNF-  $\alpha$ , in the circulation, thereby forming a local and a systemic inflammatory response. Binding of SARS-Cov-2 to the Toll like Receptors (TLR), besides, IL-6 and TNF-  $\alpha$ , causes the release of proIL-1 $\beta$ , thereby cleaving it into the active mature IL- $\beta$  that mediates lung inflammation and fibrosis occurs eventually (Cascella *et al.*, 2021).

#### Effects of SARS-Cov-2 on Extra pulmonary Organ system:

Covid-19 can affect other major organs such as Gastrointestinal Tract (GI), renal, Central Nervous System (CNS) and cardiovascular system, although the prime target of COVID19 is the respiratory system as explained above.

**Cardiovascular system:** The persons having pre-existing cardiovascular diseases, have an enhanced risk of contracting COVID-19. The virus has been connected with various ailments

that may be its direct or indirect effect that comprises of diseases like myocardial injury, venous thromboembolism, and arrhythmias. If patients have cardiovascular abnormalities, it makes them prone to poor detection of diseases due to the induced problems (Soumya et al. 2020).

**Hematological:** In COVID-19 infection, change does occur in the haematological systems, and they also give an opportunity for monitoring of infection or severity. There is occasional presence of reactive lymphocytes. Lymphocytopenia, neutrophilia, eosinophilia is commonly encountered, much less frequently thrombocytosis is also detected (Toledo *et al.*, 2020).

**Central Nervous System (CNS):** Through olfactory nerve and the olfactory bulbs the virus can possibly enter into the brain as these places are easily accessible by the virus from its intranasal site. It is also critical to note that the virus can easily damage the brain without even penetrating getting inside the brain. Effects include hypoxemia and after that brain hypoxia and in addition vasodilation, conditions like hypermia and brain edema can also occur. Primary manifestations include headache and if left untreated might cause change in level of consciousness and even coma could occur (Alomari et al. 2020).

**Gastrointestinal (GI) Tract:** In patients with COVID-19, diarrhea and gastrointestinal symptoms are commonly observed, but its significance has not yet been determined. Enterocyte dysfunction which occurs due to changes in permeability of intestine happens due to the viral infection. Gastrointestinal symptoms such as diarrhea, anorexia, and nausea were experienced by the patients was found according to a study. Intestinal damage or inflammation is the result of gastrointestinal symptoms. Systemic inflammation occurs due to the release of pro-inflammatory cytokines into the circulatory system ((Villapol, 2020).

**Hepatobiliary:** In about 60% of cases of SARS-CoV-2 infection, liver involvement was observed. Cytopathic effect of the virus causes the involvement of hepatic system. In COVID-19 patients damage to the liver is often transient and can return to normalcy without any special treatment. Cases of severe acute hepatitis which is rare have been detected in COVID-19 patients. Multiple factors might be responsible for hepatic impairment (Singla and Arora, 2020).

**Renal:** In COVID-19 infected patients, the occurrence of AKI is relatively low which is 3-9%, when it is compared to previous SARS and MERS-CoV infections which is 5 to 15%. The main kidney damage occurs at tubule-interstitium with a changing degree of acute tubular necrosis, luminal degeneration, and changing degrees of infiltration of lymphocytes was shown by a study (Armaly *et al.*, 2021).

**Ocular:** In the patients' positive with COVID-19, associated ocular findings have been on a rise. A meta-analysis study indicated a prevalence of ocular manifestations in 7,300 COVID-19 patients' as 11.03%, the most commonly occurring ocular disease was conjunctivitis having 88.8% occurrence. The probability of infection via ocular secretions is currently not known. Acute conjunctivitis symptoms, which include eye redness, ocular irritation, soreness of eyes, tearing, mucoid discharge, swelling of eyelids can be present (Hu et al. 2021).

**Variants of COVID-19:** Viruses constantly change through mutation, and novel variants of the virus are expected to occur. Occasionally new variants emerge and disappear. Other times, new variants persist. Multiple variants of the virus responsible for COVID-19 have been detected and documented in the US and globally during the course of the pandemic. Viruses are in constant process of changing to become more diverse. Scientists evaluate these alterations, including the changes to the spikes present on the surface of the virus. In order to stop the practice of identifying variants with the particular regions or nations, new nomenclature system has been released (WHO).

**SARS-CoV-2 Variants of Concern (VOC) are:**

**1] B.1.1.7 (VOC 202012/01 or 20B/501Y.V1) (Alpha) Variant:**

On 14 December, the United Kingdom (UK) administration reported the presence of a new variant of SARS-CoV-2 which was named as B.1.1.7 variant, being responsible for accelerated incidences of infections to covid-19 in eastern and south-eastern England and the London area of metropolitan. From that period, this variant has rapidly become the predominant variant of the virus. The variant could be identified as early as September 2020 from the clinical samples. Greater transmissibility of this variant has resulted in an increase in the hospitalization. This variant is more dangerous as it can cause more serious disease in the patients.

**2] B.1.351 (20H/501Y.V2) (Beta) Variant:**

On 18 December 2020, the authorities of the Republic of South Africa reported another variant of concern named as B.1.351 which is also called as 20H/501Y.V2. Within a month of its detection, the variant successfully replaced the already circulating viruses in the region and became predominant. Increased rate of transmission is indicated by this reason, increased virulence or severity has not been conclusively proven. When compared to original Wuhan

Strain, the given variant includes non-synonymous mutations number 12 and in addition a single deletion.

### 3] P.1 (B.1.1.28.1) (Gamma) Variant:

P.1 variant which is also called as the B.1.1.28.1 was detected on 6 January 2021 by the Japan's National Institute of Infectious Diseases. Four travellers who were travelling from Amazonas, Brazil to Tokyo were found to have the same variant. The above-mentioned variant was later reported in Brazil and it has become the dominant virus in Brazil. P.1 has in it 1 deletion and 17 non-synonymous substitution. It has the highest number of mutations in the spike protein (12 mutations) among the SARS-CoV-2 (Gomez et al. 2021). The following table gives information about new WHO labelling to various SARS-CoV-2 variants.

New WHO Label	Pango Lineage (Most commonly used name)	First Reported In	Date of Nomenclature	Concern Factor
Alpha	B.1.1.7	UK(Kent); September, 2020	18 December, 2020	Spreads faster than predominant virus
Beta	B.1.351	South Africa; May 2020	18 December, 2020	Shows considerable resistance
Gamma	P.1	Brazil; November 2020	11 January, 2021	Shows some resistance, increased infectivity
Delta	B.1.617.2	India; October , 2020	11 May, 2021	Considerably higher transmissibility, somewhat resistant.

### Variants of Concern:

Conclusively proved to possess attributes that endow them with higher fitness than the primary version of virus. (WHO)

**SARS-CoV-2 variants of interest (VOI):** A variant which possess particular genetic markers which have been particularly associated with changing to binding to receptors, decline in neutralization by antibodies that were generated from previous exposure to the infection or

were the result of vaccination, have reduced effects of treatments, potential diagnostic impact, or a potential increase in transmission ability or severity of the disease (CDC). According to WHO Epidemiological update April 13, 2021, six variants of interest have been identified. These are:

**Variants of Interest: Currently under investigation. (WHO)**

<b>New WHO Label</b>	<b>Pango Lineage (Most Commonly used Code)</b>	<b>First Reported In</b>	<b>Date of Nomenclature</b>	<b>Concern Factor</b>
Epsilon	B.1.427/B.1.429	California(US), March, 2020	5 March, 2021	Might have more transmissibility
Zeta	P.2	Brazil; April, 2020	17 March, 2021	Might have more resistance
Eta	B.1.525	Multiple Nations; December 2020	17 March, 2021	May have more resistance to vaccines
Theta	P.3	Philippines; January, 2021	24 March, 2021	Possess some of the mutations as other VOCs
Iota	B.1.526	New York (US); November, 2020	24 March, 2021	May be more resistant
Kappa	B.1.617.1	India; October, 2020	4 April, 2021	Might be more resistant, quick spread

**Diagnostic test for the SARS-CoV-2:**

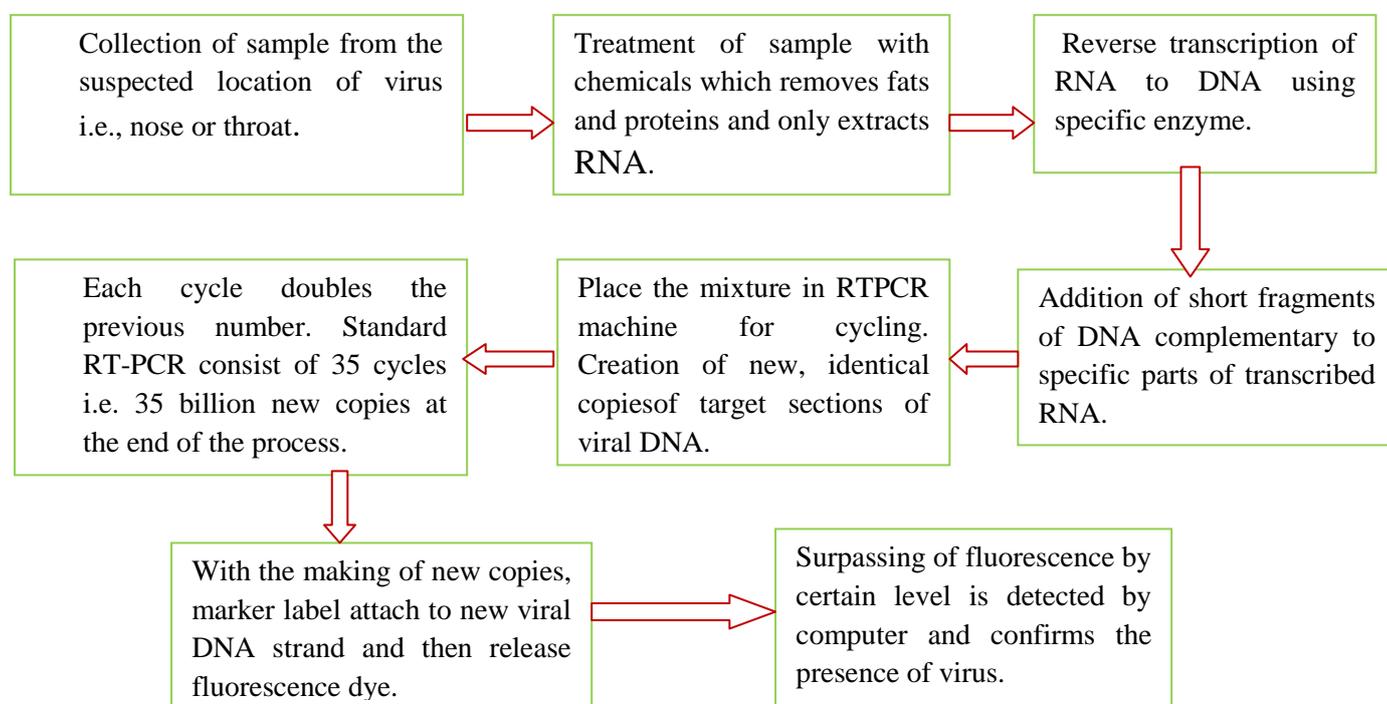
Viral tests and antibody tests are principally two types of tests available for detecting COVID-19: The viral tests are direct tests as they are designed in such a way to detect the virus and thereby indicating current infection. In a marked contrast to this, the antibody tests are indirect tests, as they do not detect the virus, but rather ascertain already present seroconversion to previous infection, or early seroconversion to ongoing infection.

**1] Direct tests:** The recommended test for diagnosis of SARS-CoV-2 infection involves detection of viral RNA using nucleic acid amplification tests (NAAT), such as reverse transcription polymerase chain reaction (RTPCR)

**2] Indirect tests:** Tests like serological testing are different than NAAT-based testing and required significantly longer time than direct test (La Marca et.al.2020).

### RT-PCR (Reverse Transcriptase- Polymerase Chain Reaction):

A nuclear derived method that is employed for detecting the presence of specific genetic material in any pathogen, including a virus is called Real Time Reverse Transcriptase- Polymerase Chain Reaction (<https://www.iaea.org>).



(Source: <https://www.iaea.org/bulletin/infectious-diseases/how-is-the-covid-19-virus-detected-using-real-time-rt-pcr>)

### Serology Testing

In serological method, a different approach is followed in diagnosing infection which is based on detecting the presence of antibodies that act specifically against the viral proteins in the blood serum which is produced against SARS-CoV-2. Antibodies which are responsible for neutralization of virus are detected by serological test. These are carried out when the immunological reaction against SARS-CoV-2 virus is going on. This method can be used to

identify the subjects which have already developed immunity. However, it cannot be used for detecting the infection or denying the possibility of infection(Kubina and Dziedzic2020).

### **Chest Computed Tomography (CT):**

Certain limitations that occur into RT-PCR technique (time costly, false negative results), have prompted some studies to suggest the employment of Chest Computed Topography (CT) scan. Being very quick in producing the results is an advantage of CT scan. But the method does possess certain limitations which includes complete dependence on the radiologist's skills. Another one being the necessity to sterilize the equipment every time after its use on patients which might have COVID-19 (Hosseini et al. 2020).

### **Lung Ultrasound:**

An interstitial diffuse bilateral pneumonia accompanying lesions in the form of asymmetric and patchy distribution mainly happening in the periphery of the lung occurs in COVID-19. By using lung ultrasound changes in the ground glass opacification (GGO) with crazy pavings and consolidations can be very well depicted. For characterizing the patchy bilateral spread of lesions and the distribution of patterns regionally can be carried out using lung ultrasound imaging(VolpicelliandGargani, 2020).

### **Pharmacological Therapies for SARS-CoV-2:**

An array of therapeutic options are available currently that comprises of antiviral drugs like remdesivir, also anti-SARS-CoV-2 monoclonal antibodies which include bamlanivimab or esesevimab, casirivimab or imdevimab are used, in addition to these anti-inflammatory drugs namely dexamethasone is also used in treatment. Certain immunomodulatorsagents likebaricitinib, tocilizumab which under FDA issued Emergency Use Authorization (EUA) are either administered or are being evaluated in the control of COVID-19.

### **Conclusion:**

Throughout the entire history of human civilization, epidemics have always been part of the life and have caused catastrophic amount of illness and mortality of humans. Yet another disastrous one in the form of SARS-CoV-2 has whiplashed humankind for the last 1 and a half year. The entire fabrics of social and societal norms have been altered. The casualty rate is haunting. The indefatigable efforts of many leading research laboratories around the globe have given us a ray of hope in the form of vaccines like Moderna, Pfizer, AstraZeneca, Sputnik

and many others. As a result, we are now slowly able to conquer the virus. It is certain that the virus will be triumphed upon but the nightmares that it has given us will continue to remain in our memory for lifetime.

#### References:

1. Piret J and Boivin G (2021). Pandemics Throughout History, *Front. Microbiol.* 11:631736.
2. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>
3. Liu Yen-Chin, Kuo Rei-Lin and Shih Shin-Ru(2020). COVID-19: The first documented coronavirus pandemic in history, Elsevier B.V, *Biomedical Journal* 43: 328-333.<https://doi.org/10.1016/j.bj.2020.04.007>
4. Vasanthi Vara (2020). Coronavirus outbreak: The countries affected. <https://www.pharmaceutical-technology.com/features/coronavirus-outbreak-the-countries-affected/>.
5. Ciotti Marco, Angeletti Silvia, MinieriMarilena, Giovannetti Marta, Benvenuto Domenico, Pascarella Stefano, Sagnelli Caterina, Bianchi Martina, Sergio Bernardini, Ciccozzi Massimo,(2020). Covid-19 Outbreak: An Overview, *S.Karger.AG*April:, 64: 215-223.
6. <https://unsplash.com/photos/rnr8D3FNUNY>
7. WHO (2021).WHO-convened Global Study of Origins of SARS-CoV-2: China Part Joint WHO-China Study 14 January-10 February 2021 Joint Report.
8. Mittal A, Manjunath K, Ranjan RK, Kaushik S, Kumar S, Verma V (2020), COVID-19 pandemic: Insights into structure, function, and hACE2 receptor recognition by SARS-CoV-2, *PLoSPathog* 16(8):1-19.
9. Huang Yuan, Chan Yang, Xu Xin-feng, Xu Wei and Liu Shu-wen(2020). Structural and functional properties of SARS-CoV-2 spike protein: potential antiviral drug development for COVID-19,*Acta PharmacologicaSinica* 41:1141-1149. <https://doi.org/10.1038/s41401-020-0485-4>.
10. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html>)
11. <https://search.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/resource/en/grc-741057>

12. WiwanitkitViroj (2020). Atypical modes of COVID-19 transmission: how likely are they? *Epidemiology and Health*, Article id: e2020059Volume 42:1-4. <https://doi.org/10.4178/epih.e2020059>
13. Tudela Juan, Luis Rodriguez, Cole Donald C., Ravasi Giovanni, Bruisma Nienke, Chiller Tom C, and Ford Nathan (2020). Exaggerated risk of transmission of COVID-19 by fomites, *The Lancet*, Vol. 20, Pages: 1-2.
14. Kotlyar Alexander M, Grechukhina Olga, Chen Alice, PopkhadzeShota , Grimshaw Alyssa, Tal Oded, Taylor Hugh S. and Tal Reshef (2021). Vertical Transmission of coronavirus disease 2019: a systematic review and meta- analysis, *American Journal of Obstetrics and Gynecology*, Vol. 224 (1): 35-53.
15. GE Zi-yu, YANG Lu-ming, XIA Jia-jia, FU Xiao-hui and ZHANG Yan-zhen, (2020). Possible aerosol transmission of COVID-19 and special precautions in dentistry. *Journal of Zhejiang University-SCIENCE B (Biomedicine & Biotechnology)*, 21 (5): 361-368. <https://doi.org/10.1631/jzus.B2010010>
16. Rana Surinder Singh (2020). Risk of COVID-19 Transmission During Gastrointestinal Endoscopy, *Journal of Digestive Endoscopy*,11(1):27-30. <https://dx.doi.org/10.1055%2Fs-0040-1712076>.
17. Dockery Dominique M., Rowe Susannah G., Murphy Marjorie A. andKrzystolik Magdalena G.(2020). The Ocular Manifestations and Transmission of COVID-19: Recommendations forPrevention., *The Journal of Emergency Medicine*, Vol. 59 (1): 137-140. <https://doi.org/10.1016/j.jemermed.2020.04.060>
18. Cascella Marco, Rajnik Michael, Aleem Abdul, Dulebohn Scott C and Napoli Raffaella Di. (2021), *Features, Evaluation, and Treatment of Coronavirus (COVID-19)*.StatPearls Publishing,. NCBI Bookshelf, 1-44. <https://www.ncbi.nlm.nih.gov/books/NBK554776>
19. Soumya R.S., Unni T. Govindan. and Raghu K.G. (2020). Impact of COVID-19 on the Cardiovascular System: A Review of Available Reports, *Cardiovascular Drugs and Therapy*, Pages:1-15. <https://doi.org/10.1007/s10557-020-07073-y>
20. Toledo Silvia Leticia de Oliveira, NogueiraLeilismara Sousa, Carvalho Maria das Gracias, Rios Danyelle Romana Alves and Pinheiro Melina de Barros, (2020). COVID-19: Review and hematologic impact, *ClinicaChemicaActa* ,Vol.510, Pages:170-176. <https://doi.org/10.1016/j.cca.2020.07.016>

21. Alomari Safwan O., Abou-MradZaki and Bydon Ali, (2020). COVID-19 and the central nervous system, *Clinical Neurology and Neurosurgery*, Vol.198 :1-9. <https://doi.org/10.1016/j.clineuro.2020.106116>
22. Villapol Sonia, (2020). Gastrointestinal symptoms associated with COVID-19: impact on the gut microbiome, *Translational Research*, Volume 226: 57-69. <https://doi.org/10.1016/j.trsl.2020.08.004>
23. Singla Vikas and Arora Anil(2020). Hepatobiliary and Pancreatic Manifestations of Coronavirus Disease 2019, *Journal of Digestive Endoscopy*, Vol. 11 (1): 21-23.
24. 24.Armaly,Z; Kinaneh, S and Skorecki, K (2021). Renal Manifestations of Covid-19: Physiology and Pathophysiology.*J.Clin.Med.* 2021, 10, 1216: 1-21. <https://doi.org/10.3390/jcm10061216>
25. 25.Hu K, Patel J and Swiston C (2021). Ophthalmic Manifestations Of Coronavirus (COVID-19), [Updated 2021 May 19].In: StatPearls[Internet], Treasure Island[FL]: StatPearls Publishing.
26. La Marca Antonio, Capuzzo Martina, Paglia Tiziana, Roli Laura, Trenti Tommaso and Nelson Scott M. (2020). Testing for SARS-CoV-2 (COVID-19): a systematic review and clinical guide to molecular and serological in-vitro diagnostic assays, *Reproductive BioMedicine Online*, Vol-41(3): 483-499.<https://doi.org/10.1016/j.rbmo.2020.06.001>
27. <https://www.iaea.org/bulletin/infectious-diseases/how-is-the-covid-19-virus-detected-using-real-time-rt-pcr>
28. Kubina Robert and Dzedzic Arkadiusz(2020). Molecular and Serological Tests for COVID-19. A Comparative Review of SARS-CoV-2 Coronavirus Laboratory and Point-of Care Diagnostics. *Diagnostics*, 10, 434: 1-18.
29. Hossein Hasti, Ali Kosar Mohamed, Hosseini Mostafa, SarveazadArash, Safari Saeed, and Yousefifard Mahmoud(2020). Value of Chest Computed tomography scan in diagnosis of COVID-19; a systematic review and meta- analysis. *Clinical and Transnational Imaging*,469-481. <https://doi.org/10.1007/s40336-020-00387-9>
30. 30.Volpicelli Giovanni and Gargani Luna(2020), Sonographic signs and patterns of COVID-19 pneumonia, *The Ultrasound Journal*, 12 (22) : 1-3. <https://doi.org/10.1186/s13089-020-00171-w>
31. Gomez, C.E.; Perdiguero, B. and Esteban, M. (2021). Emerging SARS-CoV-2 Variants and Impacts in Global Vaccination Programs against SARS-CoV-2/COVID-19. *Vaccines*, 9, 243:1-13. <https://doi.org/10.3390/vaccines9030243>

**TEST ANXIETY LEVELS DURING UNSUPERVISED EXAMINATIONS IN THE  
CONTEXT OF ONLINE TEACHING-LEARNING DUE TO ONGOING  
COVID PANDEMIC- A STUDY ON UNDERGRADUATE STUDENTS  
OF DISPUR CONSTITUENCY, ASSAM, INDIA**

**Dhunumoni Das<sup>1</sup> and Sudeshna Nath\*<sup>2</sup>**

<sup>1</sup>Baghabar High School, Jahanar Gholi, Assam 781308

<sup>2</sup>Department of Education, Gauhati University, Guwahati, Assam 781014

\*Corresponding authors E-mail: [sudeshnavortex@gmail.com](mailto:sudeshnavortex@gmail.com)

---

**Abstract:**

Test anxiety is a noticeable issue in a student's life especially at the time or before the scheduled examination. It is seen that many students as well as parents approach counsellors reflecting the severity of this problem. It is also interesting to note that such test anxieties are often associated with classroom anxiety levels, where a physical contact between the teacher and the students is avoidable. But what about anxiety during unsupervised examinations, where there is no one to invigilate the students and create irrational levels of anxiety. Such a platform has been provided to the students by the on-going pandemic wherein all the students are required to appear for examinations sitting within the comfort of their home. Hence, it becomes imperative to test the anxiety to understand its different levels among the college-going students in relation to their gender and stream in Dispur Constituency. For the present study, Purposive sampling technique was used. A total of 166 students from the various colleges of Dispur Constituency were selected as the sample of the present study. Data was collected by using Test Anxiety Scale constructed and standardized by Dr V. P. Sharma.

The research findings revealed a low level of overall test anxiety among the students indicating the lowering of stress due to weakened classroom contact. The result also showed a significant difference between the male and female undergraduate students with reference to their level of test anxiety; but the result also highlighted no significant difference between the test scores of arts and commerce students of test anxiety.

**Key words:** Test Anxiety, Undergraduates, Gender, Stream

---

### **Introduction:**

In this pandemic situation, most of the students face different psychological problems like stress, anxiety, frustration, loneliness, emotional insecurity etc.; mostly due to weakened social contacts with people concerned to maintain that balance. Whatever the context of education, be it online or offline, parents and teachers desire that their children achieve high performance as much as possible, thus adding onto the stress of students. The expectation for high level achievement puts a lot of pressure on students and hence, it can create some level of anxiety among the students. Test anxiety refers to the kind of indefinite irrational fear and tension which prevents students from doing well in their achievement.

Test anxiety is debilitating and is a source of disparagement among the students and especially for their parents. It is a prominent source of anxiety for higher education students. Students who are over anxious exhibited erratic behaviours and almost tried to avoid situations involving academic performance evaluations. Self-deprecatory and derogatory thoughts develop, which at times can lead to suicide as well. The sudden transition to online mode created the need to conduct online tests and exams, challenging both teachers and students to create the same examination set up like in offline classroom examinations. With this sudden physical shift in the mode of teaching and learning, there have been related psychological shifts as well. The tangents of test anxiety have changed depending on the structure of the test conducted online. Experience in simulation tests provided beforehand can impact the test anxiety levels in online examinations and even their overall test scores (Wu J. *et al.*2021).

### **Review of Literature:**

- Kumar (2014) indicated through their research study that addressing test anxiety issues beforehand can help a lot in cutting the negativity associated with online testing. Self-awareness about testing worries can go a long way in improvement of academic performances among students.
- Begum (2015) conducted a study on the level of Test Anxiety of B.A. 2<sup>nd</sup> semester students of provincialized colleges of Nalbari town in relation to their Academic Achievement and found that there is a significant positive correlation between test anxiety and academic achievement.
- Gohain (2016) conducted a study on test anxiety among undergraduate level students in Assam, India and found that a moderate level of anxiety is not harmful where as extreme

level of anxiety is always affective which may lead to low performance, stressful, depressive and even suicidal situation.

- Chowdhury (2019) conducted a study on examination anxiety among secondary level students and the study revealed that 39.67% of students were having high or extremely high examination anxiety and significant difference was also observed between the male and female students.
- Woldeab and Brothen (2019) assessed the impact of online proctored exams on student test anxiety and exam performance. This study indicated that students demonstrated higher test anxiety levels in online proctored settings.
- Wu *et al.* (2021) focussed on experience and training in online exams to improve their relative performances. Following a methodical instruction strategy to train the students in online tests can lessen anxiety and adapt them to new situations online.

#### **Objectives of the study:**

The objectives of the present study are:

1. To study the level of test anxiety among the undergraduate students' of Dispur constituency.
2. To compare the test anxiety of the undergraduate students on the basis of gender (male/female).
3. To compare the test anxiety of the undergraduate students on the basis of stream of study (arts/commerce).

#### **Hypotheses of the study:**

1. There is no significant difference in test anxiety of undergraduate students in relation to their gender (male/female).
2. There is no significant difference in test anxiety of undergraduate students in relation to their stream (arts/commerce).

#### **Methodology:**

1. **Research method:** Descriptive survey method of research has been adopted to conduct the present study.

2. **Research population:** The population of the present study comprised of all the undergraduate students of arts and commerce stream Degree Colleges of Dispur constituency in the year 2020.
3. **Sample of the study:** Considering the objectives and nature of the data to be collected, Purposive sampling has been adopted for the present study. Then the sample was sub-divided at two levels-
  - Gender- Male and Female
  - Steam – Arts and Commerce

**Table 1: Sample distribution**

Gender	Stream	No of students
Male	Arts	83
Female	Commerce	83

4. **Research tool:** In the present study data were collected by using Test Anxiety scale. The test anxiety questionnaire was constructed and standardized by DR. V. P Sharma.
5. **Data collection procedure:** After getting permission from the head of the institution the researcher met the sample students and collected the necessary data by using the respective scale within the allotted timings. Confidentiality was maintained and the collected data was categorized, tabulated and analysed.
6. **Statistical Techniques:** In order to analyze and interpret the result the researcher used different statistical techniques like- Descriptive statistics (Mean, Median, SD, Graph, and Percentage) and inferential statistics (t-test).

#### **Analysis and interpretation of data:**

The result obtained in the present study has been presented below with the help of tables and their interpretation.

#### **1. To study the level of test anxiety among the undergraduate students' of Dispur constituency**

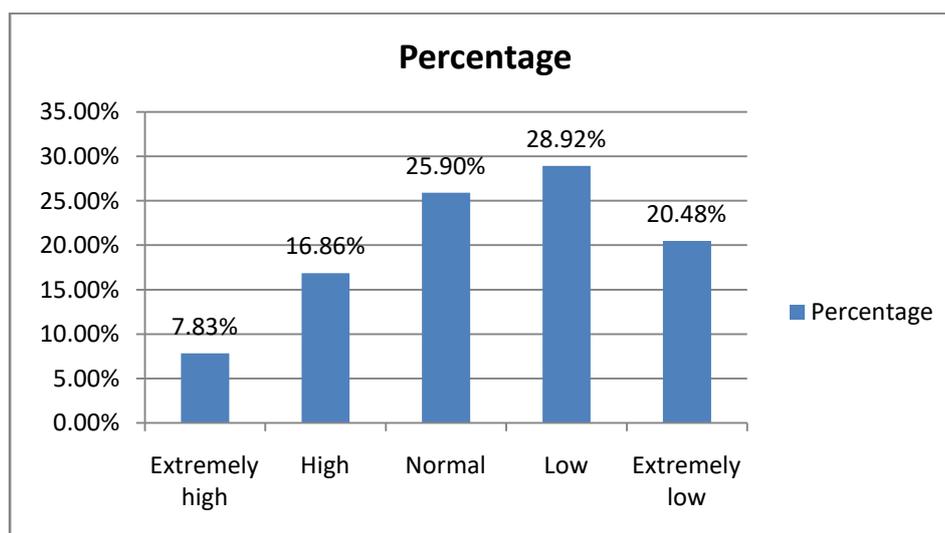
The table 1 shows that 7.83% of undergraduate students fall in the extremely high test anxiety category, 16.86% of students fall in High test anxiety category, 25.90% of students fall in

normal test anxiety category, and 28.92% of students fall in the low test anxiety category and 20.48% of students fall in the extremely low test anxiety category.

**Table 1: Level wise identification of undergraduate students having test anxiety**

Level of Test Anxiety	Number of Students	Percentage
Extremely high test anxiety	13	7.83%
High test anxiety	28	16.86%
Normal test anxiety	43	25.90%
Low test anxiety	48	28.92%
Extremely low test anxiety	34	20.48%
Total	166	100%

The different levels of test anxiety can also be shown with the following graphical representation of data-



**Figure 1: Graphical representation: Students having different levels of test anxiety**

## 2. Comparison of Test Anxiety of the undergraduate students in relation to their gender (male/female)

**Ho<sub>1</sub>:** There is no significant difference in test anxiety of undergraduate students in relation to their gender (Male and female).

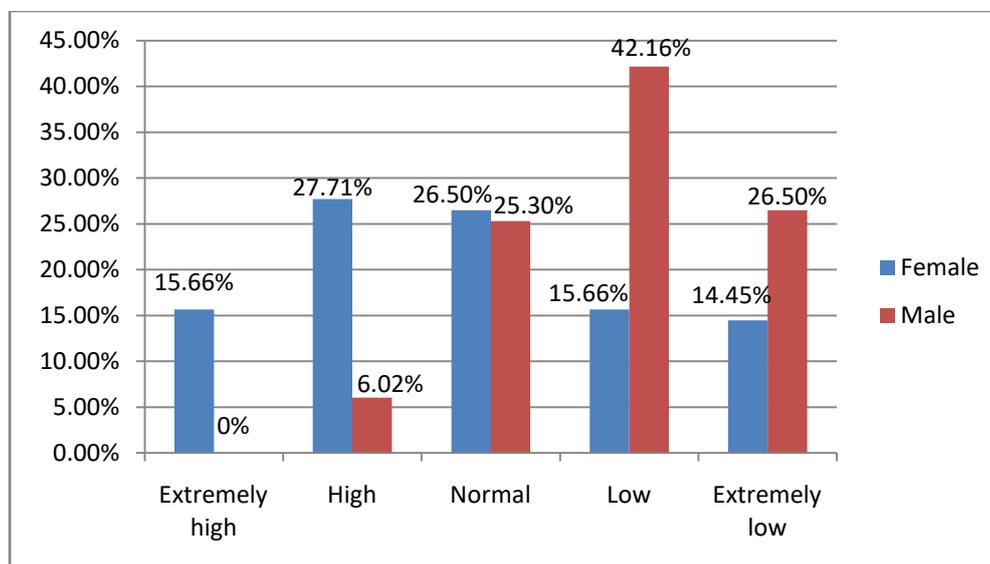
The table 2 shows that the extremely high test anxiety is much higher in female students (15.66%) than male students (0%). For the level of high test anxiety, 27.71% of male students and 6.02% of female students fall in this category. In case of normal test anxiety level, the percentage of male and students are 26.50% and 25.30% respectively. Again in the category of

low test anxiety level, the percentage of male and female students is found to be 15.66% and 42.16% respectively. In case of extremely low test anxiety, more male students (26.50%) fall under this category than the female students (14.45%).

**Table 2: Test anxiety level on the basis of gender**

Gender	Levels of Examination Anxiety					Total
	Extremely high	High	Normal	Low	Extremely Low	
Female	13 (15.66%)	23 (27.71%)	22 (26.50%)	13 (15.66%)	12 (14.45%)	83
Male	0	5 (6.02%)	21 (25.30%)	35 (42.16%)	22 (26.50%)	83
Total	13	28	43	48	34	166

Scores showing different level of test anxiety on the basis of gender can also be shown with the help of following graphical representation of data-



**Figure 2: Graphical representation of Test anxiety level on the basis of gender**

Table 3 shows the t-test showing significance of Mean difference in test anxiety scores of the undergraduate students on the basis of gender. Regarding the significance of difference between male and female students with reference to their test anxiety, the table 6.3 shows that t value of 8.94 is higher than the table value (1.96 at 0.05 level and 2.58 at 0.01 level) and

therefore Mean difference is significant at both the level of significance, 0.05 level and 0.01 level respectively. Thus the null hypothesis is rejected. So we can conclude that there is significant difference in Test Anxiety among the undergraduates in relation to their gender (male/female).

**Table 3: Comparison of test anxiety level between male and female**

Gender	N	Mean	SD	t value	Level of significance
Male	83	66.10	6.29	8.94	Significant at 0.01 level
Female	83	79.07	11.78		

### 3. Comparison of Test anxiety of undergraduate students in relation to their stream (Arts/Commerce)

**Ho<sub>2</sub>:** There is no significant difference in Test Anxiety of undergraduate students in relation to their stream (Arts/Commerce).

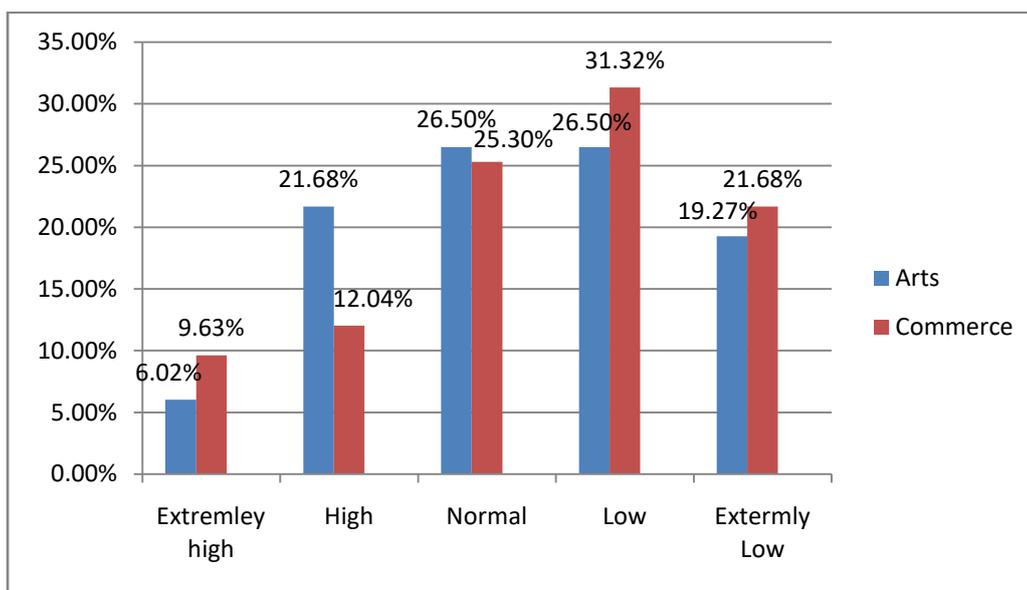
Another objective of the study is to determine the stream wise difference of Test Anxiety among undergraduate students. Now, anxiety scores of Arts and Commerce students are calculated separately and the investigator found the following outcome-

**Table 4: Test anxiety level of students on the basis of stream**

Stream	Level of test anxiety					Total
	Extremely High	High	Normal	Low	Extremely low	
Arts	5 (6.02%)	18 (21.68%)	22 (26.50%)	22 (26.50%)	16 (19.27)	83
Commerce	8 (9.63%)	10 (12.04%)	21 (25.30%)	26 (31.32%)	18 (21.68%)	83
Total	13	28	43	48	34	166

The Table 4 shows that 6.02% of arts students and 9.63% of commerce students fall under the extremely high test anxiety level category. Again 21.68% of arts students and 12.04% of commerce students fall under the category of High test anxiety level. The percentage of arts

and commerce students is 26.50% and 25.30% respectively in the category of Normal test anxiety level. Again the percentage of arts and commerce students is 26.50% and 31.32% respectively in the category of low test anxiety level. And 19.27% of arts and 21.68% of commerce students fall under the category of extremely low test anxiety level. The same can be expressed with the help of following graph-



**Figure 3: Graphical representation of test anxiety level of students on the basis of stream**

Table 5 shows the significance of difference between Mean of arts and commerce students with reference to test anxiety level. To test the hypothesis, t test was used.

**Table 5: Comparison of Test Anxiety level between arts and commerce students**

Stream	N	Mean	SD	t value	Level of significance
Arts	83	69.86	13.10	1.97	Not significant at 0.01 level
Commerce	83	68.54	11.27		

Regarding the significant difference between arts and commerce students with reference to their test anxiety, the table 6.5 shows the t value of 1.97 is smaller than the table value (2.58 at 0.01 level) and therefore not significant at 0.01 level. Thus the null hypothesis is accepted at 0.01 level and it is concluded that there is no significant difference between arts and commerce students as far as their test anxiety is concerned.

### **Findings and Discussion:**

The data analysis reveals interesting results altogether, both in case of gender and stream of study. The prevalence of majority of students lies in the category of low anxiety level followed by normal or average anxiety. It can be said a normal level of anxiety is healthy to yield better results and academic output. It keeps the students on track and helps them build better learning styles to deal with academic stress. However, low anxiety level indicates better academic results and learner's immense growth through a control on unwanted stress.

It is interesting to note that the students under study reported undue stress during classroom tests situations when questioned. But the recent transition over to online mode of teaching and learning has created conditions for unsupervised examinations. The strictness imposed by the teacher seems to intrigue the students during offline examination set ups. Absence of the invigilating eyes of the teacher gives a sense of freedom in choosing from where they want to refer their exam content. This weakening of physical connection in the online classroom has given more room for drop in test anxiety levels. Moreover there is no pressure of reaching the school on time to sit for the exam, which is now replaced by the confines of the home walls and a device to connect (Stowell and Bennett, 2010).

Since the research has been carried out just before the final semester examinations of the students, it also came to knowledge that the teachers have carried out formative evaluation tests online over a period of three months already. Various online modes like google forms, assignments in google classrooms and oral tests through zoom or google meet platforms have eased the students in online classroom managements. Eventually it had a summative effect on the anxiety level just before their final semester tests. In this context, it can be said that experiences and simulation tests provided beforehand can go a long way in determining the test anxiety levels of students (Wu *et al.*, 2021).

Regarding the comparison of male and female students with reference to their test anxiety level it was seen that there is a significant difference between them. Girls are found to have more test anxiety than the boys (Woldeab&Brothen 2019). The study also found that there is no significant difference between arts and commerce students of Dispur Constituency with reference to their test anxiety.

**Limitations of the study:**

- a. The present study is limited only to the Degree colleges of Dispur constituency Gauhati University. It can be extended to other constituencies and districts of Assam.
- b. Only undergraduates were taken as sample for the study, so it cannot be generalised that all the students of Assam will demonstrate the same state of behaviour.
- c. The study is confined to the academic year 2020-2021 for a period of three months in the first wave of covid-19. It can also be continued in the second wave as well to find to what extent the students have resettled and readjusted.
- d. The study is confined to two independent variables, but the socio-economic and demographic characteristics of parents can also be included in the study.

**Practical implications of the study:**

Overall wellbeing of the students depends on their psychological set up regarding their academic output. Any kind of anxiety related to their academic environment can result in unwarranted frustration and can even lead to suicide among the young adults. Gauging the anxiety levels of the students becomes imperative in such a case, so that any further damage can be avoided. At the same time, it also becomes equally important to find out relevant situations associated with examinations which can cause stress and tension. The factors need to be identified through rigorous research so as to develop a student friendly academic set up where examination is not a cause of concern for students.

Prior simulation experiences need to be provided to the students in the form of mock tests and other directions by teachers to deal with examination content. A proper study technique and learning style need to be developed among the students by the teachers and parents so that they are ready to challenge any kind of testing situation. Personal and demographic factors of the learner also need to be identified in relation to the learner so that they do not impact his performance in exams.

In the research study conducted, it was found that the students assured themselves of the lenient environment at home, in stark contrast to formal classroom scenario. The strict rules and regulations observed by the teacher in a well regulated classroom is sometimes enough to freak out the student. As these regulations loosened at home and examinations were fully dependent on their freedom of activity, test anxiety levels went down. The current study has provided a particular angle of the study of anxiety of students, but however it is also possible that some students who were not under investigation could have exhibited extreme higher levels of anxiety due to sudden transition to an online mode of testing. Nonetheless this

direction remains to be investigated where such factors can be identified causing high stress in online mode of learning.

**Conclusion:**

Test and examinations are the way through which the academic achievements and accomplishments of the students are measured in their formal education. In the present era, competition exists in the formal education, where marks are essential and the students have to secure good marks in their examination for their future accomplishment and success. However, when anxiety affects their performance it can become a problem and this influences their mental health. Present day education system is mainly examination oriented or we can say that it is examination dominated. Parents and teacher forget the joyful learning atmosphere where students can learn better without any stress or anxiety. Online mode of education further worsened the situation. So the research study was an attempt to provide an explanation for prevalence of such an anxiety in the online mode of examinations.

**References:**

1. Alam, K., and Halder, U. K. (2018). Test Anxiety and Adjustment among Secondary students. *International Journal of Research and Analytical Reviews*. 5 (3), 675-683.
2. Begum, S. (2015). A Study on the Level of Test Anxiety of B.A. 2<sup>nd</sup> Semester students of Provincialized Colleges of Nalbari town in relation their Academic Achievement. *Research Journal of Educational Science*. 5(3), 10-13.
3. Bhatt, N. (2020). A Study Assessing the Level of Test Anxiety among Senior Secondary School Students in Selected schools of Haldawani, Uttarkhand. *Indian Journal of public health research and development*. 11(11), 136- 140
4. Chakraborty, S. and Chaliha, A. (2016). Test anxiety and Academic Achievement: A Study on Class X students of the Borboruah Block of Dibrugarh District, Assam. *Int. Journal of English Language, Literature and Humanities*. 4 (3), 224-239.
5. Chaurasiya, K. (2018). A Study of the Examination Anxiety Among Secondary Students of Gadhinar in the Context of Some Variables. *International Journal of Research in all Subjects in Multi Languages*. 6 (1), 46-50.
6. Chowdhury, R. S. (2019). Examination Anxiety among Secondary Level Students. *IOSR Journal of humanities and social science (IOSR-JHSS)*, 24 (2), 23-28

7. Dawood, E., et al. (2016). Relationship between Test anxiety and Academic achievement among undergraduate Nursing students .Journal of Education and Practice. 7 (2), 57-65.
8. Gohain, R. (2016). Test Anxiety and Academic achievement: a Correlative Study among Undergraduate Level Students in Assam. Int. J. Edu. Psychology Research. 5(1), 64-67.
9. Goswami, M., and Roy, P. (2017). Test Anxiety of Higher Secondary Students in Relation to Some of Selected variables. Int. J. Res. Economics and Social Sciences. 7 (8), 197-206.
10. Kumar, A. N. (2014). Test anxiety and online testing: A study. IEEE Frontiers in Education Conference (FIE) Proceedings.1-6.doi: 10.1109/FIE.2014.7044376.
11. Kumari, S. (2015).Examination Anxiety among Secondary School Students in Relation to some Demographic Variables.Education for All, A Peer Reviewed Journal. 4 (1), 122-125.
12. Luckmizankari, P. (2017). Factors Affecting on Examination Stress among Undergraduate: An Investigation from Eastern University. Iconic Research and Engineering Journals. 1 (4), 9-15.
13. Malhotra, T. (2015).Exam Anxiety among Senior Secondary School Students.Scholarly Research Journal for Interdisciplinary study. 3 (17), 3089-30961.
14. Okogu, J. O., et al. (2016). Examination Anxiety and Students Academic Performance: Social Studies Approach. Edu. J.Educational Policy Research and Review. 3 (1), 1-5.
15. Stowell, J. R., and Bennett, D. (2010).Effects of Online Testing on Student Exam Performance and Test Anxiety.Journal of Educational Computing Research, 42(2), 161–171.
16. Talbot, L. (2016). Test Anxiety: Prevalence, Effects, and Interventions for Elementary school Students. James Medison Undergraduate Research Journal. 3 (1), 42-51.
17. Torrano, R, et al. (2020). Test Anxiety in Adolescent Students: Different Responses According to the Components of Anxiety as a Function of Socio-demographic and Academic Variables. A section of the journal Frontiers in psychology, 11. 3521. doi :10.3389/fpsyg.2020.612270
18. Woldeab, D., and Brothen, T. (2019). 21<sup>st</sup>Century Assessment: Online Proctoring, Test Anxiety, and Student Performance. International Journal of E-learning and distance education. 34 (1). 1 – 10.
19. Wu, J.,et al.(2021). Impact of Online Closed-book Examinations on Medical Students' Pediatric Exam Performance and Test Anxiety During the Coronavirus Disease 2019 Pandemic. Pediatr Med. 4 (1). 1 – 9. doi: 10.21037/pm-20-80.

## PSYCHOSOCIAL ASPECTS OF COVID-19 PANDEMIC: AN OVERVIEW

Deepak Malik<sup>1\*</sup> and V. N. Yadav<sup>2</sup>

<sup>1</sup>Division of Socio-Behavioural and Health Systems Research,  
Indian Council of Medical Research, New Delhi - 110029, India

<sup>2</sup>Department of Psychology,  
Central University of Haryana, Mahandergargh, Haryana

\*Corresponding authors E-mail: [malikdeepak1987@gmail.com](mailto:malikdeepak1987@gmail.com)

---

### Introduction:

The entire world is going through a challenging time with emergence of the novel coronavirus disease (COVID-19) pandemic, which rapidly approaching throughout the continents, posing an unprecedented challenge (Jones, 2020), and wreaking havoc globally, while also increasing the disease burden (Lai *et al.*, 2020). The World Health Organization (WHO, 2020) declared the COVID-19 outbreak a "public health emergency of worldwide significance" on January 30, 2020, and declared this a pandemic on March 11<sup>th</sup>.

Most COVID-19-related measures have, predictably, focused on restricting or moderating the virus's transmission, testing novel treatment modalities, and developing vaccinations strategies. Due to nationwide lockdowns and home-confinement measures undertaken by most of the countries to prevent disease spread, a large portion of the world's population is confined to their homes (Rubin *and* Wessely, 2020; Pulla, 2020). Despite the fact that various researchers and authors foresaw a probable pandemic (Taylor, 2019), the world lacked information on the subject, and the general public, as well as the government, were unprepared. However, adverse psychosomatic outcomes among public are predicted to rise dramatically as a result of the pandemic itself, as well as widely available information and the authenticity of the available information at online social networking platforms. As a result, fast spreading panic over COVID-19 might lead to long-term psychological disorders across all socioeconomic communities, which might be much more harmful in the long run than the virus itself (Depoux *et al.* 2020). . Previous studies on the health effects of infectious diseases epidemics, such as severe acute respiratory syndrome (SARS) (Lu *et al.*, 2006; Wing *and* Leung, 2012), influenza caused by H1N1 (Matsuishi *et al.* 2012), Middle East respiratory syndrome (MERS) (Jeong *et al.*, 2016), and Ebola virus (Kisely *et al.*, 2020), revealed that mental health

issues might arise among health care professionals and other populations during major public health emergencies, and similar claims is being observed during this pandemic also.

Psychological aspects are well-known influences on public health strategies used to manage epidemics and pandemics, including viral propagation, illness severity, economical, and social behaviour changes (Asmundson *and* Taylor, 2020). Excessive fear, discrimination, hostility, guilt, denial, stress, anxiety, post-traumatic stress, stigmatisation, insomnia, and depressive symptoms (Jones *et al.*, 2017) are all signs of the current pandemic, which has medical and psychosocial repercussions all across the world that raising or adding the the risk of acute complications or pre-existing chronic conditions (Torales *et al.* 2020),

After the outbreak in China, Zhan S *et al.* (2020) conducted an online survey and found that 84.9% of them were “extremely” or “very” concerned about the COVID-19 pandemic. Other studies revealed that younger people, as well as healthcare workers, were more likely to develop psychological problems if they spent too much time worrying about the pandemic (Huang *and* Zhao, 2021). In a recent study, Galea *et al.* (2020) stated that the evidence on mental health repercussions in pandemics is limited. Individuals have suffered from depression, post-traumatic stress disorder (PTSD), substance use disorder, behavioural problems, domestic violence, and child abuse as a result of all large-scale disasters.

Brooks *et al.* (2020) presented a relevant research that evaluated a significant number of prior studies and reported on the effect of quarantine on patient mental health. The majority of research consistently indicated unfavorable psychological consequences such as PTSD, disorientation, and even hostility. Longer quarantine periods, worries of infection, helplessness, frustration, boredom, insufficient supplies, insufficient knowledge, financial loss, and stigma were all stressors.

COVID-19 has also made its way into India, which, with a population of over 1.3 billion people, might be the virus's next epicentre. India reported its first COVID-19 case on January 30, 2020, in Kerala, and the number of cases has been steadily increasing since then. Maharashtra, Gujarat, Delhi, Rajasthan, Tamil Nadu, Madhya Pradesh, and Uttar Pradesh are the states in India that have been hit the hardest. The WHO noted that the "future of the pandemic will depend on how India tackles it" due to the country's high population density, low socioeconomic conditions, and lack of health-care resources.

Following WHO's declaration as a pandemic, India's government ordered a 21-day national lockdown on March 24, 2020 (The Lancet, 2020), restricting movement of the country's 138 crore people as a preventative measure against the COVID-19 pandemic, breaking the chain of transmission and slowing the disease's spread in the community, which was then extended as a nationwide response due to an increase in the number of cases until 3 May 2020 and still are in phase of lock and unlock. The Indian reaction to the pandemic was swift, with the government immediately sealing its international borders and imposing a lockdown. Simultaneously, the country has distinct pre-existing issues, such as huge population, widening socioeconomic inequality, and lack of health services which might exaggerate the situation.

Pandemics are often seen as a threat to mental health (Mak *et al.*, 2009), and studies have concluded that COVID-19 has a long-term negative influence on mental health. Various factors, include persistent worry and anxiety about family members who are COVID warriors, job loss, economic crisis, societal unrest, and uncertainty about the future, and have detrimental impact on one's psyche and social life. (Roy *et al.* 2020). As a result, researchers are becoming increasingly interested in evaluating psychological, emotional, and communal suffering in order to give psychological aids to the general population.

### **Psychological impact:**

In pandemics, health anxiety is critical to the success or failure of public health measures (Taylor, 2019). This can be described as alterations in physiological sensations that are interpreted as indicating the presence of disease. Health anxiety can be triggered by a variety of symptoms, including those associated with infectious diseases. Even for low-risk individuals, attention to preventative suggestions like as hand washing and social distance is critical in the attempts to restrict viral spread. When anxiety is low, vigilance to potential health threats can be beneficial, but when anxiety is high, it can be harmful, resulting in health issues such as lowered immunity, increased blood glucose in diabetic patients, poor sleep quality, mental health issues, and other psychological and neurological disturbances (Asmundson *and* Taylor, 2020).

Regarding pandemic scenario, it can be manifested as intrusive symptoms, negative mood, dissociation, avoidance, or arousal symptoms, and degree of anxiety can increase with factors such as prior experiences with viral infectious diseases such as influenzas, current

information about the outbreak, its symptoms, and existing comorbidities (Garfin *et al.* 2020). Individuals' views about disease, misinterpretations of symptoms may vary, and can result in greater anxiety, impaired decision-making, and behavioural changes. Due to social distancing and fear of containment, people have a greater tendency to avoid hospitals and doctors' offices, as these can be a source of contagion, delaying admission in case of real symptoms of viral infection and aggravation of existing chronic diseases. This might result in a poor therapeutic response and increased morbidity.

Excessive hand washing, social isolation, and panic shopping are also major concern, and a examples of maladaptive safety practices. Panic buying leads to excessive hoarding of superfluous resources, which can be harmful to a community in need of these resources. When sanitizers, drugs, protective masks, and surgical gloves are purchased in excess, routine medical treatment might be jeopardized (Asmundson *and* Taylor, 2020). Social isolation also causes sensory deprivation and a general sensation of paranoia, which can amplify delusional notions and fantasy thinking. Fear of contracting the illness or having a family member develop it may act as a stressor, predisposing the vulnerable group to a psychological collapse. Higher stress levels, irritability, depression, insomnia, acute stress, and trauma-related problems have all been linked to social isolation (DiGiovanni *et al.*, 2004; Hawryluck *et al.*, 2004; Lee *et al.*, 2005; Bai *et al.*, 2004; Wu *et al.*, 2009; Brooks *et al.*, 2020), especially in high-risk groups like healthcare workers. A Chinese research of 1210 people found that anxiety and depression during lockdown were present in 30% and 17% of the participants, respectively (Wang *et al.* 2020). A countrywide survey of over 50.000 adults in China also revealed a prevalence of posttraumatic stress symptoms (PTSS) of 35%. Women and young people have much greater levels of psychological distress (Qiu *et al.*, 2021).

A persistent period of depressed mood or noticeable decrease interest or pleasure in activities is a depressive disorder caused by COVID-19, and it produces considerable distress in numerous regions, according to historical and laboratory findings (Galea *et al.* 2020). Insomnia, loneliness, depression, and social withdrawal are all linked to it. In 48 studies and seven groups, the point prevalence of depression varied from 3.1 percent to 87.3 percent; the total pooled prevalence was 31.4 percent (95 percent CI: 27.3–35.5 percent), with a significant degree of heterogeneity ( $I^2 = 99.6\%$ ) was reported by Wu *et al.* 2021. In certain cases, individuals turn to substance abuse as coping strategy.

**Sociological impact:**

Although the pandemic has left an indelible mark on all sectors globally, the impact on India's underprivileged groups, women, and children has been significant. Gender-based violence, a lack of security, financial, and health have all added to the anguish of families that already live in impoverished and lower surroundings. Extending the lockdown has resulted in a fight for basic needs such as food and shelter, as well as frustration, unequal sharing of family tasks, and violence towards the household's most vulnerable members such as children and women. For most individuals, being cut off from family, friends, and co-workers is unsettling and stressful, and it can lead to short- or long-term psychological and physical health issues.

**Employment:**

Over the last year, the COVID-19 pandemic has slowed India's economy to a standstill, resulting in the loss of thousands of jobs. According to a joint analysis by the International Labour Organization and the Asian Development Bank, the pandemic cost India 41 lakh jobs in different sectors. The pandemic has strenuous the job prospects of young people throughout Asia and the Pacific, according to the report. Further stated, youth would be struck harder than adults (25 and older) in the immediate crisis and would face larger long-term economic and social consequences. Women are also facing an unemployment problem. According to estimates from the Centre for Monitoring Indian Economy (CMIE), the female labour participation rate, which is the percentage of women working out of all women of working age, declined from 16.4% to around 11% between mid-2016 and early 2020. As a result of the pandemic, it is presently believed that this number has fallen to 9% (Bloombergquint report).

**Disability:**

The COVID-19 pandemic is not only affecting social and economic situations but also exposing and intensifying marginalized communities. People with disabilities have been disproportionately affected by the COVID-19 pandemic and accompanying lockdown and recovery measures, since they are one of the groups most prone to maltreatment and neglect during times of upheaval. Around 2.2% of India's population is disabled, according to government figures. The WHO estimates that roughly 15% of the world's population is disabled, with around 80% of those living in medium and low-income countries. People with disabilities, like everyone else, require normal healthcare. Furthermore, certain disabilities are associated with underlying health issues that might exacerbate symptoms if they get COVID-19. However, according to variables such as inaccessible facilities, financial constraints, a lack of accessible transportation, interruption of social support, rehabilitation services, and past unfavorable

experiences with the healthcare system, persons with disabilities are more likely to have unmet health requirements. Furthermore, due to their dependency on other and the inaccessibility of essential public health information, methods to slow the spread of the virus, such as social distance, are difficult to execute for person with disabilities, e.g., Arogya Setu app is inaccessible to those with visual and hearing impairments, and important updates about COVID-19 were not available in accessible formats for them.

Persons with disabilities must be involved in all strategies to control the present COVID-19 pandemic in order to tackle this challenge. This means that information offered by governments and institutions to avoid infection and about Dos and Don'ts about disease must be offered in accessible formats, including as sign language, video captioning, alternate text in digital pictures and graphics, and easy-to-read versions (internet access).

**Other issues:**

Other than psychological and physical, there have been a lot of factors that have produced discomfort among the populace throughout the lockdown. During the countrywide lockdown, constant social media reporting about COVID-19 was causing widespread overreaction among public, and information on the virus was flooding in from all directions. The news channels are full of instances and personal stories of healthcare staff, patients, suspects, and quarantined families who have been stigmatized and discriminated against by their communities, reminding of the infection via news, mobile notifications, WhatsApp messaging, social media updates, and other means, it's possible that a person's thinking and anxiety may become overwhelming. Gao *et al.* (2020) found a positive correlation between thinking and anxiety in a study done in China to quantify the frequency of mental health disorders and analyze their link with social media exposure.

For many people, especially those who have been in violent relationships, confinement at home is not a godsend. According to figures released by the National Commission on Women, the lockdown has worsened the situation for victims of domestic violence. Between a week of March after lockdown, the overall number of complaints from women increased, and 214 complaints were received, with 58 are of them involving domestic violence, itself (India Today, 31 March 2020). The rise has been ascribed to abusers being confined in their houses with no outlet for their rage or frustration, as well as victims' inability to express their pain or travel to their loved ones owing to social isolation.

Another rising factor that has a negative impact on the population is the disease's stigma. Due of the stigma, there have been several stories of healthcare staff being assaulted (Altstedter *et al.*, 2020). COVID-19, being a novel disease, is sure to bring individuals

uncertainty, anxiety, and fear, according to the WHO (2020). These variables can lead to negative stereotypes. People may be driven to hide their disease for fear of discrimination, which may hinder them from obtaining prompt medical help and discourage them from adopting COVID-19 appropriate behaviours. Infected people, their relatives, and even healthcare personnel have faced stigma.

### **Conclusion:**

The conclusion of the COVID-19 pandemic is hard to foresee in the current setting, but we can learn a lot from other pandemics in history to establish plan of actions. It has a significant psychological influence on the general population, according to existing literature. To decrease psychological and emotional concerns during the COVID-19 pandemic, widespread reporting of mental health afflictions would necessitate a focused mental health strategy and policy. As a result, policymakers would require a thorough understanding of the prevalence of mental health disorders in various communities in order to enact effective responses.

### **References:**

1. Altstedter, A., Srivastava, B., and Pandya, D. (2020). Doctors come under attack in India as coronavirus stigma grows. Bloomberg News. <https://www.bloomberg.com/news/articles/2020-04-13/doctors-come-under-attack-in-india-as-coronavirus-stigma-grows>.
2. Asmundson, G. J., Abramowitz, J. S., Richter, A. A., and Whedon, M. (2010). Health anxiety: current perspectives and future directions. *Current psychiatry reports*, 12(4), 306–312.
3. Asmundson, G., and Taylor, S. (2020). How health anxiety influences responses to viral outbreaks like COVID-19: What all decision-makers, health authorities, and health care professionals need to know. *Journal of anxiety disorders*, 71, 102211.
4. Available from: <https://bridgingthegap-project.eu/the-impact-of-covid-19-on-people-with-disabilities/> (accessed on 4 June 2021).
5. Available from: <https://www.bloombergquint.com/economy-finance/41-lakh-youth-lose-jobs-in-india-due-to-covid-19-impact-ilo-aid-report>. (Accessed on 4 June 2021).
6. Bai, Y., Lin, C. C., Lin, C. Y., Chen, J. Y., Chue, C. M., and Chou, P. (2004). Survey of stress reactions among health care workers involved with the SARS outbreak. *Psychiatric services (Washington, D.C.)*, 55(9), 1055–1057.

7. Brooks, S. K., Webster, R. K., Smith, L. E., Wesseley, S., Greenberg, N., and Rubin, G. K. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *Lancet*, 395, 912–20.
8. Corona virus disease (COVID-19) pandemic. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19--11-march-2020>. (Accessed on April 23, 2021).
9. Depoux, A., Martin, S., Karafillakis, E., Preet, R., Wilder-Smith, A., and Larson, H. (2020). The pandemic of social media panic travels faster than the COVID-19 outbreak. *Journal of travel medicine*, 27(3), taaa031.
10. DiGiovanni, C., Conley, J., Chiu, D., and Zaborski, J. (2004). Factors influencing compliance with quarantine in Toronto during the 2003 SARS outbreak. *Biosecurity and bioterrorism : biodefense strategy, practice, and science*, 2(4), 265–272.
11. Galea, S., Merchant, R. M., and Lurie, N. (2020). The mental health consequences of COVID-19 and physical distancing: The need for prevention and early intervention. *JAMA Internal Medicine*, 180(6), 817–818.
12. Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., et al. (2020). Mental health problems and social media exposure during COVID-19 outbreak. 2020. *PLoS ONE*, 15(4), e0231924.
13. Garfin, D. R., Silver, R. C., and Holman, E. A. (2020). The novel coronavirus (COVID-2019) outbreak: Amplification of public health consequences by media exposure. *Health psychology: official journal of the Division of Health Psychology, American Psychological Association*, 39(5), 355–357.
14. Hawryluck, L., Gold, W. L., Robinson, S., Pogorski, S., Galea, S., and Styra, R. (2004). SARS control and psychological effects of quarantine, Toronto, Canada. *Emerging infectious diseases*, 10(7), 1206–1212.
15. Huang, Y., and Zhao, N. (2021). Mental health burden for the public affected by the COVID-19 outbreak in China: Who will be the high-risk group?. *Psychology, health and medicine*, 26(1), 23–34.
16. India Today. (31 March 2020). Domestic abuse cases rise as lockdown turns into captivity for many women. <https://www.indiatoday.in/india/story/domestic-abuse-cases-rise-as-lockdown-turns-into-captivity-for-manywomen-1661783-2020-03-31>.
17. Jeong, H., Yim, H. W., Song, Y. J., Ki, M., Min, J. A., Cho, J., and Chae, J. H. (2016). Mental health status of people isolated due to Middle East Respiratory Syndrome. *Epidemiology and health*, 38, e2016048.

18. Jones D. S. (2020). History in a Crisis - Lessons for Covid-19. *The New England journal of medicine*, 382(18), 1681–1683.
19. Jones, N. M., Thompson, R. R., Dunkel, S. C., and Silver, R. C. (2017). Distress and rumor exposure on social media during a campus lockdown. *Proceedings of the National Academy of Science*, 114 (44):11663-11668.
20. Kisely, S., Warren, N., McMahon, L., Dalais, C., Henry, I., and Siskind, D. (2020). Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. *BMJ (Clinical research ed.)*, 369, m1642.
21. Lai, C. C., Shih, T. P., Ko, W. C., Tang, H. J., and Hsueh, P. R. (2020). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *International journal of antimicrobial agents*, 55(3), 105924.
22. Lee, S., Chan, L. Y., Chau, A. M., Kwok, K. P., and Kleinman, A. (2005). The experience of SARS-related stigma at Amoy Gardens. *Social science and medicine* (1982), 61(9), 2038–2046.
23. Lu, Y. C., Shu, B. C., Chang, Y. Y., and Lung, F. W. (2006). The mental health of hospital workers dealing with severe acute respiratory syndrome. *Psychotherapy and psychosomatics*, 75(6), 370–375.
24. Mak, I. W., Chu, C. M., Pan, P. C., Yiu, M. G., and Chan, V. L. (2009). Long-term psychiatric morbidities among SARS survivors. *General hospital psychiatry*, 31(4), 318–326.
25. Matsuishi, K., Kawazoe, A., Imai, H., Ito, A., Mouri, K., Kitamura, N., et al. (2012). Psychological impact of the pandemic (H1N1) 2009 on general hospital workers in Kobe. *Psychiatry and clinical neurosciences*, 66(4), 353–360.
26. Pulla P. (2020). Covid-19: India imposes lockdown for 21 days and cases rise. *BMJ (Clinical research ed.)*, 368, m1251.
27. Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., and Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *General psychiatry*, 33(2), e100213.
28. Roy, D., Tripathy, S., Kar, S. K., Sharma, N., Verma, S. K., and Kaushal, V. (2020). Study of knowledge, attitude, anxiety and perceived mental healthcare need in Indian population during COVID-19 pandemic. *Asian journal of psychiatry*, 51, 102083.

29. Rubin, G. J., and Wessely, S. (2020). The psychological effects of quarantining a city. *BMJ (Clinical research ed.)*, 368, m313.
30. Taylor S. *The Psychology of Pandemics: Preparing for the Next Global Outbreak of Infectious Disease*. Newcastle Upon Tyne, UK: Cambridge Scholars Publishing; 2019.23–39.
31. *The Lancet*. India under COVID-19 lockdown. *Lancet* 2020;395:1315.
32. Torales, J., O'Higgins, M., Castaldelli-Maia, J. M., and Ventriglio, A. (2020). The outbreak of COVID-19 coronavirus and its impact on global mental health. *The International journal of social psychiatry*, 66(4), 317–320.
33. Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., and Ho, R. C. (2020). Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *International journal of environmental research and public health*, 17(5), 1729.
34. WHO. (2020). Coronavirus disease 2019 (COVID-19) situation report – 35. [https://www.who.int/docs/defaultsource/coronaviruse/situation-reports/20200224-sitrep-35-covid-19.pdf?sfvrsn=1ac4218d\\_2](https://www.who.int/docs/defaultsource/coronaviruse/situation-reports/20200224-sitrep-35-covid-19.pdf?sfvrsn=1ac4218d_2)
35. Wing, Y.K., Leung, C.M. (2012). Mental health impact of severe acute respiratory syndrome: a prospective study. *Hong Kong medical journal*, 3, 24–27, 18 Suppl.
36. Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z., et al. (2009). The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. *Canadian journal of psychiatry. Revue canadienne de psychiatrie*, 54(5), 302–311.
37. Wu, T., Jia, X., Shi, H., Niu, J., Yin, X., Xie, J., and Wang, X. (2021). Prevalence of mental health problems during the COVID-19 pandemic: A systematic review and meta-analysis. *Journal of affective disorders*, 281, 91–98.
38. Zhan, S., Yang, Y. Y., and Fu, C. (2020). Public's early response to the novel coronavirus-infected pneumonia. *Emerging microbes and infections*, 9(1), 534.

## SPATIO-TEMPORAL PATTERN OF COVID-19 AND ITS IMPACT ON ECONOMY OF INDIA

**Pahari Doley**

Department of Geography,

D. C. B. Girls' College,

Jorhat, Assam, India

Corresponding authors E-mail: [paharidoley2011@gmail.com](mailto:paharidoley2011@gmail.com)

---

### **Abstract:**

India has been fighting the Covid-19 pandemic since January, 2020 with the first case being identified on 30<sup>th</sup> January, 2020. Since then the cases has been rising exponentially and till 30<sup>th</sup> April, 2021, the case has reached 18,762,976. The confirmed positive cases are found to vary spatio-temporally with some of the state experiencing very high cases. This situation has caused a serious impact on the livelihood and well-being of the society in general. COVID-19 has created a global crisis and it has affected every sections of our society with serious consequences impacting individuals and all communities. Apart from the health sector, it also had a profound impact on the economy of the country creating macroeconomic uncertainty which is difficult to measure. Due to lockdown order during the COVID-19 pandemic and industrial shutdowns, many of the people lost their jobs. As a result of this prevailing situation, the unemployment rate in the country has also increased which has become one of the major problems in the country. The increasing Covid-19 crisis in India would have a long-lasting impact on the economy of the country. With the above background, an attempt has been made to analyse the prevailing pattern of spatio-temporal variation in Covid-19 spread and to have a clear understanding of its impact on the economy of the country.

**Keywords:** Macroeconomic, lockdown, shutdown, pandemic and crisis.

---

### **Introduction and Statement of the problem:**

COVID-19 is a respiratory infection with common signs that include respiratory symptoms, fever, cough, shortness of breath, and breathing difficulties. In more severe cases, infection can cause pneumonia, severe acute respiratory syndrome, kidney failure, and death (Gupta and Pal, 2020). The outbreak of Covid-19 has caused a major concern in India with the country undergoing nationwide lockdown for the first time on 24<sup>th</sup> March, 2020 for 21 days

(Phase-1) till 14<sup>th</sup> April, 2020 where the movement of entire population came to a halt. Thereafter lockdown was again extended from 15<sup>th</sup> April, 2020 to 3<sup>rd</sup> May, 2020 (Phase-2), 4<sup>th</sup> May, 2020 to 17<sup>th</sup> May, 2020 (Phase-3), 18<sup>th</sup> May, 2020 to 31<sup>st</sup> May, 2020 (Phase-4). After the Phase-4 lockdown, restrictions were lifted with ongoing lockdown extended till 30<sup>th</sup> June, 2020 for only the containment zones. Services began to be resumed in the phased manner after 8<sup>th</sup> June, 2020 and it was referred to as Unlock. However, based on the number of cases in different states as well as districts in India, the lockdown and unlock process is still going on and it is still difficult to predict when this process will end.

The spread of Covid-19 in India is found to vary spatio-temporally with shrinkage of doubling time of infections with the ongoing time and also due to the effect of second wave of the pandemic there has been rapid increase in the number of cases during the month of March April, 2021. However, due to various interventions like lockdown, social distancing and containment of hotspots of infection areas, the doubling time of Covid-19 infections is found to fluctuate and it also varies between districts and States which maybe in different stages of infection.

So in this paper, an attempt has been made to understand the spatio-temporal variation of Covid-19 spread and to analyse the prevailing pattern. The impact of Covid-19 on the economy of India has also been analysed in relation with the unemployment rate.

### **Objectives:**

The major objectives of the present study are:

- i. To understand the prevailing trend and spatio-temporal pattern of Covid-19 spread in India;
- ii. To analyse the prevailing trend of spatio-temporal variation of Covid-19 in India; and
- iii. To examine the impact of Covid-19 on the economy of India and the increase in unemployment rate.

### **Database and Methodology:**

The present study is based on secondary data collected from different sources like Ministry of Health and Family Welfare, Ministry of Statistics and Programme Implementation, Centre for Monitoring Indian Economy (CMIE), etc. Besides, various journals and books related to the topic have been consulted with a view to develop a broad theoretical framework of the

research. The data so obtained have been processed and analysed using some simple but meaningful statistical techniques for objective and logical interpretation.

### **Analysis and Discussion:**

#### **Spatial Variation of Covid-19 in India**

With the increasing number of Covid-19 cases in India, nationwide lockdown was declared from 24<sup>th</sup> March, 2020 which affected the entire 1.3 billion population of India. The number of positive cases as well as the number of death cases also witnessed a sharp rise in India with the ongoing time. The total positive and death cases during the month of April, 2020 were 34,765 and 1,151 which reached 18,762,976 and 208,330 in April, 2021. Along with temporal variation, spatial variation has also been witnessed in different States and Union Territories of India with Maharashtra having the highest positive cases with 10,498 and 459 deaths till 30<sup>th</sup> April, 2020. It has been witnessed that some of the States and Union Territories like Dadra and Nagar Haveli & Daman and Diu, Lakshadweep and Nagaland still did not had a single Covid-19 cases till 30<sup>th</sup> April, 2020. The number of positive cases and deaths till 30<sup>th</sup> April, 2021 is still found to be the highest in the state of Maharashtra with 4,539,553 confirmed positive cases and 67,985 deaths followed by Kerala (1,533,9849), Karnataka (1,474,846), Uttar Pradesh (1,217,952), Tamil Nadu (1,148,064), Delhi (1,122,286) and Andhra Pradesh (1,084,336) having more than 10 lakhs positive cases. The other states and UTs having more than 5 lakh positive cases includes West Bengal (810,955), Chhattisgarh (713,706), Rajasthan (580,846), Gujarat (553,172) and Madhya Pradesh (550,927). Most of the North-Eastern States mainly the hilly States and some UTs witnessed a very low rate of confirmed Covid-19 cases. The lowest has been witnessed in Lakshadweep with only 2,662 positive cases and 4 deaths which is followed by Andaman and Nicobar Islands with only 5,875 cases and 67 deaths. The North-eastern states having the lowest positive cases is Mizoram with 6,019 cases and 14 deaths followed by Sikkim with 7,747 cases and 146 deaths till 30<sup>th</sup> April, 2021 (table 1). Thus, the Covid-19 spread in India witnesses both spatial and temporal variation.

**Table 1: Total Number of Covid-19 Positive Cases and Death in the States and Union Territories of India (as per April 30, 2021)**

States	Covid-19 Cases till April, 2020		Covid-19 Cases till April, 2021	
	Total Cases	Death	Total Cases	Death
Andaman and Nicobar Islands	33	0	5875	67
Arunachal Pradesh	1	0	18256	59
Assam	42	1	249926	1281
Bihar	422	2	454464	2480
Chandigarh	74	0	41923	465
Chhattisgarh	40	0	713706	8312
Dadra and Nagar Haveli and Daman and Diu	0	0	7334	4
Goa	7	0	88028	1146
Gujarat	4395	214	553172	7010
Haryana	339	4	474145	4118
Himachal Pradesh	41	2	96929	1460
Jharkhand	107	3	227450	2540
Karnataka	565	22	1474846	15306
Kerala	497	4	1533984	5259
Lakshadweep	0	0	2662	4
Madhya Pradesh	2625	137	550927	5519
Maharashtra	10498	459	4539553	67985
Manipur	2	0	31315	400
Meghalaya	12	1	16617	169
Mizoram	1	0	6019	14
Nagaland	0	0	13750	100
Puducherry	8	0	57427	793
Delhi	3515	59	1122286	15772
Punjab	480	20	364910	8909
Rajasthan	2556	58	580846	4084
Sikkim	0	0	7747	146
Tamil Nadu	2323	27	1148064	13933
Telangana	1016	26	435606	2261
Tripura	2	0	35169	396

Uttar Pradesh	2203	39	1217952	12238
Uttarakhand	55	0	174867	2502
West Bengal	758	33	810955	11248
Odisha	142	1	435513	2029
Andhra Pradesh	1403	31	1084336	7928
Jammu and Kashmir	581	8	172551	2253
Ladakh	22	0	13866	140
<b>Total</b>	<b>34765</b>	<b>1151</b>	<b>18762976</b>	<b>208330</b>

Source: Ministry of Health and Family Welfare

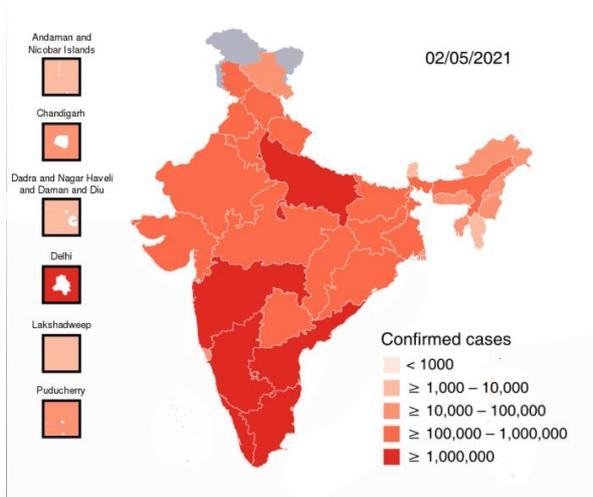


Figure 1: Map of Confirmed COVID-19 cases in India by states and UT

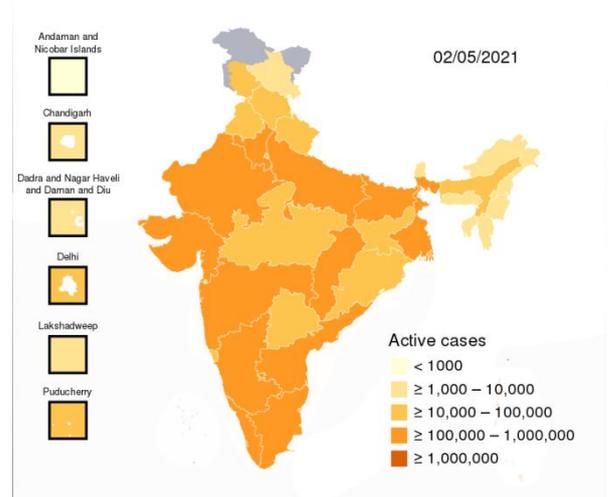


Figure 2: Map of Active COVID-19 cases in India by states and UT

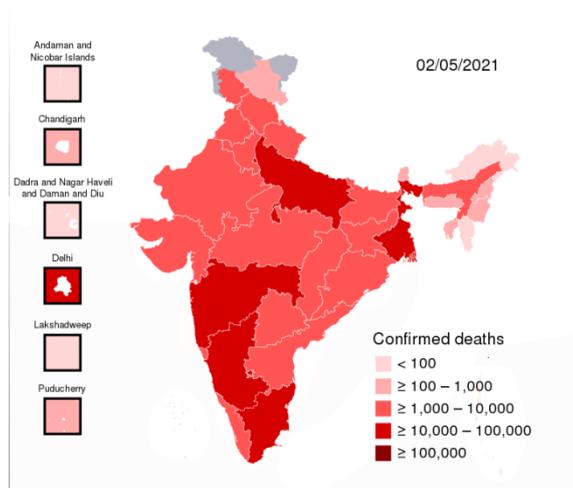


Figure 3: Map of Confirmed COVID-19 Deaths in India by states and UT (Source: Wikipedia)

### Trend of Covid-19 in India:

The trend of Covid-19 spread indicates that there was rapid surge of Covid-19 positive cases as well as death with the ongoing time. It has been witnessed that within a year after the first Covid-19 case in January, 2020, the positive cases reached to 10,746,183 in January, 2021 and 18,762,976 cases till April, 2021. The number of confirmed death cases also witnessed a high rise with 2,08,330 till April, 2021 (table 2).

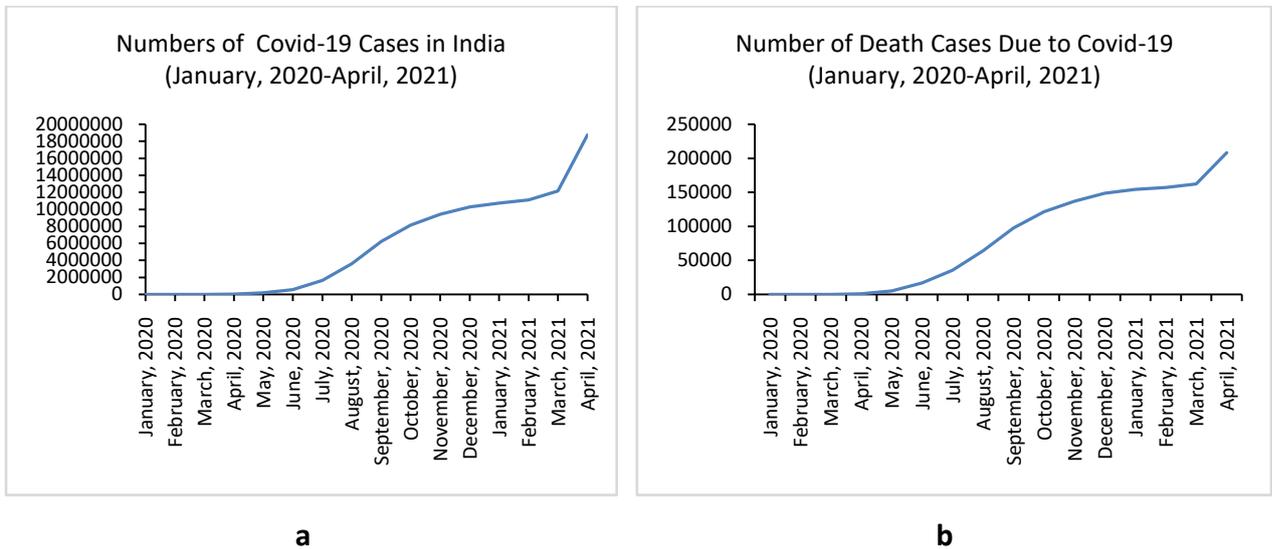
**Table 2: Trend of Covid-19 Cases and Death in India(January, 2020-April, 2021)**

Month	No. of Cases	No. of death
January, 2020	1	0
February, 2020	3	0
March, 2020	1,397	35
April, 2020	31,787	1,008
May, 2020	182,143	5,164
June, 2020	566,840	16,893
July, 2020	1,638,870	35,747
August, 2020	3,621,245	64,469
September, 2020	6,225,763	97,497
October, 2020	8,137,119	121,641
November, 2020	9,431,691	137,139
December, 2020	10,266,674	148,738
January, 2021	10,746,183	154,274
February, 2021	11,096,731	157,051
March, 2021	12,149,335	162,468
April, 2021	18,762,976	208,330

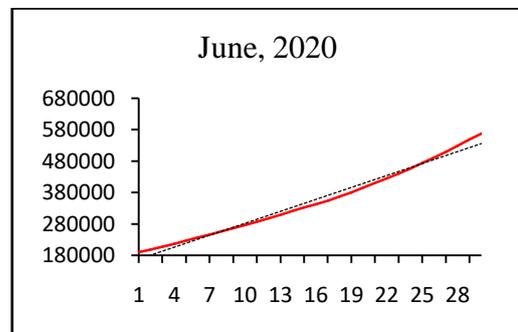
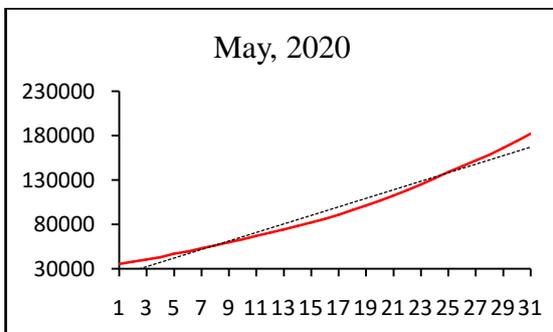
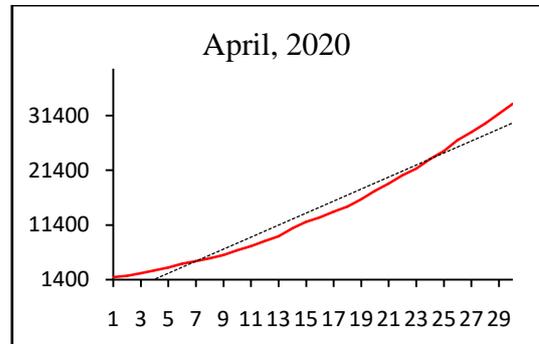
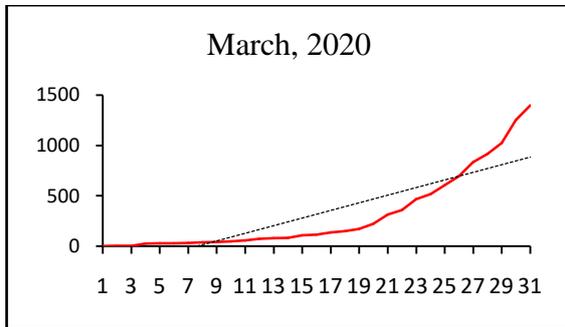
**Source:** Ministry of Health and Family Welfare

The confirmed positive cases and deaths in India witnessed a sudden spike as it crossed one lakh in the month of May, 2020 after its first infection in the month of January, 2020. The doubling period of confirmed cases also witnessed a sharp rise and in June, 2020 itself, the number of confirmed positive case reached 5,66,840. Thus, the doubling time of infections was witnessed to be shrinking with ongoing time. Till April, 2021, the number of confirmed positive reached to 18,762,976 with 2,08,330 deaths (table 2). The trend of Covid-19 cases and deaths

witnessed a flat curve till May, 2020 but after June, 2020, the curve showed a rising trend as the number of confirmed cases and deaths increase quite rapidly. The rapid rise in curve during the month of March, 2021 and April, 2021 again indicates the rising number of cases and deaths due to the second wave of Covid-19 (fig. 4a and fig.4b).



**Figure 4: Trend of Covid-19 Cases and Deaths Due to Covid-19 during January, 2020- April, 2021**



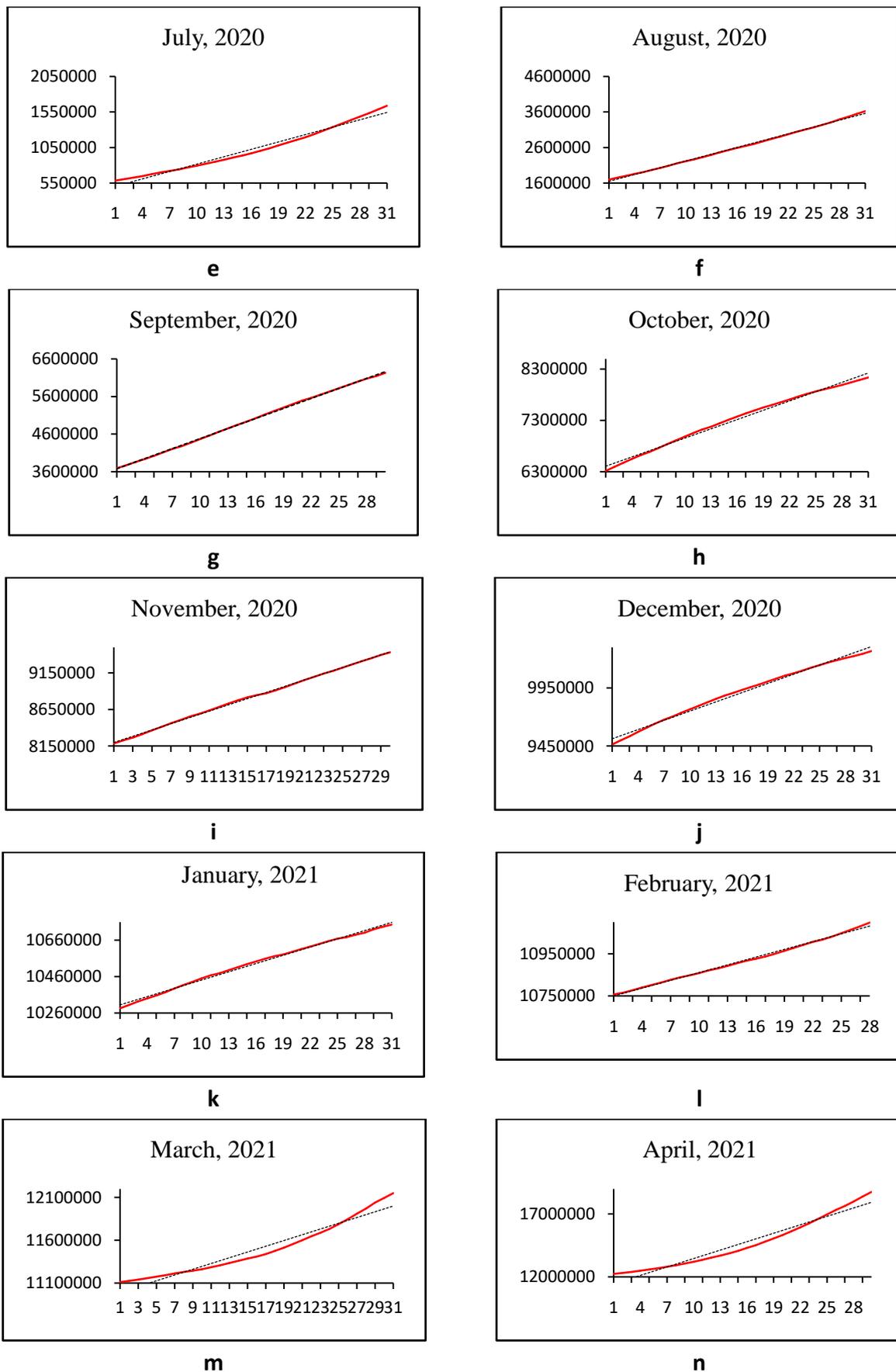
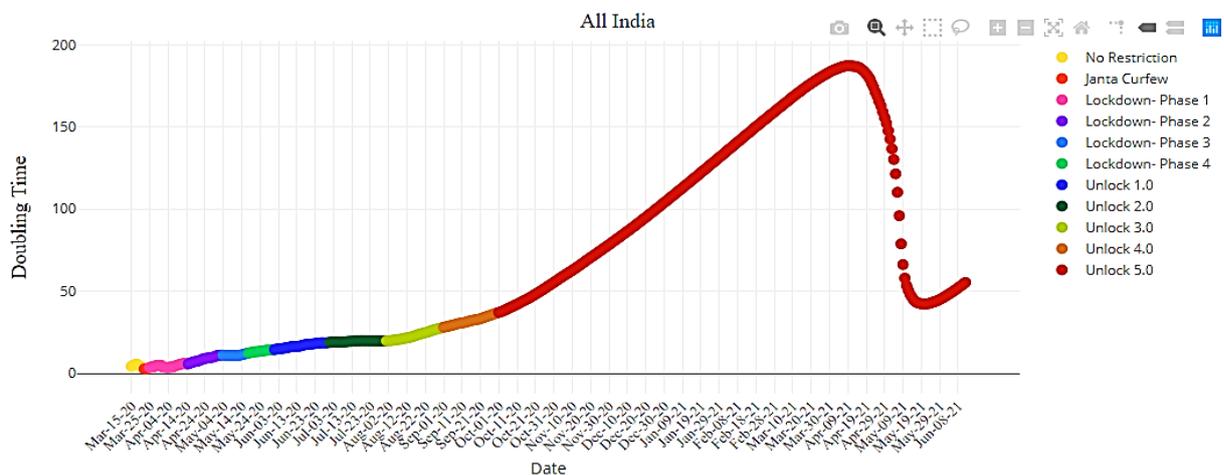


Figure 5: Monthly Trend of Covid-19 Cases and Deaths Due to Covid-19 during March 2020 to April, 2021

The month wise trend of Covid-19 cases from March, 2020 to April, 2021 shows a steep rise in the number of positive cases which indicates that the confirmed cases increased rapidly in India during the period and the doubling time of Covid-19 cases was also reduced (fig 5a-fig.5n). A higher doubling time is indicative of the fact that it takes longer time for the cases to double which means that the infection is spreading slowly. On the other hand, a lower doubling time indicates faster spread of the infection. In the case of various infections which are growing at a constant exponential rate, the doubling time is constant. However, in the COVID-19 situation, due to interventions like lockdown, social distancing and containment of hotspots of infection areas, the doubling time is found to fluctuate and it also varies between districts and states which maybe in different stages of infection.



**Figure 6: Doubling Time of Covid-19 Infections in India**

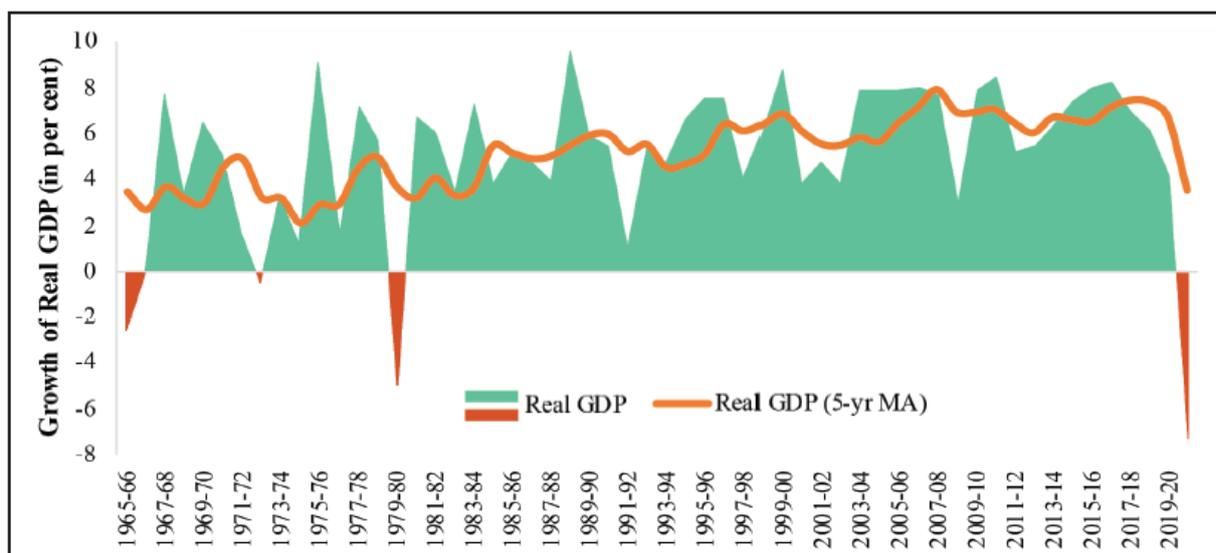
**(Source: Indian Statistical Institute, Bangalore)**

India's average doubling time of Covid-19 cases had been increasing since the end of July, 2020 and it reached a peak of 710 days on February 11, 2021. From then on, the doubling time started shrinking from 522 days by February 28, 346 days by March 15 and 139 days by March 31, indicating that COVID-19 cases were growing fast. As of May 3, COVID-19 cases were doubling in India every 35.7 days (Suresh, 2021).

**Impact of Covid-19 on the Indian Economy:**

The unprecedented increase in the Covid-19 cases has slowed down the economic progress in India with contraction in the GDP. As per the Economic Survey (2020-21), National Statistical Office (NSO) estimated a contraction of real GDP by 7.7 per cent in 2020-21 as

compared to the growth of 4.2 per cent in 2019-20. Since 1960-61, this is the fourth contraction in India's GDP. The contraction in GDP took place in the fiscal year in 1965-66, 1971-72 and in 1979-80 due to wars, drought and political instability prevailing in the country. The 2020-21 contraction in GDP is mainly attributed to the Covid-19 pandemic situation in the country and to recover from it will take a quite long time.



**Figure 7: Growth Rate of GDP from 1965-66 to 2019-20**

**(Source: NSO (Economic Survey, India, 2020-21))**

As per Centre for Economic Data and Analysis (CEDA), India's unemployment rate rose between 2008 (5.36 percent) and 2010 (5.65 percent) and then fell between 2013 (5.67 percent) and 2019 (5.27 percent). It then rose sharply to 7.11 percent in 2020 as a sharp decline was witnessed in the number of jobs in the formal sector as well as the informal sector due to the Covid-19 pandemic. The unemployment rate in 2020 is the highest since 1991.

As per Centre for Monitoring Indian Economy (CMIE) data, the unemployment rate in India increased with the rising cases of Covid-19 cases and it was found to be worse in the month of April, 2020 and May, 2020 with unemployment rate as high as 23.52 per cent and 21.73 per cent. The case in urban and rural unemployment rate was also found to be worse during those months. However, after June, 2020 the rate was found to fluctuate till December, 2020.

The year 2021 started on positive note for India as it recorded a significant fall in the unemployment rate with a decline of 6.5 per cent in January, 2021 from 9.1 per cent in December, 2020 and also an equally impressive increase in employment rate in January, 2021

as the employment rate surged to 37.9 per cent in January, 2021 as compared to 36.9 per cent in December, 2020. However, employment remained lower than it was before the pre-COVID levels.

**Table 4: Monthly Unemployment Rate (March, 2020- April, 2021)**

Month	Unemployment rate (in %)		
	Total	Urban	Rural
March, 2020	8.75	9.41	8.44
April, 2020	23.52	24.95	22.89
May, 2020	21.73	23.14	21.11
June, 2020	10.18	11.68	9.49
July, 2020	7.40	9.37	6.51
August, 2020	8.35	9.83	7.65
September, 2020	6.68	8.45	5.88
October, 2020	7.02	7.18	6.95
November, 2020	6.50	7.07	6.24
December, 2020	9.06	8.84	9.15
January, 2021	6.52	8.09	5.81
February, 2021	6.89	6.99	6.85
March, 2021	6.50	7.27	6.15
April, 2021	7.97	9.78	7.13
May, 2021	11.90	14.73	10.63

Source: Unemployment in India, A Statistical Profile (CMIE)

However, in May, 2021, the unemployment rate again shot up to a 12-month high at 11.9 per cent compared to 7.97 per cent in April, 2021 as most states remained under lockdown amid the second wave of Covid-19. Unemployment rate for June, 2020 had come down to 10.18 per cent after it touched its peak of 23.52 per cent amid severe lockdown in April, 2020. The high unemployment rate reflects joblessness across urban and rural areas. Urban and rural areas account for 14.73 per cent and 10.63 per cent unemployment rate, respectively during May, 2021 (CMIE).

**Conclusion:**

From the foregoing discussions, the following conclusions have been deriving:

- i. The trend of Covid-19 cases and deaths witnessed a flat curve till May, 2020 but after June, 2020, the curve showed a rising trend as the number of confirmed cases and deaths increase quite rapidly. The rapid rise in curve during the month of March, 2021 and April, 2021 again indicates the rising number of cases and deaths due to the second wave of Covid-19.
- ii. Along with temporal variation, spatial variation has also been witnessed in different States and Union Territories of India with Maharashtra having the highest positive cases with 4,539,553 confirmed positive cases and 67,985 deaths followed by Kerala (1,533,9849), Karnataka (1,474,846), Uttar Pradesh (1,217,952), Tamil Nadu (1,148,064), Delhi (1,122,286) and Andhra Pradesh (1,084,336) having more than 10 lakhs positive cases.
- iii. Most of the North-Eastern States mainly the hilly States and some Union Territories witnessed a very low rate of confirmed Covid-19 cases. The lowest has been witnessed in Lakshadweep with only 2,662 positive cases and 4 deaths which is followed by Andaman and Nicobar Islands with only 5,875 cases and 67 deaths. The North-eastern states having the lowest positive cases is Mizoram with 6,019 cases and 14 deaths followed by Sikkim with 7,747 cases and 146 deaths till 30th April, 2021. Thus, the Covid-19 spread in India witnesses both spatial and temporal variation.
- iv. The doubling time of Covid-19 cases started shrinking from 522 days by February 28, 346 days by March 15 and 139 days by March 31, indicating that cases were growing fast.
- v. The unprecedented increase in the Covid-19 cases has slowed down the economic progress in India with contraction in the GDP. As per the Economic Survey (2020-21), National Statistical Office (NSO) estimated a contraction of real GDP by 7.7 per cent in 2020-21 as compared to the growth of 4.2 per cent in 2019-20. Since 1960-61, this is the fourth contraction in India's GDP.
- vi. The unemployment rate again shot up to a 12-month high at 11.9 per cent in May, 2021 compared to 7.97 per cent in April, 2021 as most states remained under lockdown amid the second wave of Covid-19.

**References:**

1. Gupta, R. and Pal, S.K. (2020): Trend Analysis and Forecasting of Covid-19 in India, Medrxiv, The Preprint Server For Health Sciences, <https://doi.org/10.1101/2020.03.26.20044511>
2. Roy, S., Bhunia, G.S. and Shit, P.K.(2020): Spatial prediction of COVID-19 epidemic using ARIMA techniques in India, Model Earth Syst Environ, 2020, Jul 16:1-7, doi:10.1007/s40808-020-00890-y
3. Suresh, N (2021): Key COVID Indicators Surged From Feb 2021 But Govts Failed To Act, India Spend, Retrieved on 30 May, 2021, <https://www.indiaspend.com>
4. Vadrevu, K. P., Eaturu, A (2020): Spatial and temporal variations of air pollution over 41 cities of Indiaduring the COVID-19 lockdown period, Scientific Reports, 10:16574, <https://doi.org/10.1038/s41598-020-72271-5>.
5. Vhanalakar, S. A., Vanalakar, S. A. and Bhagat, C. P. (2020): Covid-19: Impact and Responses, Bhumi Publishing, Kolhapur, Maharashtra, India

## **EFFECTS OF HAND SANITIZERS ON HUMAN BEING IN COVID-19 PANDEMIC**

**U. W. Fule**

Hutatma Rashtriya Arts and Science College,

Ashti, Dist. – Wardha, M.S., India

Corresponding authors E-mail: [ujwalafule@gmail.com](mailto:ujwalafule@gmail.com)

---

### **Abstract:**

Hand Washing and use of hand sanitizers are important interventions in disease COVID-19 prevention. Engaging in frequent hand washing is especially effective in preventing the spread of viruses as this removes microbes and prevents the spread to others. Hand dermatitis, however is a common occurrence in certain occupation such as health care workers, with the onset of the SARS- COV2 (COVID-19) Pandemic. Sanitizers have become widely used due to the COVID-19 global health crisis. These products are at the top of people grocery lists whatever they head out to stock up on their essentials. However, as much as these household products keep us clean and prevent transmission of the virus excessive use of these can be harmful. In the study, our main focus is to highlight the effects of hand washing and the use of hand sanitizer on skin, Respiratory system , immune system, hair, fertility, hormonal problem.

**Keyword:** Hand sanitizer, COVID-19, Human health hazards, Pandemic.

---

### **Introduction:**

World Health Organization (WHO) has declared the outbreak of Covid-19 now to be pandemic. This has been a great concerned to all human being health, where mortality has been found to be increased. Being so deadliest WHO and Health Ministry advised all to be home and follow the guidelines regarding physical distancing. While the origin of outbreak and its transmission pathway are yet to be asserted, we know diseases passed from animals to human (Zoonotic Diseases). Currently, organization such as the WHO do not believe that the Novel corona virus is airborne. SARS- CoV-2, which causes COVID-19, is one of many corona virus. These can cause illness in humans and animals, and they are highly contagious.

Corona virus outbreak was first reported in Wuhan, China on 31 December, 2019. WHO is working intimately with Global specialists, governments and other wellbeing association to give guidance to the nations about preparatory and preventive measures. The episode of Corona infection pandemic has made a worldwide wellbeing emergency that profoundly affects

the manner in which we see our World and our regular live. Another class of Corona infection, known as SARS-COV-2 (severe intense respiratory condition Covid 2) has been discovered to be liable for event of this illness. To the extent the historical backdrop of Human development is worried there are examples of serious flare-ups of sicknesses brought about by various Viruses. Coronavirus has quickly spread all throughout the planet presenting huge wellbeing, monetary, natural and social difficulties to the whole human populace. The Covid episode is seriously disturbing the general public.

At the point when the Covid began spreading individuals were encouraged to wash their Hands appropriately and every now and again to dispose of germs and forestall the transmission of the Virus. People are principle transmission wellspring of SARs-COV-2 through human to human cooperation, in the event that, any contaminated individual with gentle or even no side effects interact with sound individual , up until now, no prescription or antibody is accessible adapt to this novel Corona infection and disease rate is expanding radically across the globe. In current situation preventive measures and sound way of life with productive resistant System have been proposed by WHO to battle and remain protected from COVID-19. Variation of compelling hand cleanliness is fundamental, where perhaps the best guidance by WHO is to wash or clean your hands as often as possible with liquor hand sanitizer, separately. WHO suggested liquor based hand sanitizers are chiefly made up from Ethanol, isopropyl alcohols, hydrogen peroxide in various mix (WHO 2020).

This readiness may get poisonous to human wellbeing and climate when delivered By vanishing (butcher et. al 2014). It is perceived that ingestion of low centralization of Hydrogen peroxide (3% arrangement) is liable for minor gastrointestinal lot disturbance and in couple of cases it is additionally answerable for entry vein digestion. Ingestion of Isopropyl liquor accidently or purposely prompts serious respiratory or focal sensory system sadness.

Current audit was planned with primary goal to feature the harmful and genuine wellbeing dangers to human wellbeing and climate by regular utilizing hand cleanliness Products with liquor based definition. Expanded utilization of hand rubs as preventive Measures of COVID-19 are not natural amicable and risky for human wellbeing. It is encouraged to wash hands with antimicrobial cleanser after regular spans to dispose of conceivable contamination by this pandemic.

When they cannot use soap, alcohol based hand sanitizers with at least 60% Alcohol content serve as a great alternative, especially when running errands. Even so, too much alcohol can have adverse effects on the skin, Immune system, fertility, hair, Respiratory system, central nervous system, Hormonal problem etc.

### **Effects of Hand Sanitizers:**

#### **Effects on Skin:**

##### **Dry and broken skin:**

The alcohols present in hand sanitizers include isopropyl , ethanol And n- propanol , which can dry and damage skin cells. When this happens The risk of getting contact dermatitis is higher.

##### **Skin irritation:**

Excessive use of hand sanitizers, which contain chemicals such as Alcohol, chlorhexidine, chloroxylenol, and triclosan, can cause irritation as It strips away the skins natural oils. When the skins natural moisture barrier gets disrupted, it becomes more susceptible to bacteria.

##### **Increase risk of Eczema:**

Using hand Sanitizer that contain at least 60% alcohol, increased contact with irritants and allergens may increase the risk of hand dermatitis or eczema. This commonly manifest on the skin with redness, dryness, cracks, and even blisters that cause itch or pain.

##### **Effects on immune system:**

A human body that is exposed to a clean environment early in life can have a weaker immune system later in life. A study showed that high level of tricolsan in children and teens made them vulnerable to allergies and hay fever. Our immune system work on a different programming its auto-tuned to fight diseases. It responds effectively against illnesses when sickness causing microbes or infections assaults the body. In a circumstance of outrageous clean climate, Immune framework in a way track down no unsafe substance to neutralize and consequently, it brings about its more vulnerable performens.

##### **Effects on Fertility:**

Some hand sanitizers are composed of alcohol such as ethyl alcohol, as an active ingredient that functions as an antiseptic. However there are some non-alcohol based hand sanitizers that consider of an antibiotic compound called triclosan or triclocarbon. Several research studies have reported that triclosan is health hazard as its overuse has negative effects on fertility, fetal development and rates of asthma.

**Effects on hair:**

In an emergency using hand sanitizer on the hair and scalp would most likely turn out okay, but using hand sanitizer on the hair or scalp other than for a major emergency will most likely be drying, irritating and make hair feel crunchy or sticky.

**Effects on Hormone:**

Triclosan present in a hand sanitizer also causes hormone problem. Triclosan has other side effect it's responsible for hormonal disruption in body. A few studies say that these compounds cause bacteria to adapt its antimicrobial conditions. This further causes antibiotic-resistant strain leading to hormonal fluctuation in body. This has raised serious concerns among health professional regarding the use of hand sanitizers. They believe that any disruption to the natural environment inside the body has detrimental health effects. This hormonal imbalance can lead to infections and diseases.

**References:**

1. American Association of poison control centers (AAPCC) Hand Sanitizer: (2020): <https://aapcc.org/track/handsanitizer>
2. Arches J.R., Wood D.M., Tizzard z., Jones A.L., Dargan P.I.(2007): Alcohol hand rubs: hygiene and hazard.335(7630)Pp 1154-1155
3. Barrett M.J., Babl F.E.(2015): Alcohol based hand sanitizer: a potentially fatal toy. Med.J.203(1) Pp 43-44
4. Bryce E.A., Spence D., Roberts F.J.(2001): An in use evaluation of an alcohol based presurgical hand disinfectant. Infect control Hosp Epidemiol, 22635-639
5. Elis-caleo T., Burstein S.(2017): A case of Hand sanitizer Intoxication. Proceeding of UCLA Healthcare Pp 21
6. Gimenez E.R., Valle Jo N.E., Roy E., Lis M., Izurieta E.M., Rossi S., Capuccio m.(1998): Percutaneous alcohol intoxication. Clin. Toxicol. Vol.1 Pp 39-48
7. Hayat A., Munnavar F.(2016): Antibacterial effectiveness of commercially available hand sanitizers. Int. J. Biol. Biotechnol 13(3) Pp 427-431
8. Huang C., Wang Y., Li X., Ren L., Zhao J., Huy (2020): Clinical features of patients infected with 2019 novel coronavirus in Wuhan, china. Lancet.395 Pp 497-506

9. Lachenmeier D.W.(2008): Safety evaluation of topical application of ethanol on the skin and inside oral cavity. *J.occup.Med. Toxicol.* 3:26.doi:10.1186/1745-6673-3-26
10. Morgan W. (2020): Heavy use of hand sanitizer boosts antimicrobial resistance. <https://phys.org/news/2020-04-heavy-sanitizer-boosts-antimicrobial-resistance.html>.
11. Pilot S.J., Gao W., Buultjens A. H., Monk I.R., Guerillot R., Cartes G. P.(2018): Increasing tolerance of hospital *Enterococcus faecium* to handwash alcohol. *Sci. Transl. Med.*10(452)doi:10.1126/Sci transl med.
12. Slaughter R. J., Mason R.W., Beasley D.M., Vale J.A., Schep L.J. (2014): Isopropanol poisoning. *Clin. Toxicol.* 52: Pp 470-478
13. World Health organization (2020): WHO guidelines on hand hygiene in health care: first global patient safety challenge clean care is safer care.

## CASE STUDY OF ASSESSMENT AND OCCURRENCE OF COVID 19 IN ENVIRONMENT

Sarath Chandra Koppolu<sup>1</sup>, Praveen Kumar M\*<sup>2</sup> and Noopur singh\*<sup>3</sup>

<sup>1</sup>Advance Institute of Science and Technology, Dehradun, Uttarakhand

<sup>2</sup>Agriculture Officer, ACFS, Government of Kerala, India

<sup>3</sup>Plant Biotechnology, Graphic Era (Deemed to be University), Dehradun, Uttarakhand

\*Corresponding authors E-mail: [pkumarapm@gmail.com](mailto:pkumarapm@gmail.com), [noopurs1090@gmail.com](mailto:noopurs1090@gmail.com)

---

### Abstract:

Coronavirus disease 2019 (COVID-19) was first identified in China. The global outbreak of this virus is affecting every part of human lives. It is a respiratory illness caused by the novel virus, severe acute respiratory syndrome (SARS-CoV-2). The outbreak of COVID-19 resulted in raising concerns globally. WHO has declared the global health emergency. Movement has been stopped and entire world remains in static state. Soon after the identification of the deadly virus, questions were raised like the impact of various factors like social and environment on the transmission of the virus and range of infectivity. It is essential to understand the linkage between these factors and the COVID-19. SARS-CoV-2 primarily transmitted through direct person-to-person transfer by infected respiratory droplets or aerosol, when the infected person talks, breathe, sing or cough. Highly infectious individual possesses high concentrations of the virus in the form of aerosols, especially after developing symptoms and can release tens to thousands of infectious virus particles per minute in air. Studies have reported that the stability of this virus depends on deposition onto surfaces, relative humidity, temperature, and droplet size along with some other social factors. However, contact with contaminated surfaces (fomites) may also play a significant role. Lot of research has done on Covid behavior on different surfaces and the results shows that the SARS CoV2 existence varies with different surface type (stainless steel, plastic, cardboard etc.). Assessment of the risk posed by surface contamination in indoor environments is significantly high. To reduce the number of COVID-19 cases various countries contributing their part in developing vaccines and therapeutics. Scientists suggest that to control virus infection it is important to limit crowd sizes, maintain social distancing, wear masks and living in well-ventilated settings. To stop the spread of this virus, takes to precautionary route like wearing a mask, usage of gloves and hand sanitizer on a daily basis. This study summarizes various observations made regarding the influences of abiotic factors such as climate, temperature, humidity, wind speed, air, and water quality, fomites and biotic factors like age, sex, gender, blood type, population density, other characteristics etc. on the transmission, persistence and infection of the newly discovered coronavirus (SARS-CoV-2). Further, the potential modes of virus transmission that could affect the population and various factors that influence the virus transmission, disinfection measures and the assessment and management of the COVID-19 outbreak have been discussed.

---

## **Introduction:**

In December 2019, a new infectious respiratory disease emerged in Wuhan, China and was named as COVID-19 (corona virus disease 2019) by World Health Organization (WHO). The WHO has set up an IMST (incident management support team) in Jan. 2020 in response to the recently reported numbers of cases with Covid. The committee of WHO declared a global health emergency on the last week of January 2020. As the early cases of infection with COVID-19 in Wuhan were associated with big seafood and live animal markets that indicate the transmission of the virus from animals to humans. But later found that people who had not been exposed to animals are affected with this virus indicates the transmission from human to human.

The infection is caused by a class of corona virus, known as SARS-CoV-2 (severe acute respiratory syndrome corona virus 2). It is basically a single stranded RNA virus, it is seen that this virus infects not only humans but also a wide range of animals as well. The SARS-CoV-2 is a spherical virus and belongs to beta-corona virus which is one of the SARS-CoV virus groups. The structure of this virus has 4 parts, the nucleocapsid protein (N), the spike protein (S), a small membrane protein (SM) and the membrane glycoprotein (M). The spike protein which binds to the human cells and allows the virus to enter the human body. (The spike protein of novel corona shares the identity with the spike protein of bat). The spike protein of SARS-CoV-2 binds to the cellular receptor in humans called angiotensin converting enzyme 2, which is the entry point into human cells. It has a higher binding affinity than SARS and other virus groups which lead to massive human to human transmission.

The novel corona virus is highly contagious in nature and easily unpredictable. As on May 25, 2021, there have been a minimum of 34,69,530 deaths and quite 16,71,12,771 confirmed cases around the world so far. The novel corona virus has four stages of transmission namely, imported cases (stage 1), local transmission (stage 2), community transmission (stage 3), and transmission out of control (stage 4). Transmission refers to the transmission of microorganisms from one infected individual to another healthy person, either through direct contact, through droplets, or through surface contamination.

The incubation period ranges from 1-14 days but most commonly around five days with the symptoms of fever, tiredness, and dry cough. Some are observed with aches, nasal congestion, and few other symptoms. Majority of the infected people will be recovered with proper medication but, older people with medical problems like high blood pressure, heart problems or diabetes, are more likely to develop serious illness.

COVID-19 is said to be a zoonotic disease with intermediate host. The reserve host is believed to be a bat. The direct transmission this virus can be direct in the form of droplets through sneezing, coughing, speaking and accidentally inhaling the droplets of an infected person. The indirect transmission is when healthy person comes to contact with these droplets deposits on the dead surface. Even fecal matter found to be acting as transmitting source of the virus from infected person.

WHO has published regulations on public health and social measures like maintaining social distancing, proper sanitization, usage of N95 masks etc. Some governments imposed an enforced quarantine and lockdown, travel ban etc. Covid 19 has rapidly spread around the world, causing health, economic, social and environmental challenges.

The corona virus outbreak is shows adverse effect on the global economy. Apart from the negative social and economic impacts these regulations brought several environmental positive changes in several countries. Some of them were reduction in the air pollution, an improved air quality by reduced the emission of carbon, nitrogen, sulphur and GHGs. Ozone levels in ambient air have been found to increase because of the reduction in nitrogen emission. Water pollution seems to be reduced. But we do seem that there is tremendous increase in the use of persistent chemicals due to the raise in the usage of sanitizers, disinfectants, and antibiotics. The solid waste, such as increase of medical waste, careless use and disposal of disinfectants, mask, and gloves; and untreated wastes generated due to the COVID-19 pandemic was found to increase both qualitatively and quantitatively, continuously endangering the environment. WHO even state that the rate of Covid transmission is significantly high in places where these “3Cs” overlaps. 3Cs includes Crowded places, Close contact and Confined with poor ventilation.

**Mode of transmission:**

WHO states that the rate of Covid transmission is significantly high in places where these “3Cs” overlaps. 3Cs includes Crowded places, Close contact and Confined with poor ventilation. The virus spread in poorly ventilated and/or crowded indoor settings, where people usually tend to spend more time. The virus spread occur through direct contact, respiratory droplet, aerosols, fomite (contaminated surfaces), fecal matter, blood borne, mother to-child, and animal-to-human transmission.

**Contact and Droplet transmission:**

Respiratory droplets refers to the size  $>5-10\ \mu\text{m}$  in diameter whereas aerosols refers to the droplets size  $\leq 5\ \mu\text{m}$  in diameter. These respiratory droplets transfer from infected person through cough, sneezes, talks or sings to a healthy person when he/she comes to direct or indirect contact with the infected once. Current evidence enlightens us that the virus spreads majorly between the people who are in close contact with one another, typically within the short range of 1m which leads to the direct inhalation of the aerosols or droplets or by touching surfaces that have been contaminated by the virus and then touching the eyes, nose or mouth without cleaning their hands of the healthy person.

**Airborne transmission:**

Aerosols/droplet nuclei refers to the droplets size  $\leq 5\ \mu\text{m}$  in diameter. This transmission is referred as the presence of microbes (in this case the virus) within droplet nuclei, with particles of diameter  $<5\ \mu\text{m}$  is considered and can remain in the air for long period of time. WHO and the scientific community actively working on whether SARS-CoV-2 can spread through aerosols. The theories of flow physics and the physics of exhaled air created hypotheses about the transmission through aerosols. These theories suggest that 1) a number of microscopic aerosols ( $<5\ \mu\text{m}$ ) is generated from respiratory droplets by evaporating and 2) Coughing, breathing, singing, and talking can results in exhaling aerosols. So when a healthy person comes in contact either direct or indirect with these droplets and happened to inhale them and if the virus containing nuclei have the potential to cause disease then the person will be infected with virus.

**Fomite transmission:**

Infected individuals expel the respiratory secretions or droplets which could contaminate the objects and the surface around the person which leads in creating fomites (contaminated surfaces). SARS-CoV-2 virus can be detected on those surfaces for wide range of period from hours to days; it may vary for different type of surface and at different temperature and humidity which will be discussed further. Fomites can be any objects like stethoscope, thermometer, cloths, plastic, stainless steel and other objects which are usually found on home or office.

**Other modes of transmission:**

SARS-CoV-2 virus also been detected in biological samples like the urine and feces of some of the infected patients. So there might be a transmission of virus through feces and

urine. However there is no enough evidence of blood borne transmission and mother to fetus, breastfeeding etc. It is expected to believe that there is a possibility of transmission virus from human to animals. As there were reports shows that cats, dogs even lions where tested positive for Covid. Howeverthere is no evidence that these animals can spread the virus.

**Survival of Covid on different medium:**

Since SARS CoV2 has several mode of transmission like through droplets and through other contaminated surfaces. Several experiments were done to know that how long virus can stay infectiously active which means how long that virus has the capacity to transmit the disease?

**In air:**

COVID-19 virus usually transmits through liquid droplets containing viruses. These droplets were produced by the coughing symptom of an infected person and when healthy person happened to inhale these droplets present in air or any contaminated surface eventually resulting in the transmission of the virus. There is no scientific evidence regarding the air borne transmission of SARS-CoV2, because if the virus get transmitted through air the spread of virus might be humongous with the help of air current which is not the case. Several experiments were conducted to identify the life span of SARS CoV2 survival in air. Evidences show so far that Corona virus droplets had a half life of over an hour to three hours and more in laboratory. But in real world there were lot of other factors to be considered like the effect of atmosphere temperature and humidity.

**Other contaminant surfaces:**

SARS CoV2 is spread when a healthy person comes in contact with the contaminated objects. Scientists conducted several experiments on different objects at different temperature (with respect to atmospheric temperature) to identify the survival of this virus. When we observe the results, At 20 °C, SARS-CoV-2 on glass, polymer, stainless steel, vinyl and paper notes (all non-porous surfaces tested) seen even after 28 days and on porous material (porous material) 14 days. At 30 °C, virus can still survive for 3 days for cotton cloth and vinyl, and 7 days on stainlesssteel, polymer notes and glass. When temperature even increased to 40c , the virus start to show its instability and survival ratedecreased. Which leads to the theory that hot and humid climate might reduce the transmissionof virus and this topic is discussed further.

Hence it is clear evident that Infectious virus can be detected on cardboard for up to 24hours, on copper surfaces for up to 4 hours, and on plastic and stainless steel for at least 72 hours. It seems that SARS-CoV-2 virus is more stable on plastic and stainless steel than on copper and cardboard. As these experiments were conducted in laboratory so, survival of virus not necessarily mimics the exact results in real world. This kind of information gives a clear indication that focus should be kept on decontamination practices to reduce the risk of virus transmission.

#### **Temperature effect on Covid 19:**

Temperature is an essential factor in living environment, which play a vital role in public health in terms of epidemic control and development. There is a relationship between temperature and air humidity to the life of viruses and bacteria. It is observed that the influenza virus dies more rapidly in conditions of high humidity associated with fast moving air. Studies shows that there is a specific temperature that benefits the virus growth i.e., lower temperatures, so during winter months in which decrease in the humidity level so does the air movement are more suitable for the spread of respiratory infections. It is expected to believe that there is a significant reason that respiratory virus usually show seasonal variations. It is seen that the infections from respiratory and influenza virus are more common and susceptible to winter season areas of the world. Usually people during winter spend most of their time in indoors, so when dry, cool air meets warm air from indoors, results in reduction of the air's humidity inside which leads to the stability of virus and ultimately virus transmits through aerosol. So during summer conditions water droplets dries up faster when temperature, humidity rise leads to the reduction in spread of the virus.

During the initial studies conducted on the virus indicates that the transmission of COVID-19 is affected by temperature. It is observed through various research that high temperature and high relative humidity significantly reduce the transmission of COVID-19, the suitable temperature range for covid19 survival is (13–24 °C), among which 19 °C is the most effective temperature for human transmission because at this temperature virus seen to exist in surface nearly 60 days. The humidity range is 50%-80%, of which about 75% humidity is beneficial to the survival of the corona virus. In April 2020, the U.S. Department of Homeland Security issued a report which states that increased summer temperatures, humidity, and effect of sunlight can act as a barrier to COVID-19 transmission. When experiment conducted on the laboratory-generated aerosol of SARS-CoV-2 (covid19) shows its stable at a relative

humidity of 53% at room temperature, 23°C (73°F). Degeneration of virus is not seen until after 16 hours and this explains its higher levels of airborne infectivity.

Laboratory studies cannot predict how a virus will behave in the real world. As these findings became more controversial, because in The United States it is recorded that most number of the cases during its hot and humid summer. Thus further conducted studies shows the links between COVID-19 cases and temperature are less certain. Similarly, majority of researchers report says that no effect of temperature on COVID-19 transmission or deaths. However, higher temperatures do not cause a further decline in transmission of Covid 19, which may account for some of the disparities.

Even on the WHO website, it states that Covid 19 is still possible to transmit in hot climate zones. Even though there is a slight possibility that warmer conditions may reduce the spread of transmission but relying only on weather changes alone in reducing the transmission of COVID-19 are unlikely to be sufficient. Some of the other factors expected to affect the transmission of COVID-19 are i.e., social distancing, age, GDP per capita, ethnicities, poverty, diabetes, coronary heart disease, health physical inactivity, consumption of alcohol, smoking tobacco and Other major aspects that involve in transmission of the virus can be population density, migratory flow, host immunity, quality of medical care etc.

**Factors effecting Covid 19 transmission in nature:**

**Environmental factors:** Water, food, climate, sanitation facility

**Social factors:** Social distancing, age, poverty, population density, GDP per capita, migratory form

**Health factors:** Host immunity, chronic heart disease, diabetes, physical inactivity, alcohol consumption, smoking tobacco or taking it in any other form and quality of health care

Covid measures to be taken to reduce the spread naturally chemically;

**Physical measures:**

There were lots of measures to be taken care to reduce the risk of infection.

- Washing hands regularly with soap and water or cleaning them with alcohol-based hand sanitizer.
- Maintaining at least 1 meter social distancing.
- Frequent touching on our face is avoided
- Cover your mouth and nose with a mask N95, FFP2 or FFP3 respirator.

- Use of PPE kits and gloves is recommended.
- If any symptoms shown or in direct contact with the infected person, then the person should be quarantined.
- Avoid crowded places and poor ventilated areas
- Refrain from smoking and other activities that may weaken the lungs is advisable.
- Practice physical distancing and avoiding unnecessary travel.
- Avoid touching surfaces especially in the public facilities and using of standard disinfectants is preferred.
- Covering our coughs and sneezes with a tissue or a cloth and further tissue is disposed at the close bin and immediately use sanitizer.
- Get vaccinated when your turn comes.

**Chemical measures:**

Various researches have shown that COVID-19 virus can be active on the surfaces up to several days and responsible for the transmission of virus in public. Hence, in order to minimize the spread of infection, public health agencies (such as WHO) has encouraged and released certain guidelines that individuals should follow such as maintaining high levels of personal hygiene by frequently washing their hands with soap or by using disinfectants like sanitizers that can deactivate and kill the virus and eliminate its infectivity. Multi-user items like shopping carts, elevators buttons, doors knobs etc are considered high risk areas for transmitting the virus and require continuous sterilization to kill the virus. Disinfectants are used to sterilize surfaces. The ability of a disinfectant to deactivate a microbe depends on the mode of action of the chemical, type of surface, and the intracellular vulnerability.

Some measures that are taken care during the time of disinfection:

- The disinfectant and its concentration should be carefully selected to minimize the damage on surfaces or any toxic effects
- Combining disinfectants should be avoided because these mixtures can cause respiratory irritation.
- Take care of kids and pets while disinfection period.
- Wash your hands after immediate use of disinfectant.
- Keep lids tightly closed after the use.
- Do not clean and re-use the gloves or any other disposable waste.

- Use of PPE kits and covering the whole body during the time of disinfection.
- Eye protection and medical masks may also be needed to protect against chemicals.

There is lot of disinfectants available in market, with different organic compounds. some of the disinfectants with their concentration that is used to deactivate the virus are discussed below.

#### **Ethanol and isopropanol:**

Ethanol and isopropanol are the main alcohols used as disinfectants as wide range of microbes (broad spectrum of bacteria, viruses, and fungi). The activity of these alcohols is adversely depends on their concentration and hydro affinity nature. These alcohols are capable of destroying coronavirus within 30s at 70–90% concentrations.

It is believed that the alcohol causes serious damage to membrane in protein and leads to denaturing the virus protein and ultimately damage the RNA. They were generally used in handsanitizers.

#### **Peroxide-based disinfectants:**

Such as hydrogen peroxide and peroxy acetic acid widely used in medical device disinfection because of its high potency. These peroxides generally target the oxidation of thiol groups and disulfide bonds of proteins leads to denaturation of protein resulting in killing the virus. Hydrogen peroxide can deactivate SARS-CoV within a minute at 1–3% concentrations and it can deactivate SARS-CoV within a minute.

#### **Chlorine-releasing agents:**

Household bleach is one of the commonly used domestic disinfectants due to its cheaper availability with low toxicity. The active chemical of bleach is sodium hypochlorite which presents at a concentration of 3–6.

#### **Formaldehyde and Glutaraldehyde:**

Both compounds are high-level disinfectants and used to disinfect the medical devices and surgical equipments. These aldehyde usually disinfect bacteria and viruses by alkylating their proteins and nucleic acids. They are active against coronavirus within 2mins of exposure of time at a concentration range 0.5–3% .

#### **Iodine-releasing agents:**

Iodophores (iodine-releasing agents) release elemental iodine in aqueous solution, this ion has the ability to penetrate the membrane of protein and attack at the sulfuryl and disulfide

bonds which further damages the nucleic acids. Research has shown that povidone-iodine has the capacity to deactivate SARS-CoV within seconds at a concentration of 1% or less.

**Quaternary ammonium compounds:**

Quaternary ammonium compounds (QACs) are widely used and most effective disinfectants. These QACs are organic-based salts. These compounds are active against corona viruses and can deactivate it within a minute or less time of exposure at less than 1% concentration. Since in a large area, it is not easy to disinfect on a regular basis due to various limitations like resource, chemical, workers etc. It is advisable that one should follow personal sanitization like regularly washing hands with soap or use of sanitizer, avoiding frequent touching the face and other contaminated surfaces. These are the primary prevention approaches to reduce the risk of potential transmission of virus which are associated with surface contamination.

**References:**

1. <https://www.who.int/teams/regulation-prequalification/eul>
2. <https://www.osha.gov/coronavirus/standards>
3. <https://www.osha.gov/coronavirus/control-prevention>
4. <https://iwaponline.com/jwh/article/18/5/843/75589/Chemical-disinfectants-of-COVID-19-an-overview>
5. <https://www.who.int/news-room/q-a-detail/coronavirus-disease-covid-19>
6. <https://www.nejm.org/doi/10.1056/NEJMc2004973>
7. <https://ec.europa.eu/jrc/en/science-update/do-environmental-factors-influence-covid-19-outbreaks>
8. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19-how-is-it-transmitted>
9. <https://coronavirusexplained.ukri.org/en/article/pub0008/>
10. <https://www.who.int/news-room/q-a-detail/coronavirus-disease-covid-19-cleaning-and-disinfecting-surfaces-in-non-health-care-settings>
11. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7195988/>
12. <https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions>
13. <https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection->

prevention-and-control

14. <https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations>
15. <https://www.medicalnewstoday.com/articles/how-does-weather-affect-covid-19>
16. <https://www.healthline.com/health-news/weather-doesnt-matter-covid-19-can-spread-in-warm-or-cold-temperatures>
17. <https://link.springer.com/article/10.1007/s10668-020-00818-7>
18. <https://pubmed.ncbi.nlm.nih.gov/32335408/>
19. <https://www.ncbi.nlm.nih.gov/pmc/?term=effect+of+temperature+on+covid>
20. [https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters?gclid=EAlaIQobChMIItYv-0s3m8AlVhnwrCh0aTgaOEAAAYASAAEgKDefD\\_BwE#climate](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters?gclid=EAlaIQobChMIItYv-0s3m8AlVhnwrCh0aTgaOEAAAYASAAEgKDefD_BwE#climate)
21. <https://www.frontiersin.org/articles/10.3389/fpubh.2020.554964/full>
22. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7793668/>
23. [www.sciencedaily.com/releases/2020/11/201102155409.htm](http://www.sciencedaily.com/releases/2020/11/201102155409.htm)
24. <https://www.cebm.net/covid-19/do-weather-conditions-influence-the-transmission-of-the-coronavirus-sars-cov-2/>
25. <https://virologyj.biomedcentral.com/articles/10.1186/s12985-020-01418-7>
26. [https://www.who.int/images/default-source/health-topics/coronavirus/myth-busters/52.png?sfvrsn=862374e\\_12](https://www.who.int/images/default-source/health-topics/coronavirus/myth-busters/52.png?sfvrsn=862374e_12)
27. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0238339>
28. <https://www.tandfonline.com/doi/full/10.1080/10911359.2020.1851333>
29. <https://pubmed.ncbi.nlm.nih.gov/32687997/>
30. <https://pubmed.ncbi.nlm.nih.gov/33238229/>
31. <https://pubmed.ncbi.nlm.nih.gov/32711074/>
32. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7674010/>
33. <https://environhealthprevmed.biomedcentral.com/articles/10.1186/s12199-020-00904-2> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7195988/>

## **COVID-19 IMPACT ON FISHERIES AND AQUACULTURE IN INDIA**

**Khan Rumana Shahin Amanullah**

Department of Zoology

J. A. T. Arts, Science and Commerce College (For Women),

Malegaon, Maharashtra

\*Corresponding authors E-mail: [khanrumana1967@gmail.com](mailto:khanrumana1967@gmail.com)

---

### **Abstract:**

Fisheries and hydroponics give nutritious food to countless individuals all throughout the planet furthermore, jobs for more than 10% of the total populace. Fishes are a significant part of a solid eating regimen and are protected to eat. All parts of fish supply chains are firmly influenced by the COVID-19 pandemic, with occupations, salaries and food security at hazard. Government and industry reactions are expected to address the quick financial what's more, social difficulties that the emergency is inciting in the fish area. Governments too need to keep up long haul desires for securing common assets and biological systems, what's more, the reasonability of fisheries. Fishes are not liable for an epidemiological job in spreading COVID-19 to people. In any case, individuals deceiving insights in certain nations about fish and the spread of COVID-19 need to prompt diminished utilization of fish products. There was a quick effect on the hydroponics business. Lockdowns oppressed the worth chain to certain worldwide and home-grown vehicle interruptions for crude materials for handling, creation inputs, and completed items for fare and home-grown utilization. Exacting inconvenience of limitations on the development of individuals and materials including labourers, ranch made data sources like seed, feed, and inaccessible. Little fish ranchers encountered a business misfortune since they needed to sell the items at lower costs or couldn't sell their harvests. Because of lockdown in most of the nations, fish ranchers couldn't collect and furthermore couldn't begin another creation cycle bringing about diminished fish supply in the next couple of months and furthermore loss of downstream and upstream wellsprings of work.

**Keywords:** COVID-19, Lockdowns, and limitations, epidemiological, pandemic, work.

---

### **Introduction:**

The COVID-19 pandemic has quickly spread all throughout the planet with broad social and monetary impacts. This publication canters explicitly around the ramifications of the pandemic for limited scope fishers, including promoting and preparing parts of the area, and seaside fishing networks, drawing from news and reports from around the world.

Unfortunate results to date have included total closed downs of certain fisheries, thump on monetary impacts from market disturbances, expanded wellbeing hazards for fishers, processors and networks, extra ramifications for minimized gatherings, exacerbated weaknesses to other social and natural stressors, and expanded Unlawful, Unreported and Unregulated fishing. In spite of the fact that a large part of the news is desperate, there have been some certain results, for example, food sharing the restoration of neighbourhood food networks, expansions in neighbourhood deals through direct promoting and conveyances, aggregate activities to defend rights, coordinated efforts among networks and governments, and diminished fishing pressure in certain spots. While the emergency is as yet unfurling, there is a dire need to facilitate, plan and execute successful short-and long haul reactions.

Consequently, we ask governments, advancement associations, NGOs, givers, the private area, and scientists to quickly assemble on the side of limited scope fishers, waterfront fishing networks, and related common society associations, and recommend activities that can be taken by each to assist these gatherings with reacting the COVID-19pandemic. The full scope of exercises needed to convey fish and fish items from creation to the last customer is dependent upon circuitous effects of the pandemic through new sanitary measures, changing buyer requests, market access or calculated issues identified with transportation and line limitations. This thus damagingly affects fishers and fish ranchers' vocations, just as on food security and nourishment for populaces that depend vigorously on fish for creature protein and fundamental micronutrients.

The episode of COVID-19 and the resultant complete lockdown in India has incredibly influenced the jobs of fishing networks across India. The all out lockdown may help capture the spread of Covid; be that as it may, fast and compelling mediation is needed for fishers to limit the troublesome impact on the jobs of weak populace especially on food frameworks, stockpiling and market chains, both locally and provincially. Limited scope fishers in India have issues in three regions: evaluating, advertising and association. A considerable lot of these are long haul needs yet there are a not many that are quick furthermore, identified with the Covid. The COVID-19 crisis has achieved remarkable lockdowns all throughout the planet, with obliterating monetary results. Fisheries and supply chains of new fish have been hit hard as fish items are among the most exceptionally exchanged food sources internationally, with 38% of absolute fish creation (PDF) entering worldwide exchange. Prohibitive measures against the pandemic, however fundamental, are especially harming for limited scope fisheries.

The area is pivotal to individuals' sustenance, food security, feasible livelihoods and prosperity worldwide as it utilizes 90% individuals occupied with fisheries (around 36.7 million), with many million more connected by implication. Significantly, limited scope fishing exercises, particularly those focusing on top notch ('extravagance') fish, are vigorously reliant upon the HORECA (lodging, eateries and bistros) diverts in the biggest fish markets around the world (the European Union (EU), United States, Japan) and on the travel industry. Limited scope fishing exercises in created countries are generally reliant upon home-grown very good quality business sectors and large numbers of their partners in non-industrial nations are subject to fares to these business sectors.

Obligatory terminations of the food administrations furthermore, lodging businesses in the EU and the US, China's prohibitions on imports of fish due to fears of pollution, and the decay of worldwide travel (and resulting nonappearance of tourists) brought about an accident popular with thump on financial impacts.

#### **The Covid-19 Pandemic, Small Scale Fisheries and Coastal Fishing Communities:**

- Complete lockdown in the harbours and the arrival places has enormously influenced the fisher-people's everyday income in every beach front area. Limited scope fisheries particularly are answerable for giving fish as a huge source of protein for minimal price for customers. This is especially significant for minimized networks and absence of fish in the eating routine will significantly affect sustenance security of these individuals.
- The lockdown has influenced other fish unified exercises like net retouching, regular maintenance of boat and motor. This likewise makes immense harm the significant expense resources like fishing artworks and cog wheels.
- In Goa, fish was unloaded in the ocean as fishers couldn't land fish due to conclusion of harbours. In Raigad area of Maharashtra, an enormous measure of ocean bottom was tossed back to the ocean. In Chennai fish storage spaces were at that point working at full limit and along these lines fishers couldn't safeguard their full fish catches. In regions where fishers figured out how to sell their catch, they needed to agree to as little as half or one-fourth of the market cost.
- In certain towns close to Chennai, limited scope fishers fishing close to shore regions are battling to showcase their catch. Due to physical removing standards, just few fisherwomen can purchase fish from the anglers in the arrival communities. Since the time assigned to sell the fish is extremely short, they are compelled to sell their catch at a

low cost. For instance, if the fish rate was INR 500 for every kilogram before COVID-19 lock down, the rate presently is simply INR 300 to 350.

- In Porebander in Gujrat because of the lockdown, the catch was ended. This straightforwardly affected the pay of neighbourhood fisher folk. At the point when the handling units were closed down, the anglers didn't discover purchasers. The individuals who didn't approach cold storage spaces needed to resort to selling direct to the client or unloading their stocks. Fish sellers and individuals associated with partnered exercises like shipping, net retouching, regular maintenance of boat and motor additionally endured.
- In Mumbai 15,000 tons of fish must be unloaded, making a deficiency of corers of rupees the business, and this incited him to make a move.
- Complete lockdown in the harbours and the arrival habitats has extraordinarily influenced the fisher-people's everyday profit in every beach front locale. Limited scope fisheries particularly are answerable for giving fish as a huge source of protein for minimal price for customers. This is especially significant for underestimated networks and absence of fish in the eating routine will extensively affect nourishment security of these individuals.

### **Conclusion:**

The hydroponics and fisheries are a significant piece of the worldwide food framework and colossally nutritious nutritional category of major social, social, and monetary significance.

The business is as of now confronting challenges in supply chains for sea-going and fish food sources attributable to disturbances in exchange, transportation, and work. Diminished creation from diminished fishing endeavours and broadened loading of hydroponics frameworks will make diminished admittance, supplies, and utilization of these food sources. Expanded exchange costs what's more, diminished interest from the shopper end will affect the costs of sea-going and fish items, to address these effects, the fabricates in this industry are taking a few drives.

The pandemic known as COVID-19 calamitously affects human activity and exercises, with oceanic food area and limited scope fisheries being no exemption. Food request and subsequently food security are seriously undermined because of development limitations, decreased buying power, and further effect on the most helpless limited scope fishers and related individuals. In this way, any activity taken by the Government ought to be founded on ensuring the wellbeing and food security of individuals especially to the minimized class, despite the fact that it very well may be unfavourable to financial development in the short run.

Moreover, strategies ought to guarantee that both monetary and actual components of aggregate food security, including horticulture, fisheries, dairy and poultry are considered. Prohibitive measures against the pandemic, however vital, are especially harming for limited scope fisheries. The area is urgent to individuals' nourishment, food security, manageable occupations and prosperity worldwide as it utilizes 90% individuals occupied with fisheries (around 36.7 million), with many million more locked in by implication.

Moreover, strategies ought to guarantee that both monetary and actual components of aggregate food security, including horticulture, fisheries, dairy and poultry are considered. Prohibitive measures against the pandemic, however vital, are especially harming for limited scope fisheries. The area is urgent to individuals' nourishment, food security, manageable occupations and prosperity worldwide as it utilizes 90% individuals occupied with fisheries (around 36.7 million), with many million more locked in by implication.

#### **References:**

1. Kawsar, M.A. Impact of corona virus on fisheries: Bangladesh perspective.
2. Agrinews24.com. 2020, Available in <<http://www.agrinews24.com/impact-of-corona-virus-on-Fisheries-bangladesh-perspective/>>.
3. Food and Agriculture Organization (FAO). FAO alerta sobre el impacto del COVID-19 in: <http://www.fao.org/americas/noticias/ver/es/c/1267028/>.
4. FAO. 2020e. Aquaculture topics and activities. COVID-19 and its impact on the fisheries and aquaculture sector.
5. Global Nutrition Report 2018. Chapter Two: The Burden of Malnutrition [online].
6. Dubey SK, Trivedi RK, Chand BK, Mandal B, Rout SK. 2017. Farmers' perceptions of climate change, impacts on freshwater aquaculture and adaptation strategies in climatic change hotspots:
7. FAO 2020b. How is COVID-19 affecting the fisheries and aquaculture food systems? Rome. FAO and CELAC. 2020. Food security under the COVID-19 pandemic. Rome.
8. Mohan, V. 2020. Centre exempts marine fishing operations and related activities from the lockdown restrictions. The Times of India, April 11, 2020.
9. Pandey, S. 2020. Fishing industry suffers another blow as workers are stranded on boats, debt is piling up. The Print, April 23, 2020, sec. India.
10. Shaaban, A. 2020. Coronavirus in UAE: Now, get fresh fish delivered at your doorstep in Fujairah. Khaleej Times, March 29, 2020.

## IMPACT OF SOCIAL MEDIA IN TEACHING-LEARNING

**Humaira Badruzzama**

J. A.T. Arts, Science and Commerce College (For Women),

Malegaon, Nashik, 423203, India

\*Corresponding authors E-mail: [homairaraees@gmail.com](mailto:homairaraees@gmail.com)

---

### **Abstract:**

The faculty in educational institution plays a key role for development of student, society and whole nation. Social media has a significant impact on teachers' performance. The main objective of this study is to study the impact of social media on teachers' performance in educational field. The study also reveals the extent and importance of social in the development of faculty performance.

**Keywords:** Social media, Teachers, Students' faculty members, Society, Nation.

---

### **Introduction:**

The emerging role of social media in teaching learning process cannot be ignored. Social media and mobile devices allow the students to create, edit and share the course contents in textual, video and audio forms. Face to face communication in interpersonal relationship has been gradually replaced with communication by technological devices. Social network are platform where no. of user has increased quickly because it enables people communicate with their friends and exchange information multimedia based. The social media progressively becoming an everyday part of every individual's life in modern society. Social media continuously introduce the students with Facebook, linked-in, Tweeter and WhatsApp.

### **Teaching-learning Process:**

It is a combine process where an educator assesses learning needs, establishes specific learning objectives, develops teaching and learning strategies, implements plan of work and evaluates the outcomes of the instructions. It is a media in which the knowledge of teachers is transferred to the students. It can be developed through different systems (One way in which the teacher is the only speaker, circular, in which teacher and students contribute to the development of the class etc.).

It is the interaction between teachers and students where teachers try to transmit knowledge and content to students according to their age, Capabilities, Skills and living condition.

### **Social Media:**

Social media is a computer dependent tool that allows their user to develop their account and exchange information, Creative ideas and pictures/ videos in online communication and networks. Social media is defined as a group of internet based application that build on the ideological and technological foundation of the web and that allow the creation and exchange of user generated content. Social media are interactive technologies that allow the creation or sharing, exchange of information and ideas, career interest and other forms of expression by virtual communities and network.

### **Impact of Social media in Teaching-learning:**

The social media provides plate forms to school children and give an opportunity to connect, get in touch, access information and research. Social media has become an important part of students' social life. It is now considered as a learning plate form which helps in improving students' engagement and capabilities. In today's global era of connected learning, the influence of social media plate forms on our educational systems is becoming a strong controlling factor. Social media has gained incredible popularity over the past few years as an open source of information and knowledge sharing plate form. Educational institution is using social media space to inter act with young minds. It not only provides students access to useful information but also connects them with learning group and other educational systems that make their overall learning process more interesting and engaging.

Social plate form like Facebook, YouTube, Tweeter etc. are used by everyone. These social channels are also about collaborating networking, sharing and generating knowledge and connect something which is of great value in context of education. Social media has the ability to broaden your perspective on various subjects and gives illuminating, instant content that is new. It provides opportunity on engaging experts to get answers on topic that we may need help in. Learning colleges have the ability to connect with students through social media network such as Facebook, Google plus groups and You Tubes. These channels can be used to

communicate campus news, make announcement and provide students with useful information which helps the college and student engagement and group interaction.

Institution can share supportive and positive posts that reach all students that are connected to the networks and pages. Video is a prominent tool in social media that are effective and its use inspire students and help them in their course subjects it also helps in research process. It is one of the best platform forms to extract data. It can help students compile and produced useful content for research, whether students are working on an assignment, working on project, best information and results can be extracted from social media.

Social media is networking software that delivers educational programme and aids institution in other administrative activities. This system exists to tackle students and learning related issues to improve education scheme and enhance learning management system. It also helps to resolve some educational aspects.

Social networks are empowering student and educational institution to improve teaching learning process. ResearchGate, Quora, Google meet, Zoom etc. are helping students by providing online tutorials. They also enriching Knowledge base Social media also a medium where students can established beneficial connections for their career. Professors can use their Twitter or Facebook for messaging services they can organized exams, discussion related to their subjects on social media platform forms. Faculty can create groups using social media where useful information can be accessed by all it is a good platform form sharing ideas.

Social media is increasingly becoming popular in building relationship outside the classroom setting. It is also used in learning for purpose of convenient communications with other students also. On social media, students exchange lot of information. By doing this, they get engaged with each other and learn how to manage projects and coordinate with teams sitting globally along with cross cultural sensitivities it has made easier and faster to interact with peers or teachers about class related topics. It teaches them how to develop a strong online presence by improving their communication skills. Social media also helps to exchange information about classes and examination. Teachers can engage their students even when they are travelling and not taking session.

The biggest advantage of social media is its better communication. A student can connect with any one at any point in time. They can use such platform form by their smart phone, tablets, Computer, Laptop and learner can exchange questions, make phone calls or video calls.

They do not need to wait and meet the teacher physically. Various websites and social media networks are providing plenty of information that can be helpful to students. The educational benefit of social networking also helps to prepare important lessons and learn certain concepts. It also helpful to the student to survey and look into what is new. Social media help the parents stay involved in the child's learning. Parents can be updated on school relate activities, Projects and events that are happening. The school teachers can get in touch with the parents in case they want to share the child progress.

It is usually observed that students are bored of reading and writing, however, the internet and social media provide plenty of online information by which students read specially if thee information include eye catching animation. Online messages, comments, news, articles and books provide an endless list of information to be read, and students are motivated to devote their time and put some extra efforts towards their learning such online activities contribute child general learning and develop stronger habits resulting in improvement in their writing abilities.

**Positive Impacts:**

Social media enable students to easily contact with each other to their projects and assignment students also can work on group from their home. When social media is used, students who have difficulty in expressing their thought in the class room can get involved learning process, it helps to build their confidence level as well. Any doubt can be clarified by sending messages through the social media it also helps teachers to stay in touch with the parents. It also helpful to the learners it connect and collaborate outside the institutional boundaries to gain practical experiences.

**Negative Impacts:**

Students have become prone to frequent fluctuations in mood and self-control it is observed that whenever some uploads a profile picture it immediately affect the mood f students. It produces stress, anxiety or fear for them. Students neglect study by spending time on social networking website rather than studying to inter acting with the people in person. Continuous use of social media lost the ability of students to engage in face to face communication. It should be kept in mind that social networking creates the virtual world that is drastically differing from reality.

**Conclusion:**

A social media networks advance in education systems many helpful and beneficial tools that can make learning more effective. Students today are totally involved with the social media at every stage. Using it in educational field is a very effective measure. Using social media, teachers can improve the involvement of their students in studies and improve technological abilities. As a whole social media its self has its positive as well as negative impact.

**References:**

1. European online journal of Natural and social sciences. 2017,Vol.6, No. 2, PP-206-221, ISSN 1805-3602 Muhammad Imran Khan.
2. <https://tis.edu.in>blog>positive>
3. <https://www.theasianschool.net>
4. <https://www.academiaapps.com>
5. <https://www.igi.global.com>
6. [Slejournal.springeropen.com](http://Slejournal.springeropen.com)

## **HISTORY OF PANDEMIC DISEASE AND SOCIAL AWARENESS**

**U. W. Fule\* and S. S. Nimgare**

Department of Zoology,

Hutatma Rashtriya Arts and Science College,

Ashti, Dist- Wardha, Maharashtra, India

\*Corresponding authors E-mail: [ujwalafule@gmail.com](mailto:ujwalafule@gmail.com)

---

### **Abstract:**

Covid-19 is highly transmittable and viral infectious disease caused by a newly discovered "Severe Acute Respiratory Syndrome Coronavirus-2" (SARS-CoV-2). Most people infected with COVID-19 Virus will experience mild to moderate respiratory illness. Older people and those with underlying medical problems like cardiovascular disease, Diabetes, Chronic respiratory system. The most common symptoms of COVID-19 are fever, headache and tiredness. The COVID-19 virus spreads primarily through drop discharge from the nose when an infected person coughs. This paper describes the history of pandemic disease and prevention, control and precaution in COVID-19 pandemic.

**Keywords:** COVID-19, SARS-CoV-2, Corona virus pandemic, Physical distancing.

---

### **Introduction:**

World Health Organisation (WHO) has declared the outbreak of Covid-19 now to be pandemic. This has been a great concern to all human being health, where mortality has been found to be increased. Being so deadliest WHO and Health Ministry advised all to be home and follow the guidelines regarding physical distancing. While the origin of outbreak and its transmission pathway are yet to be asserted, we know diseases passed from animals to human (Zoonotic Diseases). Currently, organization such as the WHO do not believe that the Novel corona virus is airborne. However research into its transmission route is ongoing. SARS-CoV-2, which causes COVID-19, is one of many corona viruses. These can cause illness in humans and animals, and they are highly contagious. According to the WHO, the most common symptoms of Covid-19 are fever, tiredness, and a dry cough. Learn more about the symptoms of Covid-19 here. However, some people with the disease may not have any symptoms at all.

Coronavirus outbreak was first reported in Wuhan, China on 31 December, 2019. WHO is working closely with Global experts, Governments and other health organization to provide

advice to the countries about precautionary and preventive measures. The outbreak of Coronavirus disease 2019 has created a global health crisis that has had a deep impact on the way we perceive our World and our everyday life. Another class of Corona infection, known as SARS-CoV-2 (severe intense respiratory disorder Covid 2) has been discovered to be liable for event of this sickness. To the extent the historical backdrop of Human civilization is worried there are examples of serious flare-ups of illnesses brought about by various Viruses. Coronavirus has quickly spread all throughout the planet presenting huge wellbeing, financial, environmental and social difficulties to the whole human populace. The Covid flare-up is seriously disturbing the general public.

Covid is an enormous family infection that causes the ailment. It goes from the normal virus to more extreme sickness like Middle East Respiratory syndrome (MERS-CoV) and severe intense Respiratory Syndrome (SARS-CoV). Coronavirus, aside from turning into the best danger to worldwide general soundness of the century, is being considered as a marker of disparity and inadequacy of social headway. In the name Covid-19, 'Co' represent "Corona", 'V' mean "Virus", and "D" mean "Disease", and 19 address the time of its event. Covid is a solitary abandoned RNA infection with a distance across going from 80 to 120 nm. The main present day Covid-19 pandemic was accounted for in December 2019. In Wuhan, Hubei territory, China and most starting cases were identified with source contamination from a Seafood Wholesale Market. It has been categorised as a pandemic by the World Health Organization. As indicated by WHO, in 2002-2003, in excess of 8000 individuals endured and 774 kicked the bucket of a Corona infection, called SARS.

In 2012, MERS-CoV pandemic broke out contaminating in excess of 2494 people and killing more than 858 lives Worldwide. Aside from Covid-19, the human civilization has seen somewhere around five pandemics in the current century, Exa.H1N1 in 2009, Polio in 2014, Ebola flare-up in West Africa in 2014, and zika in 2016. Coronavirus is probably going to cause so a lot or more noteworthy human enduring than other infectious sickness in the entire world. Other than its disturbing consequences for human existence, the novel Covid sickness (Covid-19) can possibly essentially stoppage the economy the China, USA, or India yet additionally of the world in general. Consequently, medical care work force, governments and general society overall need to show lone and battle side by side for counteraction and control of the pandemic. In USA, in excess of 30,000 individuals kicked the bucket of this infection. As per the

report of the Chinese government and the WHO, the current episode has contaminated around 84,180 individuals in China out of which in excess of 4642 individuals have passed on so far as of April 18. The first instance of Covid flare-up in Quite a while was accounted for on 30 January 2020 in Keralas, Thrissur area when an understudy had gotten back from Wuhan college in China. In present paper, our primary center is to feature the History of pandemic infection and Social mindfulness.

#### **Potential origin of the virus:**

All human Corona Virus have creature beginnings, specifically, regular hosts, Bats might be normal hosts of HCoV-229E, SARS-CoV, HCoV-OC42 and HKU1 most likely started from Rodents (Wong *et al.*, 2016; Forni *et al.*, 2017). Bats are without a doubt significant and the significant normal supplies of alpha-Covid and beta Covids (Tao *et al.*, 2017). Homegrown creatures can experience the ill effects of sickness as middle has that cause infection transmission from normal hosts to people; for instance, SARS-CoV and MERS-CoV crossed the species hindrances into concealed palm civets and camels, separately (Guan *et al.*, 2003; Haagmans *et al.*, 2014). SARS-CoV-2 sequenced at the beginning phase of the COVID-19 episode just offers 79.6% succession personality with SARS-CoV through early full length genomic examinations. Nonetheless, it is profoundly indistinguishable 96.2% at the entire genome level to Bat-CoV RaTG13, which was recently identified in *Rhinolophus affinis* from Yunnan Province, over 1500km from Wuhan (Zhou *et al.*, 2020). Bats are probable supply has from SARS-CoV-2; anyway whether Bat-CoV RaTG13 straightforwardly leaped to human or sends to middle hosts to work with creature to human transmission stays uncertain. No middle host test was gotten by researchers in an underlying group of disease of the Huanan fish and untamed life Market in Wuhan, where the offer of creatures might be the wellspring of zoonotic contamination. Besides, the most punctual three patients with indications beginning had no known history of openness to the Huanan market. Notwithstanding the zoonotic starting points of SARS-CoV-2 by regular development, there are a few questions about the beginning of the infection since its spike protein appears to consummately collaborate with the human receptor in adding to human to human transmission after advancement in a brief period. Nevertheless, more straightforward proof is needed to explain contentions.

#### **Evolution of SARS-CoV-2 during the past few months:**

According to information of nCov-19 (SARS-CoV-2) sequences submitted to the GISAID database in January 2020, the virus was first collected in late December 2019 from Wuhan,.

China. However, those viral sequences varied from the latest submitted sequence collected in early April 2020 from North America. Since the viral sequences continuously change, the construction of a phylogenetic network is crucial to investigate the adaptation of the virus in different human populations and environments.

Corona virus, recombination between SARS-CoV-2 and old human corona viruses such as HCoV-229E, OC43, NL63, and HKUI, has not been found. Nevertheless, a recent study claimed that three genetic types of virus have been circulating globally. Therefore, It is still unclear whether the evolution of SARS-CoV-2 could be affected by replication environments such as genetic and immunological restrictions in different human populations, with evolutionary pressure, the selection of SARS-CoV-2 mutations will be ongoing. The investigation of the geographic patterns of SARS-CoV-2 variations will provide information on vaccine development for different populations.

#### **Prevention by Hospitals:**

There are no specific reconnected treatments and medicines as a cure. However there are several ongoing clinical trials of both western and traditional medicines. Antibiotics aren't effective, so, treatment is directed at relieving symptoms and may includes, pain relievers (ibuprofen or acetaminophen), cough syrup or medication, fluid intake and rest.

Several studies are focused on an antiviral medication called Remdesivir, which was created to fight Ebola.

#### **Control Measures by Government:**

- The Government recently introduced the "Aarogya Setu" mobile application to educate citizens about Novel Corona Virus.
- The Government plans to set up a chain of 20 lakhs retail shops called "Suraksha Stores" across India which will provide daily essentials to citizens.
- Under its, "Ujwala Scheme", the Government is providing free LPG refills for 3 months to over 8.3 crore poor women.
- Under the National Social Assistance Programme, Rs. 1,400 crore has been distributed to about 2.82 crore old age people, widows and disabled people.
- Nearly 20 crore women Jan Dhan account holders received Rs.500 each in their account.
- The Government is also providing medical insurance cover of Rs.50 lakh per person to health workers fighting the Corona virus pandemic.

**Precautions:**

- Wash your hands regularly with soap and water, or clean them with alcohol-based hand rub.
- Maintain at least 1 meter distance between you and people coughing and sneezing.
- Cover your mouth and nose when coughing or sneezing with the bend of elbow or tissue. If a tissue is used, discard it immediately and wash your hands.
- Stay home if you feel unwell.
- Practice physical distancing by avoiding unnecessary travel and staying away from large group of people.
- If its necessary to go out the cover your mouth properly with clean, sanitized and dry mouth or handkerchief.

**References:**

1. Forni, D. Cagliani, R. Clerici, M. Sironi, M. (2017): Molecular evolution of human Coronavirus genomes. *Trends Microbiol*, 25, pp. 35-48.
2. Guan, Y. Zheng, B.J. He, X.L. Liu, Z.X. Cheung (2003): Isolation and characterization of viruses related to the SARS Corona virus from animals in southern China. *Science*, 302, pp.276-278.
3. Haagmans, B.L. Dhahiry, S.H. Reusken, V.S. Raj, M. Galiano, R. Myers, R. (2014): Middle East respiratory syndrome Corona virus in dromedary Camels: an outbreak investigation. *Lancet Infect Dis*, 14, pp.140-145.
4. Su, S. Wong, W. Shi, W. Zhou, J. (2016): Epidemiology, genetic recombination and pathogenesis of corona viruses. *Trends Microbiol*, pp 270-273.
5. Tao, Y. Chommanard, K. Queen, J Zhang, W. Morkoter, W. (2017): Surveillance of Bat Corona virus in Kenya identifies relatives of Human Corona Viruses NL63 and 229E and their their recombination history, *J Virol*, 91, e01953-16.
6. World Health Organization, (2004): Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003 [https://www.who.int/csr/sars/country/table\\_2004-04-21/en/](https://www.who.int/csr/sars/country/table_2004-04-21/en/).
7. Zhou, P. Yang, X.L. Wang, B. (2020): A pneumonia outbreak associated with new Corona virus of probable bat origin *Nature*, 579, pp.270-273.

## **SOCIO – ECONOMIC IMPLICATIONS OF COVID-19**

**S. Vimal Dolli**

Department of Economics,  
Holy Cross College (Autonomous),  
Nagercoil, Tamil Nadu, India

Corresponding authors E-mail: [rchristgibs@gmail.com](mailto:rchristgibs@gmail.com)

---

### **Abstract:**

The Corona virus pandemic began spreading across the world just over a year ago, it did not spare any community or society. Socio-economic implications of COVID-19 such as loss of income, impacts on business, health care food and livelihood etc. Because of pandemic basic consumers' wants were affected. The lack of awareness among people, in the wake of an unknown disaster, additional exacerbated the circumstances.

---

### **Introduction:**

The COVID-19 pandemic has prompted a sensational loss of human existence worldwide and presents a phenomenal test to general wellbeing, food and the work. The monetary and social interruption brought about by the pandemic is destroying. A huge number of individuals are in danger of falling into outrageous destitution, while the quantity of undernourished individuals, as of now assessed at almost 690 million, could increment by up to 132 million before the year's over. Almost 50% of the world's 3.3 billion workforce is in danger of losing their jobs. Casual economy laborers are especially helpless on the grounds that the larger part need social insurance and admittance to quality medical care and have lost admittance to useful resources. During lockdowns, many can't take care of themselves and their families. For most, no pay implies no food, or less food and less nutritious food.

The pandemic has been influencing the whole food framework and has revealed its delicacy. Boundary terminations, exchange cutoff points and imprisonment measures have been keeping ranchers from getting to business sectors, including for purchasing sources of info and selling their produce, and horticultural laborers from gathering crops, hence scattered homegrown and global food supply anchors and falling admittance to sound, protected and different weight control plans. The pandemic has obliterated positions and set great many vocations in danger. As providers lose positions, become sick and pass on, the food security and

nourishment of millions of ladies and men are under danger, with those in low-pay nations, especially the most minimized populaces, which incorporate limited scope ranchers and local people groups, being hardest hit. A great many horticultural specialists, pursued and independently employed, consistently face undeniable degrees of working neediness, hunger and chronic weakness, and experience the ill effects of an absence of wellbeing and work security just as different sorts of misuse. With low and sporadic wages and an absence of social help, a large number of them are prodded to keep working, frequently in hazardous conditions, along these lines uncovering themselves and their families to strengthening chances. Further, while encountering pay misfortunes, they may depend on unsafe adapting procedures, for example, trouble offer of resources, ruthless credits or kid work. Transient rural specialists are especially in danger, since they face hazards in their transportation, working and occupation and oppose to get to help estimates set up by governments. Ensuring the wellbeing and soundness of all agri-food laborers – from essential makers to those associated with food handling, transportation and retail, including road food merchants – just as better wages and defend, will be crucial for saving lives and ensuring general wellbeing, individuals' occupations and food security.

In the COVID-19 emergency food security, general wellbeing, and business and work issues, specifically laborers' wellbeing and security, meet. Clinging to working environment security and wellbeing rehearses and guaranteeing admittance to fair work and the insurance of work rights in all businesses will be urgent in tending to the human element of the emergency. Moment and relentless activity to save lives and jobs ought to incorporate expanding government backed retirement towards overall wellbeing inclusion and pay support for those generally influenced. These remember laborers for the casual economy and in ineffectively ensured and low-paid positions, including youth, more seasoned specialists, and travelers. Specific consideration should be paid to the circumstance of ladies, who are over-addressed in low-paid positions and care jobs. Various types of help are critical, including cash moves, youngster remittances and solid school dinners, safe house and food alleviation drives, support for work safeguarding and recuperation, and monetary help for organizations, including miniature, little and medium-sized endeavors. In planning and carrying out such measures it is fundamental that legislatures work intimately with bosses and laborers.

**Objectives of the Study:**

- To analyze the social implications of COVID-19
- To find out the economic implications of COVID-19

**Methodology:**

This study is based on secondary data. Secondary data were collected from books, journals, project reports and from internet sources.

**Social Implications of COVID-19:**

**Gender Gap and Inequality:**

Ladies are bound to be helpless against losing their positions when contrasted with men because of the COVID-19 pandemic. The drop in business is discovered to be one-sided and not unbiased in India which has perhaps the most lopsided sexual orientation divisions of homegrown work globally. The drop in total number is more for men contrasted and ladies due to the generally existing huge sex hole in work. By looking at the pre and post lockdown hours spent on homegrown tasks, a decrease in sexual orientation hole is found as far as hours committed to homegrown errands on a normal during the primary month of lockdown in a large portion of the states. Additionally, there is an increment of 0.5 to 4 hours in men's extent of housework post-lockdown. In any case, the male extent/dispersion keeps on being slanted to one side. Thinking about the unbalanced weight of the emergency on low gifted specialists, poors, other weak segments, numerous market analysts imagine that COVID-19 is probably expected to raise distinction inside and among nations and the aftereffects of study directed by affirms that those having fundamental schooling are influenced more than those with higher and postgraduate educations, as far as loss of pay henceforth affirming expansion in pay imbalance in the wake of during and after pandemics.

**Health Crisis:**

Because of the absence of testing administrations, lack of specialists, wellbeing hardware, beds even in the created space of India, COVID-19 is a significant peril for India. According to the National Health Profile of India, 2019, India's medical care consumption as % of GDP was just 1.28% which is lower than less fortunate nations of the world. Coronavirus pandemic has unnecessarily influenced the provincial and metropolitan regions. The effect is confronted more in metropolitan regions in light of the great thickness of individuals. In any case, the danger is substantially more to the provincial regions where around 70% of India's

populace lives. India's medical services area is as yet creating and there are huge contrasts in the medical care frameworks of country and metropolitan regions.

**Reverse Migration:**

After the separation in 1947, it is the second biggest mass replacement that India is experiencing. More particularly, it is the “reverse migration.” As indicated by IMO (International Migration Organization) return or reverse migration is the act/process or movement of individuals back to their local spots who prior moved to urban communities or urban regions looking for employment and to gain bread-butter for their families.

**Poverty:**

According to the World Bank report, every fifth Indian is poor with around 80% population residing in rural areas. At least 49 million individuals all over the world are expected to dive into “extreme poverty” as a direct result of the destruction caused by the pandemic and due to COVID-19 India is estimated to have its 12 million citizens pushed in excessive poverty.

**Economic Implications of COVID-19:**

**Declining GDP growth:**

While the pandemic is still developing and the actual economic impact has yet to be fully known, due to COVID-19 all countries will experience the most horrible economic performance in the last 40 years. The extent of the economic impact will depend upon the duration and severity of the health crisis, the duration of the lockdown, and the manner in which the situation unfolds once the lockdown is lifted.

**Declining trade volume:**

COVID-19 has severely disrupted global and regional trade and supply chains. Many countries have temporarily closed their borders, reduced luxury imports, and cancelled import orders from other countries. The reduced export earning is likely to compound the economic crisis in other sectors, like employment and household income.

**Inflation:**

The impact of COVID-19 is expected to experience a slightly higher inflation in 2020. The deficit however is expected to be slightly lower than 2019 because of the sharp fall in oil price as well as due to the disruption in global supply chain, where imports are expected to be reduced more than the reduction in exports for most of the countries.

**Macroeconomic consequences:**

In 2020, lower revenue collection and higher recurrent spending is to increase the fiscal deficit to 7.7 percentage of the GDP. It leads increase the public debt, disturbing fiscal sustainability. Low GDP growth leads to decreasing export retribution and increased fiscal deficit and also leads to serious implication to household income and poverty. The macroeconomic crisis may cascade to different economic sectors the impacts at local and unfold many economic crises through both forward and backward linkages and impact of supply and demand in national, regional and global supply chains as well as change in consumption, saving and investment.

**Conclusion:**

The increase of the COVID-19 is affecting economic activity and negatively impact on all sectors like manufacturing and service industries, particularly in developing countries; we expect that financial markets will continue to be unstable. Government should be taken necessary steps to recover the situation

**References:**

1. CRISIL (2020). The COVID-19 fall out quantifying first-cut impact of the pandemic. 19th March 2020. <https://www.crisil.com/en/home/our-analysis/views-and-commentaries/2020/03/the-covid-19-fallout.html>
2. Dev, S, Mahendra (2020), Addressing COVID-19 impacts on agriculture, food security, and livelihoods in India, IFPRI Blog, April 8. <https://www.ifpri.org/blog/addressing-covid-19-impacts-agriculture-food-security-and-livelihoodsindia>
3. Fernandes N. (2020) Economic Effects of Coronavirus Outbreak (COVID-19) on the World Economy. SSRN Electronic Journal, 1–29. <https://ssrn.com/abstract=3557504>.
4. International Monetary Fund (2020) World Economic Outlook, April 2020: The Great Lockdown. Technical Report April, Washington DC. <https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020>
5. World Bank (2020) East Asia and Pacific in the Time of Covid-19. World Bank East Asia and Pacific Economic Update, (April):234. <https://doi.org/10.1596/978-1-4648-1565-2>. <https://openknowledge.worldbank.org/handle/10986/33477>.

## **POSITIVE AND NEGATIVE IMPACT OF COVID-19 ON EDUCATION**

### **A. Sameema**

Department of Economics,  
Holy Cross College (Autonomous),  
Nagercoil, Tamil Nadu, India

\*Corresponding authors E-mail: [sameema.a@holycrossngl.edu.in](mailto:sameema.a@holycrossngl.edu.in)

---

#### **Abstract:**

Corona affects the whole education system in our country. All the educational systems are closed to control the covid- 19. It brings difficulties for students, teachers, and parents. So, distance learning is a solution to continue the education system. However, the lack of network issues, infrastructures, computers, and internet access is challenging distance learning in developing countries. Hence, countries design a strategy to use educational technology, zero-fee internet educational resources, free online learning resources, and broadcasts teaching. During closures, educational institutions design curriculum, prepare teaching-learning strategies for post-coronavirus. The educational institutions design strategies to recover lost learning, and return students to school when schools reopen.

---

#### **Introduction:**

The worldwide flare-up of the COVID-19 pandemic has spread around the world, influencing in every one of the nations. In the wake of noticing the Covid pandemic circumstance the WHO encouraged to keep up with social separating is the principle avoidance step. In this way, every nation began the activity of lockdown to isolate the defiled individuals. Every one of the instructive areas got shut. Classes suspended and all assessments of schools, universities and colleges including passage tests were delayed uncertainly. The understudies are influenced without question. In spite of the fact that it's anything but a remarkable circumstance throughout the entire existence of instruction, COVID-19 has set out many open doors to emerge from the thorough homeroom instructing model to another time of advanced model. The effect is expansive and has influenced picking up during this scholastic year or considerably more in the coming days. The majority of the schools, universities and colleges have ended eye to eye educating. There is a squeezing need to advance and carry out elective instructive and evaluation procedures.

The COVID-19 pandemic has furnished us with a chance to the way for presenting advanced learning. The COVID-19 pandemic seriously affects advanced education as colleges shut their premises and nations shut their lines in light of lockdown measures. Albeit advanced education establishments rushed to supplant vis-à-vis addresses with internet learning, these terminations influenced learning and assessments just as the security and lawful status of worldwide understudies in their host country.

**Positive impact of Covid-19 on education:**

- **Improved use of e-media:**

Learning materials are distributed in students effectively and the connected questions are settled through email, SMS, calls and utilizing diverse social Medias like WhatsApp or Facebook.

- **Enhanced use of e-content as learning material:**

Students were not able to collect the hard copies of study materials and hence most of the students used of soft copies materials for reference.

- **Improvement in collaborative work:**

There is a new opportunity where collaborative teaching and learning can take on new forms. Collaborations can also happen among faculty/teachers across the world to benefit from each other.

- **Rise in online meetings:**

The pandemic has created a massive rise in teleconferencing, virtual meetings, and webinars and e-conferencing opportunities.

- **Enhanced Digital Literacy:**

The lockdown situation induced people to learn and use digital technology.

- **World wide exposure:**

Teachers and students have the opportunity to exchange ideas with their peers from all over the world. The students adapt to an international community.

- **Better time management:**

Students are able to manage their time more efficiently in online education during pandemics.

- **Demand for Open and Distance Learning:**

During the pandemic, most of the students preferred the ODL mode as it encourages self-learning and the opportunity to learn from different resources and personalized learning based on their needs.

**Negative impact of Covid-19 on education:**

- **Impact on educational activity:**

Classes are suspended and exams at all levels are postponed. Various committees have postponed the annual examinations and entrance examinations. The admission process was delayed. Due to the continuity of learning, students almost missed classes for nearly 3 months in the 2020-21 academic years, which will further worsen the continuity of learning. Students have many difficulties in resuming their studies after a long break.

- **Impact on employment:**

Due to COVID-19, most recruits have been postponed. The company's postponement of student enrollment will also adversely affect student employment. Due to this pandemic, the unemployment rate is expected to rise. Due to the current situation, graduates are worried that their job opportunities will be withdrawn by the private sector.

- **Unprepared teachers/students for online education:**

Not all teachers/students are good, or at least not all are prepared for this sudden shift from face-to-face learning to online learning. Most teachers only teach on video platforms such as Zoom and Google Meet, and e-learning cannot be truly realized without a dedicated e-learning platform.

- **Increased responsibility of parents to educate their wards:**

Some educated parents are able to guide but some may not have the adequate level of education needed to teach children in the house.

- **Loss of nutrition due to school closure:**

Snacks are a school lunch program run by the Indian government to provide better nutrition for school children across the country. Due to the temporary suspension of lunch, school suspension has a serious impact on students' daily meals. A number of studies have shown that afternoon tea is also an important factor in increasing enrollment.

- **Access to digital world:**

As many students have limited or no internet access and many students may not be able to afford computer, laptop or supporting mobile phones in their homes, online teaching-learning may create a digital divide among students. The lockdown has hit the poor students very hard in India as most of them are unable to explore online learning according to various reports.

**Conclusion:**

The coronavirus is having a huge impact on education sectors around the world. Although this has brought many problems, there are also several possibilities. Education systems around the world, including Bhutan, need to invest in the professional development of teachers, especially in the areas of ICT and effective teaching methods. Another area of research and development is to make online learning creative, innovative and interactive through easy-to-use tools. This will help the education system and prepare for future uncertainties.

**References:**

1. Al-Samarrai, S., Gangwar, M., and Gala, P. (2020). The Impact of the COVID-19 Pandemic on Education Financing. World Bank Other Operational Studies 33739, the World Bank. <https://doi.org/10.1596/33739>
2. Basilaia, G., and Kvavadze, D. (2020). Transition to Online Education in Schools during a SARS-CoV-2 Coronavirus (COVID-19) Pandemic in Georgia. Pedagogical Research, 5, Article No. em0060. <https://doi.org/10.29333/pr/7937>.
3. Chick, R. C. (2020). Using Technology to Maintain the Education of Residents during the COVID-19 Pandemic. Journal of Surgical Education, 77, 729-732.
4. Crawford, J., Butler-Henderson, K., Rudolph, J. (2020). COVID-19: 20 Countries' Higher Education Intra-Period Digital Pedagogy Responses. Journal of Applied Teaching and Learning, 3, 1-21. <https://doi.org/10.37074/jalt.2020.3.1.7>.

## **SOCIO – ECONOMIC IMPACT OF COVID-19 IN INDIA**

**Nafeesa Beguma and Shaila M**

Department of Botany,

Sahyadri Science College, Kuvempu University

Shivamogga -577203, Karnataka, India

Corresponding authors E-mail: [nafeesabegum30@gmail.com](mailto:nafeesabegum30@gmail.com), [shailamresearchscholar95@gmail.com](mailto:shailamresearchscholar95@gmail.com)

---

### **Abstract:**

Coronaviruses are a group of related RNA Viruses that cause diseases in mammals and birds. In humans and birds, they cause respiratory tract infections that can range from mild to lethal. The COVID-19 virus is a new virus linked to the same family of viruses as Severe Acute Respiratory Syndrome (SARS) and some types of common cold. Coronavirus (COVID-19) pandemic has created an unprecedented loss and disruptions over all across the world. From developed to developing, no country has been spared from its brunt. In this paper, we have analysed the impact of COVID-19 on the economy and society of India so far. An impact assessment on the basis of available literature is impact on migrants, health, poverty, job losses, informal sector, environment, and so forth. The all sectors of the economy have been disproportionately affected and even within a sector, there is a disproportionate loss. The societal impacts are dire too with job losses, mental illness, increased domestic violence, and so forth. Some positive effects can be seen in terms of improved air quality, water quality, wildlife but the sustainability of such impact is conditional upon post-COVID and people's habits and future policies related to the environment.

**Keywords:** COVID-19, Economy, Impact, Society.

---

### **Introduction:**

The disease caused by the new coronavirus first discovered in Wuhan, China is called Coronavirus Disease 2019 (COVID19)-CO stands for Corona, VI stands for Virus, and "D" stands for Disease. Previously, this disease was called "2019 Novel Coronavirus" or "2019nCoV". The COVID19 virus is a new virus that belongs to the same virus family as Severe Acute Respiratory Syndrome (SARS) and certain types of colds. The maximum is 120 nm, the diameter of the known extreme is 50 to 200 nm, and the average total molecular weight is 40,000 kDa. They are surrounded by shells filled with various protein molecules. When the virus is outside the host

cell, the lipid bilayer envelope, membrane proteins and nucleocapsid can protect the virus. The virus is spread through direct contact with droplets from the respiratory tract of an infected person (produced by coughing and sneezing) and contact with infected surfaces. The COVID19 virus can survive on surfaces for hours, but simple disinfectants can kill it. These include fever, cough, and shortness of breath. In more severe cases, the infection can cause pneumonia or breathing difficulties. In rare cases, this disease can be fatal. These symptoms are similar to flu or the common cold, and are more common than COVID19. India ranks fourth in the number of confirmed cases and first in Asia. The total number of confirmed cases in India is 4,56,183, of which 14,476 deaths occurred mainly in Maharashtra and Delhi (Ministry of Health and Family Welfare, India, GOI). The UK does not have enough capacity to deal with this epidemic. Only for the benefit of the people and for the global economy, this is the most serious blow in every respect.

In Pre-COVID era India was encountering with major macroeconomic issues such as nearly recession with the sluggish GDP growth rate of 4.7% in 2019 which is lowest since 2013 (as indicated by the official statistics), high unemployment rate, decline in industrial output of core sectors—the worst in 14 years, stagnancy in private sector investment, decline in consumption expenditure for the first time in several decades (Dev&Sengupta, 2020). Also, the informal sector of India which is the largest in the world employs nearly 90% of the total working population and contributes significantly in overall GDP (more than 45%) has been hit by two major shocks (or reforms) already due to demonetization in 2016 and GST in 2017.

In this article, an attempt is made to investigate the socioeconomic implications of the coronavirus pandemic (COVID-19) in India. The motivation behind this is to provide an overview of the loss that occurred to different sectors of the Indian economy and society to have a better understanding of the issues to the government.

### **Economic Impact of Covid-19 in India:**

#### **Agriculture and allied activities:**

Agriculture and related activities are not a homogeneous activity group, but a collection of different activities, and each activity has different dynamics, so the impact of COVID-19 in this sector depends on the activity group, ie. H. For plants, the difference is attitude. , Fisheries, etc. Horticulture and food production are part of crops and are affected by them in different

ways. In order to curb the spread of COVID-19, India, like other countries, implemented full quarantine in March, which coincided with the peak of the rabi harvest season in India, mainly in the northwest, causing significant losses to the country. Although the agricultural sector was relaxed during the lockdown period, traffic restrictions, mobility restrictions and labor shortages occurred due to the reversal. The migration of labor to the place of origin is the main problem faced by farmers in Maharashtra, and it is called the worst than during the demonetization period in 2016 (Saha and Bhattacharya, 2020). In January 2020, as food prices began to rise, some bright spots appeared, but in this new crisis, all hopes were dashed (Mukhopadhyay, 2020).

The harvest of Rabi is progressing well and it is also announced to increase the MSP of Harif plants to ensure that farmers' yield reaches 50% to 83% of their production costs. The decline in demand for fruits and vegetables and the decline in exports have been severely hit by gardening, just as ornamental gardening has been hit by the decline in demand due to the closure of religious sites and delayed marriages. Fortunately, it has remained stable during detention. The fisheries and aquaculture industries are expected to have a strong negative impact, while the size of grains and livestock is relatively small to medium. India sees a glimmer of hope in the COVID19 crisis, and CRISIL predicts that agriculture will grow by 2.5% in the 2021 fiscal year (CRISIL, 2020).

### **Manufacturing sector:**

The assembling area is the significant giver of GDP and work in the auxiliary area and has been perceived as a motor for energetic development and maker of the country's abundance (Rele, 2020). The assembling area is significant in the manner that it has solid linkages with different areas, both forward and in reverse linkages so any effect in this area will influence different areas also. Generally, the assembling area will be influenced gravely by request supply disturbances and worldwide worth production network.

The half supporter of the assembling area, the car area was enduring before COVID-19 too due to even consider lowing purchaser interest, deficient credit offices, and more issues because of the NBFC emergency. There is a great deal of pressing factor because of interest supply interruptions on the wellbeing of the auto area in India because of COVID-19. From many years, China has been the focal point of assembling representing 33% of complete assembling over the world. However, after the flare-up of COVID-19, numerous nations are intending to move center from China and searching for nations like China where modest work is

accessible. Along these lines, it's anything but a brilliant chance for India to make "Made in India" worldwide. There is colossal potential in India, if appropriate measures will be taken to support the assembling area, India will arise as another assembling center outperforming China.

The miniature, little and medium undertakings (MSMEs) in general structure a huge portion of assembling in India and assume a vital part in giving work openings and furthermore in the nation's fares. As demonstrated by late reports MSMEs contribute 30% in India's GDP and half in the work of modern specialists. In any case, this area has issues like the non-accessibility of sufficient, ideal, and moderate institutional credit. Albeit every one of the organizations and areas are influenced because of the pandemic, this area is seriously hit because of diminished incomes, inventory network disturbances, deficiency of transient specialists because of opposite relocation, less interest, etc. Like China, India is additionally expected to have significant obliterations in this area with more difficulties to little firms as contrasted and upstream firms (Dev and Sengupta, 2020).

**Financial market and institutions:**

The monetary area that has the main task to carry out in the emergency times has additionally been having tremendous issues in India like Twin Balance Sheet (TBS), significant degrees of non-performing resources (NPAs) and a deficiently promoted banking framework. In the private corporate area as well, firms are monetarily frail and over-utilized (Sengupta and Vardhan, 2019). Some more issues like IL and FS emergency, decrease in business credit of around 90% in FY2020-first half, and a close destruction of a notable and presumed private bank—Yes Bank, etc.

There is no such effect on the financial area, but since banks are at the front line of public consideration the aberrant effect of a few different areas that are hit by the pandemic is probably going to be on the banks and other monetary foundations. Banks are the significant wellspring of help in the midst of emergency, subsequently when any remaining areas are hit gravely; banks will likewise confront the brunt. The securities exchange has likewise seen the most exceedingly terrible in March, 2020 because of the lockdown and breakdown of different business activities. Other significant components of administration area like aeronautics, transport, travel, and the travel industry are most noticeably terrible hit in India, however worldwide. The misfortune to this area also will be founded on the seriousness and life span of

the emergency. A report by KPMG shows that around 38 million occupation misfortunes are normal in India's movement, the travel industry and accommodation industry.

**Pharmaceuticals:**

Given the close ties between the pharmaceutical industry and China, the drug supply chain has been affected. API, also known as API, is an important part of pharmaceutical manufacturing. China's Hubei Province is the center of the coronavirus and the center of API manufacturing. The production facilities in Himachal Pradesh, Asia's largest pharmaceutical center, have been warned to suspend. Since January 2020, the price of paracetamol has almost doubled, so much so that the pharmaceutical industry is already facing the heat of the coronavirus.

**Automobile industry:**

The automotive industry, which has experienced its worst recession in nearly two decades, is facing supply chain disruptions. China is one of India's major suppliers of auto parts, accounting for 27% of total exports. He said: "The Coronavirus is expected to affect the Indian automotive industry, which in turn affects the auto parts and forging equipment industries, which have already reduced production due to changes in market conditions and the upcoming BSVI standard BSIV in April.

**Stock market:**

The securities exchanges across the world have remained exceptionally unstable in the last numerous days. Ajit Mishra, VP – Research, Religare Broking, said, "The business sectors would keep on following the worldwide lists which are under pressure as Coronavirus is required to unfavorably affect worldwide inventory chains. There are reports that US GDP development will back off significantly in Q1CY20, while fears of a downturn are affecting European business sectors." Taking into account insights and specialists' conclusions, it seems like it will be difficult for the Indian economy to remain protected from the hit of Covid.

**Social impacts of Covid-19:**

**Gender gap and inequality:**

Globally, it is estimated that due to the COVID19 pandemic, women are more likely to lose their jobs than men. The decline in employment in India is uneven and not gender-neutral. As there is already a considerable gender gap in employment, the absolute number of men has fallen more than women. Comparing the number of hours before and after the end of

housework, most states found that the gender gap in the average number of hours of housework in the first month of isolation has narrowed. In addition, the proportion of men doing housework after childbirth increased by 0.5-4 hours. However, the proportion/distribution of men has shifted further to the right (Deshpande, 2020). Given the heavy burden that the crisis has placed on low-skilled, poor, and other disadvantaged groups, many economists believe that COVID19 is likely to occur. The growing inequality within and between countries (Global Market Initiative, 2020) and a study (Furceri, Loungani, Ostry and Pizzuto, 2020) confirmed that people with a basic education (lower education) are more Higher education and higher-income people suffer more losses, which confirms the increasing prevalence of income inequality.

**Health crisis - Rural/Urban:**

Due to the lack of testing services, lack of doctors, medical equipment and beds, even in developed areas of India, COVID19 poses a major threat to India. Many experts questioned its ability to manage current affairs (Rakshit and Basishtha, 2020). Rural and urban areas are disproportionately affected by the coronavirus pandemic. The most difficult part at the moment is due to the high population density in urban areas. In rural areas where about 70% of the Indian population lives, the risk is much higher. During this pandemic and spread, especially in the northern states where the population density is high due to a shortage of doctors, there are no medical facilities available. Beds, equipment, etc. that can accommodate thousands of people (Kumar *et al.*, 2020)

**Domestic violence and crime:**

According to the latest report from the National Women's Council (NWC), domestic violence against women has increased by 45% within 25 days after isolation. Especially in Uttar Pradesh, domestic violence has increased. According to NCW director Rekha Sharma, the number of cases in Bihar, Haryana and Punjab is almost double the number before the closure. However, the actual situation may be more dangerous, because many rural women are not specifically represented on the matter and speak out. And they are afraid of their husbands and family (Kundu and Bhowmik, 2020). In terms of overall crime rates, after the blockade, the good news is that crime rates in India and around the world have also dropped significantly, but research shows that hunger, poverty and inequality are the consequences of any crisis and epidemic. The crime rate is rising (Uppal, 2020).

**Reverse migration:**

This is the second largest mass displacement that India has experienced since the partition in 1947. This is especially the issue of "reverse migration". As stated by the International Maritime Organization (International Organization for Migration, 2011), return or re-migration is the act/process or migration of people returning to their place of origin. These people have previously moved to urban communities or urban areas to find jobs and oil families for their Work to earn income. Due to COVID19, limited employment opportunities have led to large-scale return of immigrants. Due to uncertainties such as future crises, financial crises, and health crises, they are worried about further damage. The extent of this return of migrants is so great that the government (Mukhra *et al.*, 2020) Singh in 2020 reviewed the impact of the coronavirus pandemic on the rural economy of India, mainly the plight of migrant workers and COVID19 on rural areas The short-term impact. He said that the new crown pneumonia epidemic will have a negative impact on the rural economy in the short and long term, because immigration will bring undue pressure on agriculture and the rural economy, severely affect poverty, and plunge more people into extreme poverty. He also believes that although the government is announcing the plan and providing help in various ways, the widespread corruption in the system is the biggest problem in making the plan effective.

**Poverty, job losses and informal sector:**

Somewhere around 49 million people everywhere on the world are relied upon to jump into "outrageous destitution" as an immediate consequence of the obliteration brought about by the pandemic and as indicated by World Bank, India is assessed to have its 12 million residents pushed in outrageous neediness (Bloomberg, 2020). According to the Center for Monitoring Indian Economy (CMIE), in India in excess of 122 million individuals lost their positions in April 2020, out of them to a great extent were the little merchants and compensation workers. As per a telephone study of 4,000 specialists led by Center for Sustainable Employment, around 80% of metropolitan laborers in the example lost positions with a sharp decrease in the income of ranchers and the individuals who were independently employed in areas other than agribusiness.

Prior similitudes in the formal and casual areas in India are bound to be expanded on the grounds that the casual or sloppy area or laborers don't approach government managed retirement advantages and there is a ton of vulnerability in their work. The casual area laborers were at that point confronting issues like low wages and pay and in this pandemic; they are

among the most influenced individuals. Around 40 to 50 million laborers are occasional transient which are straightforwardly and cruelly influenced and moved back to their local spots (switch relocation) because of absence of work, pay, cover, etc (Dev and Sengupta, 2020).

**Psychological impact - Mental Illness:**

The mental difficulties can be extreme to minimized individuals like ranchers who as of now have mental weights because of previous issues in the horticulture area. Aside from the wellbeing and financial emergency, this is the significant test to each nation hit by the pandemic. Because of lockdown, mass joblessness, the breakdown of different organizations, loss of pay, expanding disparities and neediness, passings, less versatility, etc. there is an enormous effect on the psychological status of individuals. From more seasoned to more youthful, rich to poor, everybody is influenced. This episode is bringing about extra medical problems like nervousness, stress, misery, outrage, dread, etc, worldwide. Almost 16,500 instances of ranchers' self destruction are accounted for consistently because of their poor financial conditions and because of COVID-19 such cases can be disturbed. (Hossain *et al.*, 2020)

Late investigations in mental science and proof show that comparative pandemics like the current one expanded psychological wellness issues like post-horrible pressure problem (PTSD), disarray, depression feeling, weariness during and after the isolate as well (Creeks *et al.*, 2020). More seasoned individuals are engaging with bigger wellbeing hazards just as are moreover inclined to be less fit for supporting themselves in separation. Albeit social separating is critical to contain the spread of the infection, if not executed viably, such measures can in like manner brief grow social restriction of more established individuals when they may need the most help. (UNDP, 2020) So, there is more pressure and strain for more seasoned individuals and the adolescent there are a few difficulties as well. Schools and Colleges are yet shut and there is disturbances in examinations, the individuals who are more fragile at considers and don't have web admittance to contemplate on the web (like in some rustic regions, particularly young ladies are not permitted to have a telephone and web association) are probably going to confront the brunt more. What's more, the individuals who are going to enter the labor force are probably going to deal with issues because of changing necessities of the businesses and less opportunities These all components lead to mental pressure and in outrageous situations where individuals are now experiencing some psychological sickness, the results of this pandemic might be brutal.

**Positive impact on environment:**

With serious negative implications and destruction to the economy and people, COVID-19 has got some positive implications too. One such is a gift to the river Ganga. In just 34–35 days of lockdown due to COVID-19 in India, the pollution in the river has decreased significantly which the two major plans, Ganga Action Plan, 1986, and NamamiGange, 2014, with hundreds of crores investment could not do, said Prof. B. D. Tripathi, Chairman, MahamanaMalaviya Research Centre for Ganga. There is a positive impact on air quality, water quality, wildlife and vegetation due to less traffic, less pollution due to lockdown and less business activities etc.

**Conclusion:**

COVID-19 pandemic has incurred unprecedented loss globally but India being an emerging economy is likely to get more affected in every sector and that too disproportionately. Agriculture and allied sector have been hit disproportionately with horticulture, poultry facing more brunt but overall agriculture sector is seen as a bright spot and is likely to get affected less as compared with loss occurred to other sectors. Manufacturing sector especially automotive sector and MSMEs are suffering more loss and due to global supply chain disruptions this sector is affected badly. Service sector which is the key driver of economic growth and largest contributor of GDP has been hit hardly due to various restrictions on mobility, halt on tourism and hospitality for the time being, very less transport activities, shutdown of schools/colleges, and so forth. The overall loss to the economy and to different sectors depends on the severity and longevity of crisis. Amid this coronavirus pandemic and an unprecedented crisis, apart from the monetary losses, the societal impact is harsh with major sociological and psychological challenges. Although there are some positive impacts also but the sustainability of these impacts on air quality, water quality, wildlife is conditional to post-lockdown scenario and people's behaviour and habits.

**References:**

1. Dev, S. M., and Sengupta, R. (2020). Covid-19: Impact on the Indian economy. Mumbai: Indira Gandhi Institute of Development Research.

2. Hossain, M. M., Purohit, N., Sharma, R., Bhattacharya, S., McKyer, E. L. J., and Ma, P. (2020). Suicide of a farmer amid COVID-19 in India: Perspectives on social determinants of suicidal behavior and prevention strategies.
3. [Financialexpress.com](https://www.financialexpress.com)
4. Erken H., R. Hayat and K. Ji (March 13, 2020). Coronavirus: The Economic Impact of COVID-19 on India.
5. Keelery S., (May 14, 2020) Estimated economic impact from COVID-19 on India's GVA April-June 2020 by sector.
6. Kumar, A., Nayar, K. R., and Koya, S. F. (2020). COVID-19: Challenges and its consequences for rural health care in India. *Public Health in Practice*, 1, 100009.
7. Naureen A and U. Waqar (May 01, 2020) Indian economy hit by COVID. <https://nation.com.pk/01-May-2020/indian-economy-hit-by-covid>
8. Rakshit, B., and Basishtha, D. (2020). Can India stay immune enough to combat COVID-19 pandemic? An economic query. *Journal of Public Affairs*.
9. Ranjan Aneja and Vaishali Ahuja (2020) An assessment of socioeconomic impact of COVID-19 pandemic in India, *Journal of Public affairs*, pp:1-7.
10. Saha, T., and Bhattacharya, S. (2020). Consequences of lockdown amid covid-19 pandemic on indian agriculture. *Food and Scientific Reports*. 1(special issue), 47– 50.
11. Sengupta, R., and Vardhan, H. (2019). Banking crisis is impeding India's economy. In *East Asia Forum* (Vol. 3).
12. United Nations (2020). *Everyone Included: Social Impact of COVID-19*. United Nations, Department of Economic and Social Affairs Social Inclusion.
13. Udhaya Kumar S, D. Thirumal Kumar, B. Prabhuhristopher and C. George Priya Doss (22 May 2020) The Rise and Impact of COVID-19 in India. <https://www.frontiersin.org/articles/10.3389/fmed.2020.00250/full>
14. Uppal, P. (2020). Covid-19 will Lead to increased crime rates in India. *International Journal of Research-GRANTHAALAYAH*, 8(4), 72– 78.
15. <https://www.mygov.in/covid-19/>

## MUCORMYCOSIS: A NEW EMERGING CONCERN

### IN THE TREATMENT OF COVID-19

Munmi Gogoi\*<sup>1</sup> and Bijit Sensua<sup>2</sup>

<sup>1</sup>Department of Zoology, Cotton University, Guwahati, Assam, India

<sup>2</sup>Department of Zoology, Swahid Peoli Phukan College, Namti, Assam, India

\*Corresponding authors E-mail: [gogoim70@gmail.com](mailto:gogoim70@gmail.com)

---

#### Abstract:

Despite currently dealing with a debilitating wave of corona virus infection, India is observing an increase in COVID-19 induced mucormycosis in specific places. Mucormycosis commonly referred to as black fungus, is a serious uncommon disease which is caused by mucormycetes, a type of moulds. Patients with health issues or taking medication are more susceptible to get an infection that reduces the body ability to fight infections and sickness. The use of steroids in the treatment of COVID patients as well as the fact many COVID patients had diabetes as co-morbidity may have contributed to the recurrence of black fungus infections. Although since the outbreak, there are still unresolved concerns about the origin of this fungal infection. According to different current report on the appearance of black fungus morbidity throughout the new COVID -19 crises on this selective have a look at are early detection of this probably life-threatening infection and well timed care become crucial in decreasing mortality rates.

**Keywords:** Mucormycosis, COVID-19, Steroids, Fungus

---

#### Introduction:

Even as the country continues to deal with the aftermath of the COVID-19 pandemic, a new health problems looks to be on the verge of erupting in India .Mucormycosis is a kind of rare but lethal black fungus infection, has been identified in COVID-19 patients, and is now being referred to as COVID -19 caused mucormycosis.Paltauf initially reported phycomycosis, also known as zygomycosis in 1885 (Singh *et al.*, 2021) and later Baker created the term Mucormycosis in 1957 (Baker, 1957). Mucormycosis is caused by different types of fungus. The predominant fungal pathogens for co-infection in persons with COVID-19 have been identified as Aspergillosis and Candida (Song *et al.*, 2020). *Rhizopus oryzae* is the most frequent kind of Mucormycosis agent in humans, accounting for roughly 60% of all cases and 90% of the Rhino-

orbital cerebral variant (Singh *et al.*, 2021). Mucormycosis does not affect everyone who has a corona virus infection and is taking COVID-19 treatment. Some people are more susceptible to the fungal infection than other. According to an advisory issued by the Indian Council of Medical Research(ICMR), people with diabetes who are unable to maintain appropriate blood sugar level, people with chronic disorder or conditions who have been using immunosuppressive steroid medicines to treat pre-existing illness as well as COVID-19 for a long time, for a extended period of time, patients are admitted to the intensive care unit (ICU) of hospitals, having compromised immune system as a result of comorbidities such prior organ transplant procedures or cancer, antifungal medications are already being prescribed to treat infections etc.

According to a recent estimate for the year 2019-2020 the prevalence of mucormycosis range from 0.005 to 1.7 per million people worldwide, with the prevalence in India approximately 80 times greater than in developing countries (Chander *et al.*, 2018; Prakash and Chakrabarti, 2019; Skiada *et al.*, 2020). In India Diabetes mellitus is the most prevalent risk factor in mucormycosis, where as in Europe and the United States, hematological malignancies and organ transplant take the lead (Prakash and Chakrabarti, 2019). India already has the world's second largest country in diabetes population (International Diabetes Federation, 2013). Diabetes mellitus however remains the major risk factor for mucormycosis worldwide with a death rate of 46% (Jeong *et al.*, 2019). In a major 2018,meta analysis of 851 cases of uncommonly occurring mucormycosis. The presence of *Diabetes mellitus* was a major risk factor with *Rhizopus* (48%) being the most commonly isolated species (Jeong *et al.*, 2019).

At the same time as long time use of corticosteroids has regularly been related to numerous opportunistic fungal infection which includes aspergillosis and mucormycosis, even a of corticosteroids has recently been stated to link with mucormycosis specially in humans with diabetes. Few cases of mucormycosis have been reported as a result of even a short period (5-14) days of steroid medications, primarily in person with diabetes (Hoang *et al.*, 2020). Unexpectedly, in the European Confederation of Medical Mycology Study, 46% of patients had administered corticosteroids during the month prior to the diagnosis of mucormycosis (Skiada *et al.*, 2011). In the context of the COVID-19 epidemic, where corticosteroids are frequently administered, these findings need to be reexamined. In patients with COVID -19, there has been a sharp increase in case reports of mucormycosis, particularly in India. Similarly other case

reports from various parts of the world have been documented. In published articles, such as print and electronic media, several incidents have been published. These findings are ground breaking and have enormous public health implications, especially given the high mortality rate associated with mucormycosis. Mucormycosis with cerebral involvement, in particular, can result in a death rate of up to 90% (Deutsch *et al.*, 2019). To improve quality of life and reduce risks, a high index of suspicion and proactive management are required.

### **Types of Mucormycosis:**

According to Centers for Disease Control and Prevention (CDC), Mucormycosis are mainly five types-(a) Rhino cerebral (sinus and brain) mucormycosis is a sinus infection that has potential to spread to the brain. (b) Pulmonary (lung) mucormycosis is an infection due to the inhalation of fungi spores into the bronchioles and alveoli. (c) Gastrointestinal mucormycosis is an infection due to invasion of fungi into the gastric mucosa (d) Cutaneous (skin) mucormycosis occurs when fungi enter the body through skin break. (e) Disseminated mucormycosis occurs when the infection spread from one portion of the body to another via blood stream. The infection is most usually found in the brain, although it can also damage the spleen, heart and skin.

### **Fungi causing Mucormycosis:**

Mucormycosis is an angio-invasive fungal infection with high morbidity and mortality rates and generally affects immune-compromised cases. A variety of fungi are capable of causing this. Mucormycosis are fungi that belong to the mushroom family Mycormycetes. *Rhizopus* and *Mucor* species, which are the most common, cause mucormycosis. Other some examples of fungi species which causes mucormycosis include *Rhizopus arrhizus*, *Rhizopus homothallicus*, *Mucor irregularis*, *Syncephalastrum* species, *Cunninghamella bertholletiae*, *Apophysomyces variabilis*, *Thamnostylum lucknowense*, *Saksenaea*, *Lichtheimia* etc, Bhat *et al.* (2021).

### **Relation between COVID-19 and Mucormycosis:**

Mucormycosis is a life-threatening fungal infection that occurs in immunocompromised patients (Veisi *et al.*, 2021). There has been lot of case reports from India showing COVID recovered patients presenting with invasive fungal infections, this could be because of their immunocompromised status and long-term corticosteroid use. India has so far reported

approximately cases of 8,848 mucormycosis or black fungus, one of the rapidly-spreading infections observed in those recovering from COVID-19 (Sentinel Digital Desk, 2021).

Assam has reported its first death related to black fungus. A 27-year-old diabetic patient had developed the infection days after recovering from COVID -19, India today (2021).It most commonly affects patients with poorly controlled *Diabetes mellitus* and immunocompromised patients, leading to significant morbidity and mortality. The most common region affected is the nose, paranasal sinus, and brain leading to rhino-orbital and rhino-cerebral mucormycosis. In the present pandemic it has been most of the case reports are of rhino-orbito-cerebral mucormycosis (John *et al.*, 2021). However, there are some cases of pulmonary (Garg *et al.*, 2021) and gastrointestinal mucormycosis too (Monte *et al.*, 2020). The causes for increased mucor infection in patients of COVID-19 is complex which includes various factors, like pre-existing diseases, such as diabetes mellitus; use of immunosuppressor like glucocorticoids and tocilizumab and also pre-existing lung conditions; and systemic immune alterations by the virus itself like reduced number of T lymphocytes, CD4+T, and CD8+T cells (John *et al.*, 2021). According to the Centre for Disease Control and Prevention (CDC), Mucormycosis cases have a 54 percent all-cause mortality rate. However, this rate varies depending on the underlying medical condition, type fungus, and infected area of the body. The black fungus or mucormycosis has sent many COVID-recovered patients back into ICUs since the onset of the pandemic (News 18, 2021). According to some studies, the virus causes intense pain which has led to the blindness of 20-30% of the affected patients. When the fungus infection emerges behind the retina and compresses the optic nerve, loss of vision occurs (BBC, 2021).

#### **Symptoms of Mucormycosis in COVID-19 patients:**

Mucormycosis, or black fungus, appears two to three days after a person recovers from the COVID-19 infection. After the patient has been relieved of COVID-19, this fungal infection begins in the sinuses and spreads to the eyes in two to four days. The black fungus will spread to the brain in the next 24 hours (Bhat *et al.*, 2021). Mucormycosis symptoms vary depending on where the infections develops in the body, According to the Centre for Disease Control and Prevention. Rhinocerebral syndrome manifests itself as one-sided face edema, cough, nasal or sinus irritation, fever, and black lesions on the nasal bridge or upper interior of the mouth that rapidly worsen (sinus and brain) mucormycosis. Symptoms of pulmonary (lung) mucormycosis

include fever, cough, chest pain and shortness of breath. Early detection and diagnosis of the infection, as well as timely delivery of effective antifungal treatment, have improved outcomes in mucormycosis patients (National Organization for Rare Disorders, 2021).

### **Pathogenesis:**

Ketone reductase is an enzyme found in *Rhizopus* fungus species that permits them to flourish in high glucose and acidic conditions. The serum of healthy people suppressed the growth of *Rhizopus*, while the serum of patients with diabetic ketoacidosis promoted the growth (Gale and Welch, 1961). The inhalation of spores causes Rhino-orbital-cerebral and pulmonary mucormycosis. These spores are transported to the pharynx by cilia and then eliminated through the gastro-intestinal tract in healthy people. Infection commonly starts in the nasal turbinates or alveoli in immune-compromised patients (Ferguson, 2000). Mucormycosis agents are angioinvasive hence infarction of infected tissue is a defining feature of the disease (Greenberg *et al.*, 2004).

Deferoxamine, a chelator of both iron and aluminium, raises the risk of mucormycosis through promoting proliferation and pathogenicity (Boelaert *et al.*, 1991; Boelaert *et al.*, 1994; Ferguson, 2000). The deferoxamine-iron chelate ferroxamine is a siderophore for the *Rhizopus* species, which increases fungus growth and tissue penetration via enhancing intake by the fungus (Boelaert *et al.*, 1993; Greenberg *et al.*, 2004). In the absence of deferoxamine treatment, iron excess may be a risk factor for mucormycosis (Maertens *et al.*, 1999). Furthermore, people with diabetic ketoacidosis have higher levels of free iron in their blood, which encourages *Rhizopus oryzae* development at an acidic condition but not at alkaline conditions (Artis *et al.*, 1982; Ibrahim *et al.*, 2012). Although deferoxamine was originally widely utilized as an aluminium chelator in patients with renal failure, aluminium overload is now uncommon. Patients who have received several blood transfusions and are treated with this chelating drug for iron overload are currently at risk for deferoxamine associated mucormycosis. Most patients with deferoxamine-related infections developed spread disease, which can be quickly fatal, with a mortality rate close with 90% (Boelaert *et al.*, 1991). Other iron chelating drugs as deferasirox and deferiprone, do not operate as siderophores and hence do not raise the risk of mucormycosis, unlike deferoxamine.

### **Challenges in the treatment of Mucormycosis associated COVID-19:**

Mucor infection is usually deep-seated making early detection challenging. It is not always effective, to do broad clean debridement, especially if the infection has progressed to the brain. The best course of action is to begin anti-fungal treatment immediately and if possible, to debride any diseased necrotic tissue. If the infection has spread to the brain, the only treatment option is to administer an anti-fungal medicine that is powerful and effective. The procedure ought to be administering potent anti-fungal drugs as soon as conceivable with ideal dosage for ideal term until disease is clinically, microbiologically and radio logically cleared. According to complete guidelines on process of mucormycosis by European Confederation by agreement of Medical Mycology, the selection of anti-mucor drugs is confined to three molecule-Isaconazole, Posaconazole and Amphotericin B. Among them, if there is pre-existing renal damage, it is recommended to use Isaconazole and Posaconazole. Mucormycosis is treated with Amphotericin B, a strong broad spectrum fungicidal. Amphotericin B, at a high dose should be used to begin the treatment. Liposomal Amphotericin B is the primary choice in terms of dose limiting toxicities, particularly nephro toxicity. There are two types of liposomal formulation available in India-(1) Liposomal Amphotericin B suspended in dextrose, 5-10 vials per day (2) Liposomal Amphotericin B in saline, a dosage of 1-3 vials per day is advised. The use of saline instead of dextrose has been shown to help minimize nephrotoxicity. The treatment is cost-effective because to the lower dose of drug prepared in saline. Mucor is a more prevalent infection among diabetics because it thrives on high blood sugar levels. Steroid treatment for diabetic COVID patients may result in even higher sugar levels, which encourages mucor development. As a result, Liposomal Amphotericin B in saline will be a superior alternative for inhibiting mucor growth and providing a more effective treatment. Many lives will be saved by the prudent use of steroids and antimicrobial agents in COVID patients as well as early diagnosis and treatment with Liposomal Amphotericin B, which should be continued until the infection is cleared (Economic times, 2021).

### **Conclusion:**

A unique novel corona virus has recently caused a global epidemic that has affected practically the whole world culminating in a fatal illness. Due to immunity deterioration, corona virus disease associated mucormycosis has emerged as a new threat to world as it strives to

maintain stability in the current scenario. COVID-19 with mucormycosis also posing a serious concern to medical professionals. Patients on steroids, diabetics and other who have had a transplant are more susceptible to get an infection. As a result, the infection can be cured with early detection, antifungal treatments and preventive measures.

#### **References:**

1. Artis, W. M., Fountain, J. A., Delcher, H. K., and Jones, H. E. (1982). A mechanism of susceptibility to mucormycosis in diabetic ketoacidosis transferring and iron availability. *Diabetes*, 31(12), 1109-1114.
2. Baker, R. D. (1957). Mucormycosis—a new disease?. *Journal of the American Medical Association*, 163(10), 805-808.
3. Bhat, I., Beg, M. A., and Athar, F. (2021). A contemporary intimidation for COVID-19 patient's co infected with mucormycosis in India. *J Bacteriol Mycol Open Access*, 9(2), 69-71.
4. Boelaert, J. R., de Locht, M., Van Cutsem, J., Kerrels, V., Cantinieaux, B., Verdonck, A. ... and Schneider, Y. J. (1993). Mucormycosis during deferoxamine therapy is a siderophore-mediated infection. In vitro and in vivo animal studies. *The Journal of clinical investigation*, 91(5), 1979-1986.
5. Boelaert, J. R., Fenves, A. Z., and Coburn, J. W. (1991). Deferoxamine therapy and mucormycosis in dialysis patients: report of an international registry. *American journal of kidney diseases*, 18(6), 660-667.
6. Boelaert, J. R., Van Cutsem, J., de Locht, M., Schneider, Y. J., and Crichton, R. R. (1994). Deferoxamine augments growth and pathogenicity of *Rhizopus*, while hydroxypyridinone chelators have no effect. *Kidney international*, 45(3), 667-671.
7. Chander, J., Kaur, M., Singla, N., Punia, R. P. S., Singhal, S. K., Attri, A. K., ... and Guarro, J. (2018). Mucormycosis: battle with the deadly enemy over a five-year period in India. *Journal of Fungi*, 4(2), 46.
8. Deutsch, P. G., Whittaker, J., and Prasad, S. (2019). Invasive and non-invasive fungal rhino sinusitis—a review and update of the evidence. *Medicina*, 55(7), 319.
9. do Monte Junior, E. S. D., Santos, M. E. L. D., Ribeiro, I. B., Luz, G. O., Baba, E. R., Hirsch, B. S., de Moura, E. G. H. (2020) Rare and Fatal Gastrointestinal Mucormycosis (Zygomycosis) in a COVID-19 Patient: A Case Report. *Clinical Endoscopy*, 53(6), 746–749

10. Federation, I. D. (2013). IDF diabetes atlas. Brussels: International Diabetes Federation, 128, 40-50.
11. Ferguson, B. J. (2000). Mucormycosis of the nose and paranasal sinuses. *Otolaryngologic Clinics of North America*, 33(2), 349-365.
12. Gale, G. R., and Welch, A. M. (1961). Studies of opportunistic fungi. I. Inhibition of *Rhizopus oryzae* by human serum. *American Journal of Medical Sciences*, 241(5), 604-12.
13. Garg, D., Muthu, V., Sehgal, I. S., Ramachandran, R., Kaur, H., Bhalla, A., and Agarwal, R. (2021). Coronavirus disease (Covid-19) associated mucormycosis (CAM): case report and systematic review of literature. *Mycopathologia*, 1-10.
14. Greenberg, R. N., Scott, L. J., Vaughn, H. H., and Ribes, J. A. (2004). Zygomycosis (mucormycosis): emerging clinical importance and new treatments. *Current opinion in infectious diseases*, 17(6), 517-525.
15. Hoang, K., Abdo, T., Reinersman, J. M., Lu, R., and Higueta, N. I. A. (2020). A case of invasive pulmonary mucormycosis resulting from short courses of corticosteroids in a well-controlled diabetic patient. *Medical mycology case reports*, 29, 22-24.
16. <https://health.economictimes.indiatimes.com/>
17. <https://rarediseases.org/rare-diseases/mucormycosis>
18. <https://www.bbc.com/news/world-asia-india-57027829>
19. <https://www.cdc.gov/fungal/diseases/mucormycosis/causes.html>
20. <https://www.icmr.gov.in/>
21. <https://www.indiatoday.in/coronavirus-outbreak/story/assam-reports-first-black-fungus-death-1804724-2021-05-20>
22. <https://www.news18.com/news/india/covid-19-triggered-mucormycosis-delhi-sir-ganga-ram-hospital-black-fungus-fungal-infection-3713495.html>
23. <https://www.sentinelassam.com/amp/topheadlines/india-reports-8848-black-fungus-mucormycosis-cases-539485>
24. Ibrahim, A. S., Spellberg, B., Walsh, T. J., and Kontoyiannis, D. P. (2012). Pathogenesis of mucormycosis. *Clinical Infectious Diseases*, 54(suppl\_1), S16-S22.
25. Jeong, W., Keighley, C., Wolfe, R., Lee, W. L., Slavin, M. A., Kong, D. C. M., and Chen, S. A. (2019). The epidemiology and clinical manifestations of mucormycosis: a systematic

- review and meta-analysis of case reports. *Clinical Microbiology and Infection*, 25(1), 26-34.
26. John, T. M., Jacob, C. N., and Kontoyiannis, D. P. (2021). When uncontrolled *Diabetes mellitus* and severe COVID-19 converge: the perfect storm for mucormycosis. *Journal of Fungi*, 7(4), 298.
27. Maertens, J., Demuyne, H., Verbeken, E. K., Zachee, P., Verhoef, G. E. G., Vandenberghe, P., and Boogaerts, M. A. (1999). Mucormycosis in allogeneic bone marrow transplant recipients: report of five cases and review of the role of iron overload in the pathogenesis. *Bone marrow transplantation*, 24(3), 307-312.
28. Prakash, H., and Chakrabarti, A. (2019). Global epidemiology of mucormycosis. *Journal of Fungi*, 5(1), 26.
29. Singh, A. K., Singh, R., Joshi, S. R., and Misra, A. (2021). Mucormycosis in COVID-19: a systematic review of cases reported worldwide and in India. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*.
30. Skiada, A., Pagano, L. I. V. I. O., Groll, A., Zimmerli, S., Dupont, B., Lagrou, K., and Petrikos, G. (2011). Zygomycosis in Europe: analysis of 230 cases accrued by the registry of the European Confederation of Medical Mycology (ECMM) Working Group on Zygomycosis between 2005 and 2007. *Clinical Microbiology and Infection*, 17(12), 1859-1867.
31. Skiada, A., Pavleas, I., and Drogari-Apiranthitou, M. (2020). Epidemiology and Diagnosis of Mucormycosis: An Update. *Journal of Fungi*, 6(4), 265.
32. Song, G., Liang, G., and Liu, W. (2020). Fungal co-infections associated with global COVID-19 pandemic: a clinical and diagnostic perspective from China. *Mycopathologia*, 1-8.
33. Veisi, A., Bagheri, A., Eshaghi, M., Rikhtehgar, M. H., Rezaei Kanavi, M., and Farjad, R. (2021). Rhino-orbital mucormycosis during steroid therapy in COVID-19 patients: a case report. *European Journal of Ophthalmology*, 11206721211009450.

## CURRENT MANAGEMENT STRATEGIES OF COVID-19

Mayuresh A. Burhade, Sanjay J. Kshirsagar and Umesh D. Laddha\*

MET's Institute of Pharmacy,

Bhujbal Knowledge City, Nasik-422003, MS-India

(Affiliated to Savitribai Phule Pune University)

\*Corresponding authors E-mail: [umeshladdha698@gmail.com](mailto:umeshladdha698@gmail.com)

---

### Abstract:

Since December 2019, the highly contagious COVID-19 virus has been spreading worldwide, with a rapid spike in the number of deaths. The WHO declared Covid-19 as a pandemic in March. The pandemic has affected all over the world. So far, COVID-19 has affected more than 20 million people all over the world and has caused more than 7 lakh deaths. Each and every suffering country is trying to save the residence people by controlling the spread of the virus. In this critical situation of COVID-19 pandemic, this chapter summarises the treatment which is followed by majority of countries. It also provides overlook on different vaccines and their role along with different *in vivo* animal models to evaluate effectiveness of medicines in management of COVID-19.

**Keywords:** Corona virus; COVID-19; Anti-viral; Vaccines.

---

### Introduction:

Coronavirus disease (COVID-19) is an infection which is usually caused by a newly discovered coronavirus. It is also denoted as the Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). Coronaviruses has a place with the group of Nidoviruses which can cause respiratory, enteric, hepatic and neurologic disarranges in humans. It is extremely infectious disease, which originated in Wuhan city in China. Due to its rapid spreading the World Health Organization (WHO) declared it as a global crisis on 31st January 2020 and on 11th March, it was signified as 'Pandemic' (Qu *et al.*, 2020).

SARS-CoV-2 is a sole candidate of the family *Coronaviridae* and order *Nidovirales*. This family consists of two subfamilies, *Coronavirinae* and *Torovirinae* and members of the subfamily *Coronavirinae* are partitioned into four generation:

- a) Alpha-coronavirus contains the human coronavirus (HCoV)-229E and HCoVNL63;
- b) Beta coronavirus includes HCoV-OC43, Severe Acute Respiratory Syndrome human coronavirus (SARS-HCoV), HCoV-HKU1, and Middle Eastern respiratory syndrome coronavirus (MERS-CoV);

- c) Gamma coronavirus includes viruses of whales and winged creatures and;
- d) Delta coronavirus includes viruses isolated from pigs and winged creatures.

SARS-CoV-2 is an encompassed and positive sense single-stranded RNA (+ss RNA) infection.

They are zoonotic. SARS-CoV was the main causative agent for the severe acute respiratory syndrome outbreaks in 2002 and 2003 in Guangdong Province, China. MERS-CoV was the pathogen which was responsible for severe respiratory disease outbreaks in 2012 in the Middle East (James *et al.*, 2020).

### **Structure of corona viruses:**

Coronaviruses are large in structure, enveloped, positive stranded RNA viruses. They have the largest genome which ranges from 27 to 32kb. This genome is packed inside a helical capsid formed by the nucleocapsid protein (N) and is encircled by an envelope.

They are related with the viral envelope are at any rate three primary proteins: The membrane protein (M) and the envelope protein (E) are associated with infection gathering; though the spike protein (S) intervenes infection section into have cells. Some Covids additionally show an envelope-related hemagglutinin-esterase protein (HE). Among these primary proteins, the spike frames enormous knot from the infection surface, giving Covids the presence of having crowns like appearance (crown in Latin methods crown) (Li, 2016).

The Covid spike contains three sections: a huge ectodomain, a solitary pass transmembrane anchor, and a short intracellular tail. The ectodomain comprises of a receptor-restricting subunit S1 and a layer combination subunit S2. Electron microscopy contemplates shows that the spike is a clove-formed trimer with three S1 heads and a trimeric S2 tail (Simas *et al.*, 2015).

### **Current treatments:**

#### **A. Anti-Virals:**

##### **1. Remdesivir**

Remdesivir is a broad-spectrum antiviral known for containing coronavirus activity in vitro It is an investigational analog of nucleoside and a monophosphoramidate prodrug of remdesivir-triphosphate (RDV-TP). RDV-TP is a simple of adenosine that goes about as a RNA-subordinate RNA polymerase (RdRp) inhibitor. For joining into the incipient viral RNA chain, RDV-TP contends with adenosine-triphosphate. Once joined into the viral RNA, it ends RNA union, accordingly repressing the creation of viral RNA. Since RDV-TP doesn't trigger quick chain end, the medication is attempted to dodge editing by viral exo-ribonuclease movement. Studies performed on animals recommended that remdesivir can essentially decrease the viral burden

in the lung tissue of MERS-CoV contaminated mice. It likewise upgrades lung working and limits neurotic disturbance of lung tissue. Remdesivir firmly inhibits interference with SARS-CoV-2 at low micromolar ( $\mu\text{M}$ ) concentrations but has a high selectivity index (Half Maximum Effective Concentration (EC50), 0.77  $\mu\text{M}$ ; Half Cytotoxic Concentration (CC50) > 100  $\mu\text{M}$ ; IS > 129.87) (Agostini *et al.*, 2020).

## 2. Favipiravir

Favipiravir (T-705; 6-fluoro-3-hydroxy-2-pyrazine carboxamide) is an anti-viral agent that efficiently inhibits RNA-dependent RNA polymerase (RdRp) from RNA viruses. It has been investigated by compound regulation of a pyrazine simple, at first separated invitro for against flu action. Following its part against hostile to flu infections, favipiravir can hinder the replication of alpha-, flavi-, filo-, arena-, bunya-, noro-, and other RNA viral infections. Favipiravir would thus be able to have huge antiviral action on SARS-CoV-2 likewise Favipiravir is a prodrug that goes through intracellular phosphorylation and gets changed over to its dynamic structure, favipiravir-ribofuranosyl-50 - triphosphate (favipiravir-RTP), which associates with viral RNA polymerase and hinders viral replication. Since RdRp's synergist area is saved across various kinds of RNA infections, this etiology approves a more extensive scope of favipiravir's anti-viral activity. It is recommended that favipiravir may get coordinated that into an incipient viral RNA, or it might work by restricting to rationed polymerase areas, in this way forestalling the joining of the nucleotide for duplicating and deciphering viral RNA. However more work is needed to clarify the association between favipiravirs against viral movement and concealment of the RdRp exercises.

National Infectious Diseases Clinical Medical Research Center and the Shenzhen Third People's Hospital got wonderful outcomes on February 14, 2020, from a clinical report on favipiravir for the administration of COVID-19. Primer discoveries from an aggregate of eighty patients recommended that the antiviral action of favipiravir was more effective than that of lopinavir/ritonavir. No likely results in the favipiravir treated gatherings were found, and it had considerably less unfavorable impacts than the group of lopinavir/ritonavir (Agostini *et al.*, 2020).

## 3. Arbidol (Umifenovir)

Arbidol, a Russian made indole derivative, stays an antiviral medication used to battle flu contamination in china and Russia. Arbidol essentially works by hindering the association between the infection and host cells, forestalling viral intrusion into have cells. It additionally shows immunomodulatory work by instigating interferon creation and macrophages initiation.

As per a report, it has been accounted for that arbidol at a concentration of 10–30  $\mu\text{M}$  in vitro is viable against SARS-COV-2. In a clinical report including 111 patients, it was discovered that arbidol advances and reinforces the pattern of viral leeway, improves central infiltration on radiological pictures, and diminishes interest for the high-flow nasal cannula (HFNC) oxygen treatment in-clinic treatment. In a review investigation, arbidol, in blend with lopinavir/ritonavir, showed useful impacts. However, in a randomized clinical investigation including 240 COVID-19 patients half of which got arbidol and other half got Favipiravir demonstrated that the clinical recovery pace of day 7 was 55.86% in the arbidol bunch and 71.43% in the favipiravir bunch showing the prevalence of favipiravir.

## **B. Biological agents:**

### **1. Tocilizumab**

Tocilizumab is a recombinant monoclonal immunoglobulin G1 (IgG1) immunizer against the human interleukin 6 (IL-6) receptor. Membrane bound IL-6 receptors (sIL-6R and mIL-6R) and dissolvable are two types of the receptor to which tocilizumab ties explicitly and restrains downstream signal transduction. Tocilizumab is utilized for the treatment of cytokine discharge condition (CRS), rheumatoid joint inflammation, and fundamental adolescent idiopathic joint inflammation. In addition, it has been accounted for to assume a specific part in Castleman's illness. It has been shown that a cytokine storm happened in the pathogenesis of SARS-CoV, including the huge arrival of favorable to fiery cytokines like IL-6. Articulation of IL-8, IL-1 $\beta$ , and IL-6 was particularly high in the event of Middle East respiratory condition, brought about by another Covid (MERS-CoV). Nonetheless, MERS-CoV has additionally reported a delayed induction of proinflammatory cytokine. Comparable in patients with SARS and MERS, COVID-19 patients likewise show higher plasma levels of cytokines, including IL-6, development variables and proteins that demonstrated a cytokine tempest and identified with the seriousness of the infection and its forecast. IL-6 is one of the basic cytokines answerable for a fiery tempest that prompted disabled dispersion of oxygen in the lungs. Along these lines, meddling with IL-6 may likewise be a potential treatment for extreme and basic COVID-19 contaminations. An investigation including 21 patients treated with tocilizumab in China showed quick improvement in fever, oxygen admission, lung sore murkiness, levels of C-responsive protein, and lymphocyte focus in fringe blood. Out of 21, 19 (90.5%) were released on a normal of 13.5 days after the treatment which shows a promising impact of tocilizumab, notwithstanding, more investigations are required in regards to its safety and efficacy study (Wu *et al.*, 2020).

## 2. Convalescent Plasma Therapy

Detached resistance conveyed as hostile to COVID antibodies from healing human plasma may offer a novel remedial methodology for COVID-19. The primary driver for the examination of recuperating human blood items in the therapy of COVID-19 started from its utilization in the H1N1 pandemic, during which patients inferred a clinically critical mortality advantage and improved viral clearance from recovering blood products. In a review audit of 40 patients with SARS who bombed treatment with methylprednisolone and ribavirin at 3 days, 74% of patients who got gaining strength plasma (n =19) were released by day 22 contrasted with just 19% of patients who got high-portion corticosteroids (n =21) ( $p < 0.001$ ). Five passing were accounted for in the steroid bunch contrasted with no passing with improving plasma. To get the best profit by recovering plasma treatment ought to be utilized right off the bat throughout sickness (before day 16), as viremia from SARS has been appeared to top in the main seven day stretch of therapy followed by an essential invulnerable reaction by days 10 to 14. Primer information from on-going recovering plasma treatment information in COVID-19 episode proposes improvement in clinical manifestations with no sign of unfriendly impacts. Directed enemy of SARS-CoV-2 antibodies that consider a more specific treatment against COVID are being developed and a few organizations have started dynamic enrolment for examination concerning its clinical viability and well-being treatment of COVID-19. Takeda Pharmaceutical has reported examination concerning another plasma determined treatment authored TAK-888. This plasma-determined treatment includes eliminating plasma from COVID-19 survivors, extricating COVID explicit antibodies to control to contaminated patients to invigorate a strong resistant reaction against SARS-CoV-2. Improving treatment stays in the trial stage however shows up it might well impact the treatment course and enrolment of patients into a clinical preliminary will help in characterizing its function in treatment (Chen *et al.*, 2020).

## 3. Stem cell therapy

Mesenchymal stem cells (MSCs) have been broadly used in cell therapies based on various preclinical and clinical studies regarding their safety and efficacy. MSCs have immunomodulatory effects and are capable of differentiation. MSC's immunomodulatory effects are due to its ability to communicate directly with immune cells or to the paracrine secretion of several forms of cytokines. The cytokines are triggered further by the stimulation of toll-like receptors in MSCs on stimulation by pathogen-associated molecules like LPS or double-stranded RNA from the virus. After MSC infusion in numerous unhealthy conditions, the subsequent improvement was ascribed generally to their immunomodulatory impacts. An

examination where seven COVID-19 patients were directed with human MSCs (106 cells for every kilogram of weight, intravenously) brought about improved utilitarian results or improved functional outcomes and quick recovery. The indications of the relative multitude of patients and aspiratory capacities improved in 2 days fundamentally after transplantation, and furthermore no unfavourable impacts were seen for 14 days.

Increases in peripheral lymphocytes, reductions in C-reactive protein, and overactivated cytokine-secreting immune cells (CXCR3 $\beta$ CD8  $\beta$  T cells, CXCR3 $\beta$ CD4  $\beta$  T cells, and CXCR3  $\beta$  natural killer (NK) cells) disappeared within 3–6 days of treatment. Besides that, there was a decline in TNF- $\alpha$  level, whereas IL-10 and a group of CD11c  $\beta$  CD14 $\beta$  CD11bmid regulatory dendritic cell (DC) population increased.

The chest computed tomography (CT) scan on the 9th day after MSC transplantation revealed that ground-glass opacity and inflammation of pneumonia were significantly decreased. MSCs' gene expression profile shows that they were negative with ACE2 and type-2 transmembrane serine protease (TMPRSS2), suggesting that MSCs are free of SARS-CoV2 infection. The intravenous transplantation of MSCs was, therefore, not only effective but also safe for the treatment of patients with COVID-19 pneumonia, especially patients under critically severe conditions. However, additional studies are required in a greater number of patients to validate this therapeutic intervention further (Chibber *et al.*, 2020).

#### **4. Interferons**

Interferons (IFNs) consist of a group of secreted ahelical cytokines triggered by stimulation of toll-like receptors in response to different cell surface biomolecules. Interferon-alfa (IFN- $\alpha$ ) is a broad-spectrum antiviral, widely used to combat hepatitis. It is documented to impair in vitro SARS-CoV reproduction. Interferon-beta (IFN- $\beta$ ) is a naturally occurring protein that orchestrates antiviral responses of the body. IFN- $\alpha$  and - $\beta$  both have shown anti-SARS-CoV activity in vitro IFN- $\beta$  has also displayed potent activity against MERS-CoV in vitro with an IC50 of 1.37 U/ml . Antiviral effect of IFN type I (IFN- $\alpha$  and IFN- $\beta$ ) against SARS-CoV were stated in twelve in vitro studies. It is also apparent from previous reports that IFN- $\beta$  was superior to IFN- $\alpha$  against SARS-CoV. Effective synergistic results for leukocytic IFN- $\alpha$  with ribavirin, IFN- $\beta$  with ribavirin, and IFN- $\beta$  with IFN- $\alpha$  have also been reported against SARS-CoV. In an in vitro study, following recombinant type-I IFN- $\alpha$  treatment, SARS-CoV-2 revealed a significant decrease in viral replication. Besides several other agents, IFN- $\alpha$  is also recommended for the treatment of COVID-19 in the guidelines issued by the National Health Commission and State Administration of Traditional Chinese Medicine. Further preclinical/clinical studies are required to depict the efficacy and the safety of interferons for the COVID-19 treatment (Chibber *et al.*, 2020).

## **Emerging treatments:**

### **1. Vaccines:**

It is crucial to develop safe and effective vaccines to control the COVID-19 pandemic, eliminate its spread, and ultimately prevent its future recurrence. Since the SARS-CoV-2 virus shares significant sequence homology with two other lethal coronaviruses, SARS and MERS, the vaccines identified in these patents related to SARS and MERS viruses could potentially facilitate the design of anti-SARS-CoV-2 vaccines.

A condensed report on several patents that describe vaccines for generating immunity to SARS and MERS follows.

#### **a) Attenuated Virus Vaccines**

Patent application US20060039926 discloses live attenuated coronavirus or torovirus vaccines. Introduction of a mutation (Y6398H) into the Orf1a/b polyprotein (p59/nsp14/ExoN) was shown to completely attenuate virulence of mouse coronavirus (MHV-A59). The attenuated MHV virus exhibited reduced replication in mice at day five following intracerebral inoculation (Liu *et al.*, 2020).

#### **b) DNA-Based Vaccines**

Patent application WO2005081716 reveals arrangements and techniques for prompting/upgrading immune response, especially antigen-explicit CD8+ T cell interceded reactions, against antigens of the SARS Covid. An upgrade of the immune response including especially cytotoxic T cell safe reactions is actuated in vivo by chimeric nucleic acids that encode an endoplasmic reticulum chaperone polypeptide (e.g., calreticulin) connected to at any rate one antigenic polypeptide or peptide from SARS-CoV. Utilizing gene gun delivery of DNA-covered gold particles, inoculation of mice against a calreticulin–nucleocapsid combination protein came about in intense nucleocapsid-explicit humoral and T cell-intervened resistant reactions. Immunized creatures were able to do fundamentally lessening the titre of a difficult vaccinia vector communicating the N protein of the SARS infection. Patent application WO2015081155 reveals immunogens, which include consensus proteins got from the MERS CoV spike protein, for use in DNA-based immunizations focusing on MERS-CoV. The agreement spike protein essentially prompted both humoral and cell safe reactions, including expanded titers of IgG and neutralizing antibodies. The actuated cell insusceptible reaction included expanded CD3+CD4+ and CD3+CD8+ T cell reactions that delivered IFN- $\gamma$ , TNF- $\alpha$ , IL-2, or both IFN- $\gamma$  and TNF- $\alpha$ . On March 3, 2020, Inovio Pharmaceutical, Inc. declared they had planned the

DNA immunization called INO-4800 to be anticipated human trials in the United States in April (Liu *et al.*, 2020).

### **c) Protein-Based Vaccines**

Patent application WO2010063685 by GlaxoSmithKline (GSK) uncovers or discloses a vaccine fit for inciting a defensive insusceptible reaction against SARS. The antibody involves a S protein immunogen and an oil-in-water emulsion adjuvant. A designed ectodomain immunogen (solvent S protein), in mix with the emulsion adjuvant, GSK2, incited significant degrees of against SARS-CoV IgG2a or IgG2b counter acting agent reactions and killing immunizer reactions in creature models. In late February 2020, GSK declared a coordinated effort with Chinese firm Clover Biopharmaceuticals to survey a (COVID-19) immunization candidate. This cooperation will include the utilization of Clover's protein-based Covid antibody up-and-comer (COVID-19 S-Trimer) with GSK's adjuvant framework. By applying their Trimer-Tag innovation, Clover has made a S-Trimer subunit immunization utilizing a quick mammalian cell culture-based articulation framework. The Trimer-Tag is a high-level medication advancement stage, which empowers the creation of novel, covalently trimerized combination proteins that can all the more likely objective past undruggable pathways. Patent application US20070003577 uncovers immunogenic organizations and immunizations related with the S protein of SARS Covid. A TriSpike SARS Covid antibody was set up from a recombinant full-length trimeric S protein.

The recombinant protein was appeared to (1) display local antigenicity as demonstrated by reactivity with healing SARS patient sera; (2) show explicit restricting to solvent ACE2 receptor; (3) advance neutralizer subordinate viral section in any case stubborn human Raji B cells; and (4) evoke insurance against a test contamination in a creature model. Patent application US20060002947 (Antigen Express, Inc., an auxiliary of Generex) reveals the readiness of mixture peptides made out of three components, including (a) an invariant chain (Ii) key peptide for antigen show upgrading movement, (b) a synthetic construction connecting the Ii to the antigenic epitope, and (c) an antigenic epitope that ties to a MHC class II atom. The philosophy was utilized to make Ii-Key/MHC II SARS cross breeds. As of late, Generex declared that it is fostering a COVID-19 immunization following a legally binding concurrence with a Chinese consortium involved China Technology Exchange, Beijing Zhonghua Investment Fund Management, Biology Institute of Shandong Academy of Sciences, and Sinotek Advocates International Industry Development. The organization will use its Ii-Key invulnerable framework actuation innovation to create a COVID-19 viral peptide for human clinical trials (Liu *et al.*, 2020).

**d) Virus-like Particle Vaccines**

In 2015, patent application WO2015042373 by Novavax unveiled an immunogenic organization made out of MERS-CoV nanoparticle VLPs containing at any rate one trimer of a S protein, created by baculovirus overexpression in Sf9 cells. This VLP arrangement actuated a killing counter acting agent reaction in mice and transgenic dairy cattle, when directed alongside their exclusive adjuvant Matrix M (RN 1235341-17-9). What's more, arrangements of sera from immunized steers (SAB-300 or SAB-301) were infused into Ad5-hDPP4 transduced BALB/c mice before challenge with MERS-CoV. Both SAB-300 and SAB-301 had the option to shield these mice from MERS-CoV contamination with a solitary prophylactic infusion. Novavax declared on February 26, 2020<sup>54</sup> that it was starting creature testing on potential COVID-19 immunization applicants because of their past encounters working with other Covids, including both MERS and SARS. Their COVID-19 applicant antibodies focusing on the S protein of SARS-CoV-2 were created utilizing their recombinant nanoparticle immunization innovation alongside their restrictive adjuvant Matrix-M.

**e) mRNA-Based Vaccines**

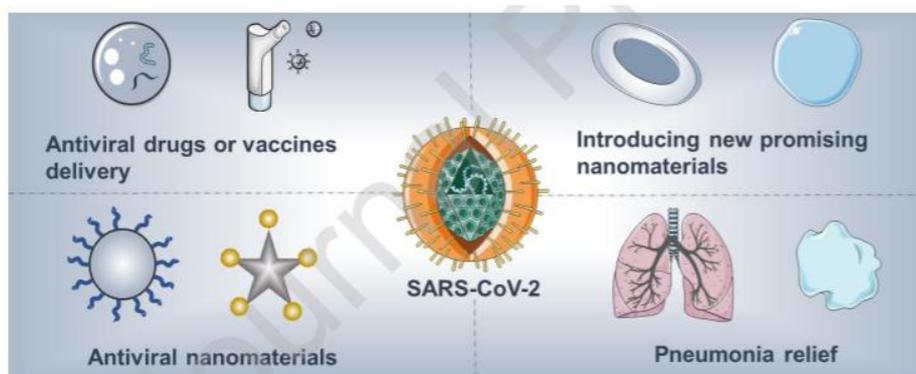
The likely benefits of a mRNA way to deal with prophylactic antibodies incorporate the capacity to imitate common disease to investigate a more intense resistant reaction just as the capacity to consolidate different mRNAs into a solitary immunization. Patent application WO2017070626 by Moderna unveils mRNA antibodies made out of mRNAs encoding antigenic viral full-length S, S1, or S2 proteins from SARS-CoV and MERS-CoV infection, detailed in cationic lipid nanoparticles. They show that mice inoculated with mRNA encoding Covid full-length S protein created a lot higher killing immune response titers contrasted with mRNA encoding the S protein S2 subunit. New Zealand white hares vaccinated with MERS-CoV mRNA immunization encoding the full-length S protein decreased over 90% of the viral burden in the lungs of the hares and incited a lot of killing counter acting agent against MERS-CoV. Moderna declared on February 24, 2020<sup>55</sup> that it has delivered the main cluster of mRNA-1273 against SARS-CoV-2 for use in people, arranged utilizing techniques and methodologies illustrated in their past licenses. Vials of mRNA-1273 have been sent to the National Institute of Allergy and Infectious Diseases (NIAID), a division of the National Institutes of Health (NIH), to be utilized in the arranged Phase 1 examination in the United States. Moderna reports that mRNA-1273 is a mRNA immunization focusing on a prefusion settled type of the S protein related with SARS-CoV-2, which was chosen by Moderna in a joint effort with examiners at the NIAID Vaccine Research Center. Assembling of this cluster was financed by the Coalition for Epidemic

Preparedness Innovations. Intradermal organization into mice of a lipid nanoparticle (LNP)-embodied mRNA combination encoding MERS-CoV S proteins was appeared to bring about interpretation in vivo and enlistment of humoral insusceptible reactions (Liu *et al.*, 2020).

## 2. Nanotechnology:

Decades of rapid development have witnessed the widespread application of nanotechnology in the biomedical field. Although it is not being widely applied in current antiviral research, its potential is unquestionable. To summarize, the advantages of nanotechnology in antiviral research include the following:

- promotes the delivery of water-insoluble drugs;
- enhances the circulation time of drugs in vivo;
- achieves co-delivery of drugs;
- improves drug utilization efficiency and reduce side effects through targeting antibody modification;
- protects DNA and mRNA vaccines, overcoming bottlenecks for in vivo applications; and the physicochemical properties of nanomaterials can also be employed directly against viruses.



In this section, we will focus on the aspects of nanotechnology that have the greatest potential for clinical transformation or that have already been applied in the clinic, including in the delivery of antiviral drugs and vaccines, and the design of nanomaterials directly effective against viruses (Tang *et al.*, 2021).

### Delivery of Drugs and Vaccines:

The FDA-approved nanomaterials liposomes and polylactic-co-glycolic corrosive (PLGA) are as of now in develop use in the conveyance of medications (and not just antiviral medications). As depicted previously, FDA-endorsed nanomaterials offer one of a kind benefits for antiviral medication conveyance, and potential nanomaterial applicants are as yet arising. For instance, to ensure high stacking proficiency, biocompatible permeable metal-natural system nanomaterials were used as nanocarriers to convey drugs including retroviral to treat

(AIDS), delivering the medications continuously. Through synthetic bioconjugation, lipid-covered PLGA nanomaterials first objective T aide cells, which express the CD4+ (group of separation 4) protein on their surface. Resulting nanomaterials were intended to deliver embodied inactivity switching specialists (LRAs) reasonably, guaranteeing synergistic impacts against human immunodeficiency infection type 1 (HIV-1). Moreover, nanoparticles were designed to offer the controlled arrival of against HIV drugs when set off by outside energy. Inferable from the magnetoelectricity capacity of these nanoparticles, the connection between hostile to HIV drugs and the nanoparticles can be broken as needed with the use of a uniform attractive field, delivering the medications in a controlled way. Three antiretroviral drugs were likewise synthetically formed to human vault nanoparticles, which are intracellular ribonucleoprotein molecule edifices that can be effortlessly inundated by safe related cells, guaranteeing the focused on conveyance of antiretroviral drugs against HIV type 1 (Fig. 1a). Moving into the time of "widespread" flu immunizations, aspiratory surfactant (PS)-biomimetic liposomes were intended for heterosubtypic insusceptibility potentiation managed by cytotoxic T lymphocytes that express the CD8+ protein. Besides, the PS aided the conveyance of liposomes to alveolar epithelial cells and accomplished further insusceptible initiation, which guaranteed great treatment results in vivo.

To improve immunogenicity and prevent the humoral invulnerability of DNA antibodies, double utilitarian fullerene nanomaterials with a HIV infection like morphology were created to convey the immunization to proficiently animate resistant reaction. Since the RNA impedance (RNAi) procedure was proposed, various siRNA-or mRNA-based antibodies have been carefully planned. Joining them with nanomaterials improves the solidness of RNA to the levels essential for in vivo applications. For example, sans adjuvant dendrimer nanomaterials were made for mRNA antibody conveyance; just one portion was important to support insusceptibility and battle H1N1 flu as well as Ebola infection. Because of the deadly Zika infection, mRNA immunizations were referenced in many exploration activities and some clinical preliminaries. For eg, researchers initially implanted the mRNA immunizations intended to ensure against the Zika infection into lipid nanomaterials, and afterward assessed the invulnerable reaction in vivo. The energizing outcomes drew worldwide consideration.

Coincidentally, the positive after effects of late clinical trials by Moderna Inc. utilizing an enemy of Zika mRNA immunization typified in lipid-nanomaterials give solid support to the headway of mRNA antibodies against SARS-CoV-2. Recent information from Pfizer Inc. also, BioNTech SE has affirmed enhancements in the wellbeing and portion subordinate productivity

of BNT162b2 mRNA immunizations, supporting their potential for progressing Phase 2/3 enormous scope assessment. The mRNA-1273 antibody against SARS-CoV-2 is in Phase 3 clinical preliminaries to decide its wellbeing and productivity for COVID-19 counteraction as long as 2 years after the subsequent portion. In other work, the endogenous untranslated locales (UTRs) of mRNAs were additionally designed to improve the age of SARS-CoV-2 antigens. Moreover, utilizing TT3 nanoparticles for the conveyance of mRNA antibody improved execution over FDA-supported lipid nanoparticles.

Besides these vaccine examples, nanotechnology also shows potential in developing adjuvants for vaccines that promote antibody expression. As traditional aluminium hydroxide (alum) adjuvants, presenting as plate-like microgels with a positive charge, are likely to attach to the membrane rather than be internalized by the dendritic cells, an oil/water interphase of particulate alum via Pickering emulsion (rather than a surfactant-stabilized emulsion) was generated, which not only absorbed plenty of antigens but also promoted the uptake of loaded antigens by dendritic cells, improving the immune response induced by vaccines while maintaining safety (Tang *et al.*, 2021).

#### **Antiviral nanomaterials:**

As well as filling in as a conveyance stage for antiviral medications or antibodies, painstakingly planned nanomaterials themselves can likewise straightforwardly battle infections. To start with, understanding the infection replication cycle is vital to an appropriate antiviral methodology. In spite of the fact that we may at last come to comprehend viral life cycles in an unexpected way, the current model incorporates connection, passage, biosynthesis, gathering of new infections, and delivery; viral restraint is conceivable inside every one of those means. Around here, the energizing capability of nanomaterials has recently started to be tapped. The approach of DNA origami innovation has likewise improved the first nanomaterial library, while its application in antiviral examination is as yet in its beginning phases. By planning the DNA nanoarchitecture to have a particular star shape, the action of the dengue infection can be hindered through spatial example collaboration. In particular, the nanoarchitecture was adjusted with ED3-focusing on aptamers for perceiving ED3 bunches on the viral surface.

In addition, utilizing heparan sulfate proteoglycan (HSPG), gold nanomaterials were utilized as expansive range viral inhibitors. Dissimilar to past HSPG substances, recently incorporated mercaptoundecane sulfonic (MUS) corrosive containing ligands are fit for restricting viral connection ligands even after weakening, creating powers that disfigure

infections. Additionally, HSPG was joined into nanogels with different levels of adaptability to help forestall infection passage.

Moreover, MUS corrosive altered cyclodextrins have likewise been the subject of wide range antiviral research, as the changed MUS corrosive can emulate HSPG to create a virucidal response. Notwithstanding the above nanomaterials, mercaptobenzoic corrosive altered gold nanomaterials were likewise utilized for HIV hindrance through the multivalent restricting methodology. In view of a similar antiviral technique, new kinds of giantic structures of globular glycofullerenes were planned against fake Ebola infection disease.

Another candidate utilizing nanostructured glycan engineering with reasonable space between ligands, made out of multivalent 6'-sialyllactose-polyamidoamine (6SL-PAMAM) forms, was intended for flu An infection contamination inhibition. Most as of late, bacteriophage capsids conveying ligands that firmly tie the flu infection were additionally acquainted to prevent its entrance through a characterized multivalent procedure. Also, the glycodendrimer nanoparticles gathered by high-valency glycodendrimeric parts were produced to emulate microorganisms and square popular infection. The great polyvalency consequences for the nanoparticles' surface territory propose a general methodology to restrain viral contamination. By means of cell layer innovation, Zika infection have cells' film inferred vesicles were added to the outside of gelatin nanomaterials. These "nanodecoys" catch the Zika infection from planned focusing on targeted sites and to silent viral disease.

Recently, plasma layers got from human lung epithelial sort II cells or human macrophage cell film inferred Nano wipes were used to mirror the host cell surface and catch the SARS-CoV-2 for balance. Inspiration from the above models, we have high expectations for the fate of nanotechnology in antiviral exploration (Tang *et al.*, 2021).

#### ***In vitro* COVID-19 models:**

To comprehend the component of viral pathogenesis, antiviral medication activity, and to treat infections securely in the research center, we need cell lines in which SARS-CoV-2 can imitate effectively. Assessment of antiviral exercises of different mixtures in various cell lines contaminated with SARS-CoV-2 can work with the treatment procedures. Late investigations performed against SARS-CoV-2 have shown that the cell lines like Vero (got from the kidney of an African green monkey), Vero E6 (clone of Vero 76 cell line) and Huh7 (Human hepatocytes cell line) have shown vulnerability to SARS-CoV-2 contamination. The clinically segregated strain of the SARS-CoV-2 infection, C-Tan-nCoV Wuhan strain 01, was spread in Vero cells and the counter SARS-CoV-2 movement of chloroquine and hydroxychloroquine were likewise

researched utilizing SARS-CoV-2 tainted Vero cells. Wang and partners have likewise shown chloroquine and remdesivir's in vitro movement against SARS-CoV-2 in Vero E6 cells. These two mixtures strongly impeded SARS-CoV-2 contamination in Vero E6 cells. Furthermore, favipiravir, penciclovir, nafamostat, and nitazoxanide were additionally discovered to be inhibitive against SARS-CoV-2 contamination in Vero E6 cells (Chibber *et al.*, 2020).

An examination from China revealed that researchers effectively detached SARS-CoV-2 from contaminated patients in Huh7 and Vero cell lines. Likewise, in an investigation TMPRSS2-communicating Vero E6 cell lines were discovered to be profoundly vulnerable to SARS-CoV-2. Subsequently, it is apparent from these investigations that Vero, Vero E6, and Huh7 are lenient to SARS-CoV-2 replication. Nonetheless, a few other cell lines from various beginning like Monkey (FRhK-4 cells, MA-104 cells, COS cells, and BGM), Human (HEK-293, HepG2, HPEK, PMBCs, and Caco2) and Pig (PS, POEK, and Pk-15) have demonstrated to be lenient to SARS-CoV and MERS-CoV replication, which recommends that these cell lines can likewise be helpless to SARS-CoV-2 contamination.

#### **Animal models for COVID-19:**

Transgenic mice that express human ACE2 are probably going to be significant COVID-19 creature models. Bao *et al.*, detailed the improvement of the clinical illness by transgenic hACE2 mice after contamination with SARS-CoV-2, including interstitial pneumonia and weight reduction. In another investigation, it has been shown that viral spike protein restricting to ACE2 receptors in mice downregulates ACE2 articulation, which is connected with outrageous lung disappointment. Accordingly, ACE2 Knockout mice, which were utilized in ARDS and SARS examines, can likewise hold any importance with COVID-19 related ARDS contemplates. There is likewise the chance of transmembrane protease, serine 2 (TMPRSS2) Knockout and STAT 1 Knockout mice as COVID-19 infection models. Since TMPRSS2 aids the passage of SARS-CoV-2 into the cells, its restraint may comprise a system for treatment/prophylaxis of COVID-19.

So TMPRSS2 knockout mice can help in investigating COVID-19 pathogenesis. Detail 1 Knockout mice support SARS-CoV replication in the lung illness. Such mice can likewise be useful to contemplate the pathogenesis and antiviral medicines of COVID-19 infection. In standard mouse strains, the ingrained mice were broadly utilized in SARS-CoV contemplates, youthful innate mice like C57BL/6, BALB/c, and 129S6 help viral replication of SARS-CoV and may be valuable for the antibody and antiviral examination of COVID-19.

They can likewise help study resistant reactions to the disease. Another investigation recorded a ferret model of contamination and transmission of SARS-CoV-2, which summarizes parts of the human sickness where ferrets tainted with SARS-CoV-2 presentation raised internal

heat level. It was seen that SARS-CoV could likewise contaminate hamsters, *Cynomolgus* macaques, rhesus macaques and African green monkeys. In this way, it is relevant to specify here that these creatures may likewise be lenient to SARS-CoV-2 disease and replication (Tang *et al.*, (2021).

#### References:

1. Qu, Y. M., Kang, E. M., and Cong, H. Y. (2020): Positive result of Sars-Cov-2 in sputum from a cured patient with COVID-19, *Travel medicine and infectious disease*, 34.
2. James, M., Marguerite, L., Tomasz, Z., and James, B. (2020): Pharmacologic treatments for coronavirus disease 2019 (COVID-19), *JAMA*, 323(18):1824-1836.
3. Li, F. (2016): Structure, function, and evolution of coronavirus spike proteins, *Annual review of virology*, 3: 237-261.
4. Simas, P. V. M., de Souza Barnabé, A. C., Durães-Carvalho, R., de Lima Neto, D. F., Caserta, L. C., Artacho, L., and Arns, C. W. (2015): Bat coronavirus in Brazil related to appalachian ridge and porcine epidemic diarrhea viruses, *Emerging infectious diseases*, 21(4):729.
5. Agostini, M. L., Andres, E. L., Sims, A. C., Graham, R. L., Sheahan, T. P., Lu, X. and Denison, M. R. (2018): Coronavirus susceptibility to the antiviral remdesivir (GS-5734) is mediated by the viral polymerase and the proofreading exoribonuclease, *MBio*, 9(2).
6. Wu, Y., Xu, X., Chen, Z., Duan, J., Hashimoto, K., Yang, L. and Yang, C. (2020): Nervous system involvement after infection with COVID-19 and other Coronaviruses, *Brain, behavior, and immunity*, 87: 18-22.
7. Chen, L., Xiong, J., Bao, L., and Shi, Y. (2020): Convalescent plasma as a potential therapy for COVID-19, *The Lancet Infectious Diseases*, 20(4): 398-400.
8. Chibber, P., Haq, S. A., Ahmed, I., Andrabi, N. I., and Singh, G. (2020): Advances in the possible treatment of COVID-19: A review, *European journal of pharmacology*, 883.
9. Liu, C., Zhou, Q., Li, Y., Garner, L. V., Watkins, S. P., Carter, L. J., and Albaiu, D. (2020): Research and development on therapeutic agents and vaccines for COVID-19 and related human coronavirus diseases, *ACS central science*, 6(3): 315–331.
10. Tang, Z., Zhang, X., Shu, Y., Guo, M., Zhang, H., and Tao, W. (2021): Insights from nanotechnology in COVID-19 treatment, *Nano today*, 36.

## **BIOSKETCH OF SARS-CoV-2 AND ITS REALISTIC SOLUTION THROUGH VACCINATION**

**Pravin Deshmukh\* and Yashwant Chaukate**

Department of Microbiology,

Pratapsinh Mohite – Patil Mahavidyalaya,

Karmala, Dist. Solapur (Maharashtra), India – 413203

\*Corresponding authors E-mail: [pradesh187@gmail.com](mailto:pradesh187@gmail.com)

---

### **Introduction:**

#### **Historical background of Coronavirus:**

Despite the extensive and contemporary progress in development of diagnostics, therapeutic agents and treatment procedures; unpredictable emergence of numerous diseases causes threats to human health and global stability (Akrita *et al.*, 2020). Since last 2-3 decades, many devastating diseases such as SARS, MERS, Swine Flu, etc. have been emerged due to various humans' anthropogenic activities (more specifically food culture and disturbance in food chain) and adoption of new character by causative agent (switching of host from animal to humans) leading to extensively spread within human population.

Coronaviruses are emerging and re-emerging zoonotic pathogen drawing tremendous attention around the world due to its earlier notorious serious outbreaks in animals and humans, as in 2002-2003, SARS-CoV-1 infected 8000 people with 800 deaths, and fatality rate almost 10% (Chen, *et al.*, 2020); in 2012, MERS-CoV infected more than 1651 people with 590 deaths and fatality rate of 36% (Tok and Tatar, 2017); and PEDV-CoV (Porcine epidemic diarrhea Coronavirus) infected large number of pigs in USA with fatality rate almost 100% in 2013 (Li, 2016). Moreover, evolutionary studies revealed that, SARS-CoV and MERS-CoV are emerged from bats and then transmitted into intermediate mammalian host, then eventually infected to humans (Song *et al.*, 2019). Among which SARS CoV was originated in china while MERS-CoV and PEDV originated from Middle East and USA respectively (Swatantra Kumar *et al.*, 2020).

The novel Coronavirus *i.e.* Severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2) is zoonotic virus and etiological agent of COVID-19 was first identified in Wuhan, China in December 2019; that creates serious global issue resulted into declaration by World Health Organization (WHO) as a pandemic on March 11, 2020 (Strizova *et al.*, 2021). On 7<sup>th</sup> January

2020 Chinese researchers isolated the SARS-CoV-2 (McCreary and Pogue, 2020) which is later temporarily named as 2019 novel Coronavirus (2019nCoV) by WHO (Chen, *et al.*, 2020). As of date, the virus has affected more than 200 countries around the world with unexpected number of human death. The spread of COVID-19 may be correlated with china due to earlier history of Coronavirus emergence and unique food culture of Chinese people i.e. consumption of freshly slaughtered animals leading to increased potential of virus transmission in humans (Akrita *et al.*, 2020).

Better understanding of the of Coronaviruses (SARS-CoV-2) is critical to elucidate their emergence, origin, evolution, diversity, pathogenesis, molecular mechanism, epidemiology, prevention of spread across population, development of effective diagnostic tools and safe effective vaccines and therapeutics.

#### **Taxonomic Position:**

Coronaviruses included in family Coronaviridae under the order Nidovirales (Swatantra Kumar *et al.*, 2020) which is further classified into subfamily Coronavirinae comprising of four genera Alphacoronavirus ( $\alpha$ CoV), Betacoronavirus ( $\beta$ CoV), Gammacoronavirus ( $\gamma$ CoV), and Deltacoronavirus ( $\delta$ CoV) (Cui *et al.* 2019). Among which, based on evolutionary trend analysis, alpha and beta originated from bat and rodents that later on infects to mammals, while gamma and delta originated from avian species which infects to avian species and mammalian correspondingly (Ge *et al.* 2017). The genetic analysis of SARS-Cov-2 implicates 89% and 96.2% identity with SARS-CoVZXC21 and beta CoV RaTG13 of bats (*Rhinolophus affinis*) respectively (Kumar *et al.* 2020); which revealed the bats are the most likely primary host or reservoir for SARS-CoV-2 (Lu *et al.*, 2020).

#### **Morphology of Coronavirus:**

Electron microscopy studies showed that, Coronavirus (SARS-CoV-2) is large and roughly spherical with average diameter of 80–120 nm. The complete typical virion consist of envelop, Spike protein and nucleocapsid.

**a) Envelop:** The SARS-CoV-2 viral envelop composed of at least three structural proteins as glycosylated trans-membrane protein (M) (Tok and Tatar, 2017), envelope glycoprotein (E) (comprising 76-109 amino acids) and timeric spike glycoprotein (S); among which M protein and E protein involved in virus morphogenesis, assembly, and budding whereas, the spike protein (S) is believed to be a member of the class I viral membrane fusion proteins which mediates

virus entry into host cells (Swatantra Kumar *et al.*, 2020; Li, 2016). Generally, all of these proteins are needed to form a structurally complete virion. However, in some, Coronaviruses, envelope protein hemagglutinin esterase (HE) is observed (de Haan *et al.*, 1999).

**b) Spike:** Spike proteins are Club like, pear, clove shaped, thin trimeric with size ranging from 17–20 nm that protrudes from envelop surface. The SARS-CoV-2 spike contains three domains as a large ectodomain (containing receptor binding subunit S1 and membrane fusion stalked subunit S2), a single trans-membrane anchor and a short intracellular tail (Li, 2016). Moreover, glycoprotein (S) is critical in determination of host range and major inducer of host immune response. During pathogenesis and virus entry S1 binds to a receptor on host cell and S2 fuses the host and viral membrane help in entry of viral genome to host cells.

**c) Nucleocapsid:** A positive single stranded RNA (sensed as mRNA) is packed in helical capsid formed by nucleocapsid protein (N) (Akrita *et al.*, 2020). The N proteins are phosphoproteins and antagonist of Interferon (IFN) (Chen, *et al.*, 2020) play crucial role in packaging and stabilizing viral genome, replication and transcription of SARS-CoV-2 (Tok and Tatar, 2017) and modulation of host cellular response such as regulating host cycle, cell stress response and influencing immune system (Akrita made *et al.*, 2020).

**Genetic organization:**

The Coronavirus possesses a large sized genome, therefore the space inside the viral envelope would not be adequate to pack loosely bounded ribonucleoproteins hence, the viral genome is further supercoiled to get fit into the capsid by the influence of N protein (Gui *et al.*, 2017). The genome of CoVs is a single stranded positive sense RNA (genome size ranging from 27 to 32kb) with 5'cap structure and 3'polyA tail and comprises 6-11 open reading frames (ORFs) encoding 9680 amino acid polyproteins (Guo *et al.* 2020). Owing to the positive single stranded RNA, the genomic RNA itself used as a template to translate directly into structural proteins such as Spike (S), Membrane (M), Envelope (E) glycoproteins, Hemagglutinin Esterase (HE) (present only in beta Coronavirus) and Nucleocapsid (N) protein, (Tok and Tatar, 2017) and nonstructural proteins (nsps) to form the replication transcription complex (RTC) (Chen, *et al.*, 2020). However SARS-CoV-2 lacks the hemagglutinin esterase gene (Swatantra Kumar *et al.*, 2020). As far as Open reading frames are concern, the first ORF comprises approximately 67% of the genome that encodes conserved 16 nonstructural proteins (nsps) likely to be involved in the transcription and replication of SARS-CoV-2, whereas the remaining ORFs encode for diverse accessory and structural proteins need for adaptation to new host (Chen, *et al.*, 2020).

**Life cycle, Replication and pathogenesis**

**a) Attachment:** The infection of Coronavirus is initiated with binding of virus particle to the receptor on the host cell surface *via* the spike (S) protein (Masters, 2006; Burkard *et al.*, 2014). However, Coronaviruses demonstrate a complex pattern for receptor recognition (Li, 2015) e.g. alphacoronavirus HCoV-NL63 and the betacoronavirus SARS-CoV recognize a zinc binding carboxypeptidase angiotensin-converting enzyme 2 (ACE2) (He *et al.*, 2021) while other alphacoronaviruses such as PEDV, and PRCV recognize another zinc peptidase, aminopeptidase N (APN) (Delmas *et al.*, 1992). Moreover, the highly pathogenic human SARS-CoV and SARS-CoV-2 recognize the same receptor, *i.e* the human angiotensin-converting enzyme 2 (ACE2). ACE2 is a zinc-binding carboxypeptidase type I membrane protein widely expressed in lung, heart, kidneys, and intestine tissues and exerts crucial role in the maturation of peptide hormone angiotensin, which regulates vasoconstriction and blood pressure. Infact the wider and rapid spread of SRAS-CoV-2 may be due to its spike proteins exhibits 10-20 times greater affinity to ACE2 as compared with SARS-CoV (Wrapp *et al.* 2020). During attachment, the two S protein trimers simultaneously bind to an ACE2 homodimer leading to accommodation of ACE2 on receptor binding domain (RBD) of S protein. Astonishingly, the RBD structure of SARS-CoV and SRAS CoV-2 are similar (Lan *et al.*, 2020) which shows its close phylogenetic relationship (Shang *et al.*, 2020).

**Cross species transmission:** The genetic distance between host species; availability, accessibility and permissiveness of susceptible host cells to replicate virus in it; and innate immune response of host cell are the main criteria which supports the cross species transmission of virus (Akrita *et al.*, 2020).

**b) Entry into host cell:** Following attachment, the entry of Coronaviruse occurred pH dependant endosomal pathway where a conformational change in the structure of spike protein leading to fusion of viral envelop with host cell membrane (Tok and Tatar, 2017).

**c) Uncoating:** Viral entry is followed by uncoating, where the viral genome is released into host cell and get available for viral replication and translation.

**d) Replication:** The replication of coronaviruses occurs in host cell cytoplasm in which virus particle releases its positive single stranded RNA in to host cell cytoplasm and translated into genomic and subgenomic RNA which encodes viral structural and nonstructural proteins. The replicase gene 1 encoded two large open reading frames ORF1a and 1b that are translated into

two large polypeptides pp1a and pp1b, which is further converted to 16 non-structural proteins (nsp1 – nsp16) by viral proteases. These 16 proteins form Double-Membrane Vesicles (DMV) which acts as virus Replication and Transcription Complex (RTC) where replication of genomic RNA occurs (Cynthia *et al.*, 2004). Replicase genes 2 to 7 are translated from sub-genomic mRNA encoded the major viral Structural proteins (S), Envelope protein (E), Membrane protein (M), Nucleocapsid protein (N), and the accessory proteins, essential for virus-cell receptor binding. Furthermore the newly synthesized structural proteins are released into the endoplasmic reticulum or ERGIC region and the process of assembly begins (Tok and Tatar, 2017).

**e) Assembly:** Genomic replication is followed by assembly of viral particles. Most of the enveloped viruses are assembled in the host cells plasma membrane, however in Coronaviruses, budding and assembly occurs at the endoplasmic reticulum-Golgi intermediate compartment (ERGIC) hence, Coronavirus obtain their envelop from ERGIC region (Ujike and Taguchi, 2015). Before assembly all the structural proteins are gathered in the ERGIC (budding site) through secretory pathway and in some cases (M, E and S proteins) through intracellular trafficking signals and protein-protein interactions (Akrita *et al.*, 2020). Most of the protein-protein interactions required for Coronavirus assembly are mediated by the M proteins. Moreover M protein acts as a central organizer for virion assembly due to its ability to form virus like particles (VLP) in presence of N and E proteins and exert pivotal role in it (Tseng *et al.*, 2010). The packing of viral genome in capsid is governed by packaging signals (PS) which are recognized by N and M proteins (Woo *et al.*, 2019). The spherical shape and morphology of Coronavirus is due to membrane inducing activity of E protein (Schoeman and Fielding, 2019).

**f) Release:** Following assembly, the progeny virions accumulated in smooth-walled vesicles are transported to the cell surface, and released into the extracellular space through exocytosis or cell lysis (Akrita *et al.*, 2020).

#### **Spread of SARS-CoV-2:**

The prevalence of SRAS-CoV-2 is mainly occurred from person to person through respiratory droplets from sneezing and coughing, personal contact or by touching contaminated surfaces; however, few other transmission routes, such as alimentary transmission or through conjunctival mucosa have also been described. Moreover, COVID-19 poses an enormous threat for underlying health conditions and health professionals, elderly or chronically ill patients such as obesity, hypertension, asthma, diabetes, etc. (Strizova *et al.*,

2021). Apart from the respiratory tract, Coronaviruses can also affect other organs in the body, such as the gastrointestinal tract, liver, kidney, and brain of both humans and animals (Akrita *et al.*, 2020).

#### **Arsenal of Drugs available for COVID-19:**

Many of the preventive measure and numerous chemotherapeutic agents are being employed for decreasing the spread and cure of the disease.

##### **a) Chloroquine and Hydroxychloroquine:**

Chloroquine, is an antimalarial agent having anti-inflammatory and immunomodulatory activities, showed one of the important potential therapeutic option for COVID-19. Wang *et al* (2020) demonstrated the *in vitro* efficacy of chloroquin against SARS-CoV-2 in Vero E6 cells which supported its clinical application. Chloroquin exerts various functions as inhibiting the exacerbation of pneumonia, improving lung imaging findings, promoting a virus-negative conversion, and shortening the disease course in COVID-19 infected patients. Although this development has been encouraging, but some constrains such as supply issues and cardiovascular toxicity limit its use. Furthermore numerous researchers used hydroxychloroquin as an alternative to chloroquin as it having better tolerability (McCreary and Pogue, 2020).

##### **b) Remdesivir:**

Remdesivir (GS-5734) is monophosphoramidate prodrug (adenosine analog) was developed by Gilead Sciences, Inc. in response to the Ebola outbreak in West Africa from 2014 to 2016 (McCreary and Pogue, 2020). At molecular level active component of Remdesivir *i.e* triphosphate nucleoside selectively binds to ribonucleic acid (RNA)-dependent RNA polymerase of virus and acts as an RNA-chain terminator. Moreover, it displays potent *in vitro* activity against SARS-CoV-2 with an EC<sub>50</sub> (effective concentration 50%) at 48 hours of 0.77  $\mu$ M in Vero E6 cells (Wang *et al.*, 2020). For COVID-19 patients, remedesivir is administered at 200mg intravenously (IV) on first day, followed by 100mg IV daily for up to 10 days (McCreary and Pogue, 2020).

##### **c) Lopinavir/Ritonavir:**

Lopinavir is a human immunodeficiency virus (HIV)-1 protease inhibitor commonly administered in combination with potent CYP3A4 inhibitor ritonavir (LPV/r). The *in vitro* efficacy data of Lopinavir against SARS-CoV-2 was not available, but Young *et al* (2020) reported the reduction in oxygen requirement, deteriorated respiratory failure and clearance of viral

shedding in patients infected with SARS-CoV-2, when treated with LPV/r (McCreary and Pogue, 2020).

**d) Nitazoxanide:**

Nitazoxanide with its active metabolite tizoxanide has demonstrated potent *in vitro* activity against SARS CoV-2, by interferes with host regulated pathways involved in viral replication in Vero E6 cells; but more data needed to determine its mechanism in management of COVID-19. In addition, Nitazoxanide shows broad-spectrum *in vitro* antiviral activity against influenza, respiratory syncytial virus, parainfluenza, rotavirus, and norovirus.

**e) Tocilizumab:**

Tocilizumab is a humanized monoclonal antibody that inhibits both membrane-bound and soluble interleukin-6 (IL-6) receptors due to which it is listed as a treatment option in the 7<sup>th</sup> edition of National Health Commission of People's Republic of China. It was first approved by the FDA in 2010 for the treatment of rheumatoid arthritis. Owing to Interleukin-6 antagonism it makes patient more susceptible to bacterial infection and responsible for neutropenia and thrombocytopenia when prolonged administered (McCreary and Pogue, 2020).

**f) Ribavirin With or Without Interferon:**

Ribavirin, (a guanosine analog) that terminates RNA synthesis commonly used for respiratory syncytial virus, viral hemorrhagic fever, and in combination with interferon for hepatitis C. Wang *et al* (2020) evaluated the *in vitro* activity of ribavirin against SARS-CoV-2, concluded that ribavirin was 100 times less potent than remdesivir and it shows hematologic toxicity at high doses, due to which it is not considered as viable candidate (McCreary and Pogue, 2020).

**g) Interferons:**

Interferons are antiviral proteins which stimulate innate response against viral particles. It is expected that interferon would show *in vitro* activity against SARS-CoV-2, as it previously exerted antiviral activity against MERS-CoV at 175 IU/ml concentration.

**h) Oseltamivir:**

Oseltamivir is an anti-influenza drug used for management of COVID-19 at previously or at initial state of emergence; where exact knowledge of causative pathogen was not known and medical practitioners assumed that infection caused by influenza. But now a day's Oseltamivir

is not used for management of COVID-19 as the detailed structure of causative agent was elucidated (McCreary and Pogue, 2020).

**i) 2-deoxy-D-glucose (2-DG):**

The anti-COVID-19 drug 2-deoxy-D-glucose /2-Deoxy-D-arabino-hexose (2-DG) Produced by Institute of nuclear medicine and Allied Sciences (INMAS), a lab of Defence Research and Development Organisation (DRDO), in collaboration with Dr. Reddy's Laboratories (DRL), Hyderabad and permitted by Drug Controller General of India (DCGI) for emergency use. It is assumed that, 2-DG drug will help in faster recovery and reduce oxygen dependence of COVID-19 patients. Chemically 2-deoxy-D-glucose (2-DG) is a glucose analogue molecule whose 2-hydroxyl group replaced by hydrogen, so it can't undergo further glycolysis and competitively inhibits the production of glucose-6-phosphate from glucose at phosphoglucoisomerase level. Moreover it selectively accumulates within the virus infected cells and prevents virus growth by stopping viral synthesis and energy production (Ralser, *et al.*, 2008).

**j) Plasma and antibodies:**

Plasma and antibodies obtained from the previously infected patients proposed to use for treatment earlier but it is suggested that they are non-effective and poses tremendous complications in post-COVID-19 infections (Chen *et al.*, 2020).

All the aforementioned drugs are not specific for the management of SARS-CoV-2 and showed more or less adverse effects on human health when prolonged administered; but these drugs are used to reduce the clinical complications, decreasing viral load, boosts immune system and to save lives. Since none of the single effective drug available for the COVID-19, therefore control the source of infection, early diagnosis, reporting, isolation, supportive treatments, and timely publishing epidemic information, good personal hygiene, fitted mask, ventilation, and avoiding crowded places play a crucial role in controlling the outbreak (Niazkar, *et al.*, 2020). Thus, there is an urgent need to develop realistic, effective therapies and vaccines against CoVs to end current pandemic situation.

**Vaccine:**

The era of vaccine was started by Edward Jenner and from therein many different vaccine have been developed and used against different diseases to mobilize the innate immune response. However, the effective vaccine may not eradicate the viral infection including SARS-CoV-2, but protect from severe and deadly forms of the disease. As far as SARS-

CoV-2 is concern, the rapid evolving viral nature (Akrita *et al.*, 2020), higher mutation rate (Chen, *et al.*, 2020), and adaptation to new host and environment and by post-translational modifications of viral proteins which exhibit new functional group (Fung and Liu, 2018) are the major constrains in development of an effective vaccine and if vaccine prepared therein may give seasonal protection.

Current knowledge and use of contemporary methods play crucial role to elucidate the vaccine design, selection of antigens and adjuvant, vaccination routes, and the required dosage (Niazkar, *et al.*, 2020; Swatantra Kumar *et al.*, 2020). In addition clinical data on antiviral therapy of other viruses such as SARS-CoV-1, MERS-CoV and Non coronavirus (Ebola virus) is also used for vaccine development (McCreary and Pogue, 2020).

To get complete solution from above mentioned obstacles the classical and modern vaccination strategies, such as inactivated vaccines, live attenuated vaccine, subunit vaccine, viral vector based vaccine, recombinant vaccines, mRNA vaccines and DNA vaccine are currently being tested in clinical trials against COVID-19 infection (Chen, *et al.*, 2020; Strizova *et al.*, 2021).

#### **a) Inactivated Vaccines:**

Inactivated vaccines are prepared by culturing of virus in cell lines followed inactivation of viral particles by formaldehyde and beta propiolactone. In some cases adjuvants are required to achieve sufficient efficacy of inactivated vaccines (Zepp, 2010).

#### **b) Subunit Vaccines:**

Subunit vaccines are prepared from purified antigen rather than whole virus particle. Because of relatively low immunogenicity of the subunit vaccines, adjuvants such as aluminum salts, virosomes, AS03 ( $\alpha$ -tocopherol, surfactant polysorbate 80, and squalene), AS04 (Monophosphoryl lipid A, MPLA) and MF59 (squalene) are used to create a sufficient immune response. However, novel adjuvants such as Advax-SM composed of polysaccharide delta-inulin and CpG oligodeoxynucleotide (CpG ODN) are also used (Strizova *et al.*, 2021).

#### **c) DNA Vaccines:**

In DNA vaccines the Coronavirus's genes are delivered in to the human cells nucleus through plasma vector where the transcription and translation of the antigen is initiated. The produced antigens are recognised by antigen-presenting cells leading to development of humoral or cytotoxic immune responses.

**d) RNA Vaccines:**

The mRNA vaccines leads to a production of coronavirus's proteins or antigens which are recognized by APC (Antigen presenting cells) leading to production of humoral or cell mediated immune response.

**e) Viral Vector-Based Vaccines:**

Viral vector-based vaccines (VBVs) are prepared by engineered viral vector such as adenoviruses, adeno-associated viruses, togaviruses, measles virus, Newcastle disease virus, human parainfluenza virus, rhabdoviruses carrying Coronavirus genes to slowly replicate in host cells leading to subsequent immune system activation. However, adenoviral vectors, such as ChAdOx, adenovirus type 5, and adenovirus type 26 are the most commonly used vectors in SARS-CoV-2 vaccine development (Strizova *et al.*, 2021).

In india, the Central Drug Standards Control Organization (CDSCO) as well as Drugs Controller General of India (DCGI) permits, Covaxin Produced by Bharat Biotech, Hyderabad in association with the Indian Council of Medical Research's and National Institute of Virology, Covishield jointly Produced By the University of Oxford in collaboration with Swedish-British drug maker AstraZeneca and Serum Institute of India (SII) India, Sputnik-V developed by Gamaleya National research center of epidemiology and microbiology of the Ministry of Health the Russian Federation in Moscow and Pfizers mRNA/BNT162b2 vaccine developed by american pharmaceutical company, are the four vaccines to use under emergency situation till date. The detailed comparison of these four anti-COVID19 vaccines with its technical names, type of vaccine, quantity and number of doses required, time between doses, eligibility age, storage temperature, ingredients and efficacy of vaccine is illustrated in Table 1.

**Conclusion:**

It is assumed that the new CoV outbreaks are unavoidable in future due to climate changes and increased interaction between humans and animals. Hence development of reliable, realistic and safe vaccine is the only mainstay and need of hour to end this pandemic situation.

**Table 1: Comparison of Some anti-COVID19 Vaccine on various parameters**

Parameters	Vaccines			
	COVAXIN	COVISHIELD	SPUTNIK V	BNT162b2
<b>Produced and Manufactured by</b>	Bharat Biotech-ICMR-NIV	University of Oxford/AstraZeneca and SII	Gamaleya National research center and Dr. Reddy's Laboratory	Pfizer-BioNTech
<b>Technical names</b>	BBV152	AZD1222 or ChAdOx1 nCoV19	Gam-COVID-Vac	COVID-19 mRNA vaccine (nucleoside modified)
<b>Type of Vaccine and viral source used</b>	Inactivated SARS-CoV-2 virus vaccine (with a chemical beta-propiolactone)	Vector Based Vaccine, (chimpanzee adenovirus vector)	Vector Based Vaccine (Uses two modified human adenovirus vector) i.e. rAd5 and rAd26	mRNA Vaccine, Uses single modified nucleoside mRNA (modRNA)
<b>Recommended Dose in ml</b>	0.5 ml	0.5 ml	0.5 ml	0.3 ml
<b>Recommended number of Dosage</b>	2 doses	2 doses	2 doses	2 doses
<b>Time between doses</b>	4 week	12 week	3 week	3 week
<b>Eligible age</b>	18+	18+	18+	16+
<b>Storage temp. and shelf life</b>	2 to 8° C	2 to 8° C 6 month's	2 to 8°C 6 month's	2 to 8° C For 5 Days
<b>Ingredients</b>	TLR 7/8 agonist (imidazoquinolinone) 15 µg, aluminium hydroxide gel (250 µg), phosphate buffer saline up to 0.5 ml, and 2-phenoxyethanol 2.5 mg.	L-Histidine hydrochloride monohydrate, L-Histidine, Ethanol, sodium chloride, Magnesium chloride hexahydrate, Polysorbate 80, Disodium edetate dihydrate (EDTA), Sucrose, Water for injection.	Magnesium chloride hexahydrate, Tris (hydroxymethyl) aminomethane, sucrose (sugar), sodium chloride (salt), Polysorbate 80, ethanol 95%, Disodium EDTA dihydrate as a buffer and Water.	mRNA, lipids ((4-hydroxybutyl) azanediyl) bis (hexane-6,1-diyl) bis (2-hexyldecanoate), 2 [(polyethylene glycol)-2000]-N,N-ditetradecylacetamide, 1,2-Distearoyl-sn-glycero-3 phosphocholine, and cholesterol),sodium chloride, , monobasic potassium phosphate, potassium chloride, dibasic sodium phosphate dihydrate, and sucrose.
<b>Efficacy</b>	81%	76% to 90%	91.6%	95%

Source: Respective companies' website.

**References:**

1. Akrita made I., Aghnianditya Kresno Dewantari, Ageng Wiyatno (2020), Molecular biology of Coronavirus : current knowledge. *Heliyon*, 6; e04743: pp. 1-22.
2. Burkard, C., Verheije, M.H., Wicht, O., van Kasteren, S., van Kuppeveld, F.J., Haagmans, B.L., Pelkmans, L., Rottier, J.M., Bosch, B.J., de Haan, C.A.M. (2014). Coronavirus cell entry occurs through the endo-/lysosomal pathway in a proteolysisdependent manner. *PLoS Pathog*; 10: pp. 1–17.
3. Chen Yu, Qianyun Liu, Deyin Guo (2020), Emerging coronaviruses: Genome structure, replication, and pathogenesis. *Journal of Medical Virology*, 92; pp. 418-423.
4. Cui J, Li F, Shi ZL. (2019). Origin and evolution of pathogenic coronaviruses. *Nat Rev Microbiol*; 17(3):181-192.
5. Cynthia SG, Kathleen MT, Thomas GK, Pierre ER, James AC, (2004). Ultra structural characterization of SARS coronavirus. *Emerg Infect Dis*; 10: pp. 320-326.
6. de Haan, C.A.M., Smeets, M., Vernooij, F., Vennema, H., Rottier, P.J.M. (1999). Mapping of the coronavirus membrane protein domains involved in interaction with the spike protein. *J. Virol*; 73: pp. 7441–7452.
7. Delmas B, Gelfi J, Lharidon R, Vogel LK, Sjostrom H, (1992). Aminopeptidase-N is a major receptor for the enteropathogenic coronavirus TGEV. *Nature*, 357:pp. 417–20.
8. Fung, T.S. and Liu, D.X. (2018). Post-translational modifications of coronavirus proteins: roles and function. *Future Virol*. 13: pp. 405–443.
9. Ge XY, Yang WH, Zhou JH, Li B, Zhang W, Shi ZL, Zhang YZ (2017). Detection of alpha- and betacoronaviruses in rodents from Yunnan. China. *Virol J*; 14(1):98.
10. Gui, M., Liu, X., Guo, D., Zhang, Z., Yin, C.-C., Chen, Y., Xiang, Y. (2017). Electron microscopy studies of the coronavirus ribonucleoprotein complex. *Protein Cell*; 8: pp. 219–224.
11. Guo YR, Cao QD, Hong ZS, Tan YY, Chen SD, Jin HJ, Tan KS, Wang DY, Yan Y (2020). The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak-an update on the status. *Mil Med Res*, 7(1):11.
12. He J, Ni Y, Liao L, Xiao Y, Guo Y (2021). Proportion of asymptomatic coronavirus disease 2019: a systematic review and meta-analysis. *J Med Virol*; 93(2): pp. 820–30.

13. Kumar S, Maurya VK, Prasad AK et al (2020) Structural, glycosylation and antigenic variation between 2019 novel coronavirus (2019-nCoV) and SARS coronavirus (SARS-CoV). *Virus Dis*; 31(1):13–21.
14. Lan, J., Ge, J., Yu, J., Shan, S., Zhou, H., Fan, S., Zhang, Q., Shi, X., Wang, Q., Zhang, L., Wang, X. (2020). Structure of the SARS-CoV-2 spike receptor binding domain bound to the ACE2 receptor. *Nature*, 581: pp. 215–220.
15. Li F. (2015). Receptor recognition mechanisms of coronaviruses: a decade of structural studies. *J. Virol.* 89:pp. 1954–64.
16. Li Fang (2016). Structure, Function, and Evolution of Coronavirus Spike Proteins. *Annual Reviews of Virology*, 3: 237-261.
17. Lu, R., Zhao, X., Li, J., Niu, P., Yang, B., Wu, H., Wang, W., Song, H., Huang, B., Zhu, N., Bi, Y., Ma, X., Zhan, F., Wang, L., Hu, T., Zhou, H., Hu, Z., Zhou, W., Zhao, L., Chen, J., Meng, Y., Wang, J., Lin, Y., Yuan, J., Xie, Z., Ma, J., Liu, W.J., Wang, D., Xu, W., Holmes, E.C., Gao, G.F., Wu, G., Chen, W., Shi, W., Tan, W., (2020). Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *Lancet*; 395: pp. 565–574.
18. Masters, P.S. (2006). The molecular biology of coronaviruses. *Adv. Virus Res.* 66: pp. 193–292.
19. McCreary Erin K. and Pogue Jason M. (2020). Coronavirus Disease 2019 Treatment: A Review of Early and Emerging Options. *Open forum infectious diseases*, pp. 1-11.
20. Niazkar Hamid Reza, Behdad Zibae, Ali Nasimi, Narjes Bahri (2020). The neurological manifestations of COVID-19: a review article. *Neurological Science*: pp. 1-5.
21. Ralser, M.; Wamelink, M. M.; Struys, E. A.; Joppich, C.; Krobitch, S.; Jakobs, C.; Lehrach, H. (2008). "A catabolic block does not sufficiently explain how 2-deoxy-D-glucose inhibits cell growth". *Proceedings of the National Academy of Sciences*, 105 (46): pp. 17807–17811.
22. Schoeman, D. and Fielding, B.C. (2019). Coronavirus envelope protein: current knowledge. *Virol. J.* 16: pp. 1–22.
23. Shang, J., Ye, G., Shi, K., Wan, Y., Luo, C., Aihara, H., Geng, Q., Auerbach, A., Li, F., (2020). Structural basis of receptor recognition by SARS-CoV-2. *Nature*, 581: pp. 221–224.
24. Song Z, Xu Y, Bao L, Zhang L, Yu P, Qu Y, Zhu H, Zhao W, Han Y, Qin C (2019) From SARS to MERS, thrusting coronaviruses into the spotlight. *Viruses*. 11(1). pii: E59.

25. Strizova Zuzana, Jitka Smetanova, Jirina Bartunkova, Tomas Milota (2021). Principles and Challenges in anti-COVID-19 Vaccine Development. Archives of Allergy and immunology, 182: pp. 339-349.
26. Swatantra Kumar, Rajni Nyodu, Vimal K. Maurya, and Shailendra K. Saxena (2020). Morphology, Genome Organization, Replication, and Pathogenesis of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in S. K. Saxena (ed.), Coronavirus Disease 2019 (COVID-19), Medical Virology: from Pathogenesis to Disease Control. pp. 23-31.
27. Tok Tugba Taskin and Tatar Gizem (2017). Structures and Functions of Coronavirus Proteins: Molecular Modeling of Viral Nucleoprotein. International Journal of Virology and infectious diseases, 2(1): pp. 1-7.
28. Tseng, Y.-T., Wang, S.-M., Huang, K.-J., Lee, A.I.-R., Chiang, C.-C., Wang, C.T. (2010). Self assembly of severe acute respiratory syndrome coronavirus membrane protein. J. Biol. Chem. 285: pp. 12862–12872.
29. Ujike, M., Taguchi, F. (2015). Incorporation of spike and membrane glycoproteins into coronavirus virions. Viruses, 7: pp. 1700–1725.
30. Wang M, Cao R, Zhang L (2020). Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) *in vitro*. Cell Res.30: pp. 269–71.
31. Woo, J., Lee, E.Y., Lee, M., Kim, T., Cho, Y.E. (2019). An *in vivo* cell-based assay for investigating the specific interaction between the SARS-CoV N-protein and its viral RNA packaging sequence. Biochem. Biophys. Res. Commun. 520: pp. 499–506.
32. Wrapp D, Wang N, Corbett KS, Goldsmith JA, Hsieh CL, Abiona O, Graham BS, McLellan JS (2020). Cryo-EM structure of the 2019-nCoV spike in the prefusion conformation. Science, 367(6483): pp.1260–1263.
33. Young BE, Ong SWX, Kalimuddin S (2020). Epidemiologic features and clinical course of patients infected with SARS-CoV-2 in Singapore. JAMA:e203204.
34. Zepp F. (2010). Principles of vaccine design-lessons from nature. Vaccine; 28(Suppl. 3): pp. C14-24.

## **VACCINATION: AN EFFECTIVE TOOL TO CURE COVID-19**

**P. M. Kahate**

Department of Botany,

Phulsing Naik Mahavidyalaya, Pusad,

Dist. Yavatmal, Maharashtra, India 445 204

Corresponding authors E-mail: [pankajkahate@gmail.com](mailto:pankajkahate@gmail.com)

---

### **Introduction:**

Vaccination has been described as a deliberate attempt to protect humans against disease. All vaccines work by teaching our bodies to recognize and fight the pathogen in a safe way. They encourage our immune system to produce antibodies, T-cells or both, so that if we encounter the infection later our immune system knows how to defend against it.

Vaccination has a long history of successes, and during the twentieth century the practice matured into routine vaccination of large populations. During the past 200 years, since the time of Edward Jenner (the founder of vaccinology in 1796) and his smallpox vaccination procedure, vaccination has controlled or contained epidemics for many infectious diseases in many parts of the world (Elliott, 2011). Plague vaccine was also invented in the late 19th Century. Between 1890 and 1950, bacterial vaccine development proliferated, including the Bacillus-Calmette-Guerin (BCG) vaccination, which is still in use today.

Infectious diseases have always constituted a major public health concern. For their control and eradication, in 1974 the World Health Organization (WHO) launched an Expanded Program on Immunization (EPI) against six vaccine-preventable diseases (VPDs) – diphtheria (D), measles, pertussis (P), poliomyelitis (using Oral Poliovirus Vaccine [OPV]), tetanus (T), and tuberculosis (using the Bacillus Calmette-Guerin [BCG] vaccine). Viral tissue culture methods developed from 1950-1985, and led to the advent of the Salk (inactivated) polio vaccine and the Sabin (live attenuated oral) polio vaccine. Mass polio immunisation has now eradicated the disease from many regions around the world.

According to Ministry of Health and Family Welfare, Government of India, Coronaviruses are a large family of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The most recently discovered coronavirus causes coronavirus

disease COVID-19. This new virus and disease were unknown before the outbreak began in Wuhan, China, in December 2019.

**Corona Vaccine:**

In order to end this pandemic, most parts of the world must be immune to the virus. The safest way is to vaccinate. Deaths from infectious diseases The vast majority of vaccines currently approved for use in humans can be classified as virus-based or protein-based vaccines. Virus-based vaccines can consist of inactivated viruses or live attenuated viruses that are no longer infectious. Adjuvants are important in stimulating the immune system. Attenuated virus vaccines are usually made by passage in cell culture until they lose their pathogenic properties and cause only mild infections after injection. Protein vaccines can be composed of purified viral proteins, recombinant proteins or virus-like particles from virus-infected cells. Protein-based vaccines require the addition of adjuvants to induce a strong immune response.

Vaccines contain tiny fragments of organisms that cause disease or intend to produce tiny fragments.They also contain other ingredients that make the vaccine safe and effective. These latter components are present in most vaccines and have been used in billions of vaccine doses for decades. Each component in the vaccine has a specific purpose, and each component is tested during the manufacturing process. Since the discovery of SARSCoV2, antiviral drugs and vaccines have been developed, and many treatment options and vaccines are undergoing clinical trials worldwide. They need to control it.

**COVID-19 Corona vaccine race:**

Scientists around the world are working faster than ever to develop and produce vaccines that can stop the spread of COVID-19. Since the emergence of this novel coronavirus in December 2019, more than a dozen vaccines have started to be rolled out. Here is an overview of vaccines and recent developments of vaccine candidates in clinical trials.

Preclinical	PHASE 1	PHASE 2	PHASE 3	In Use	PHASE4
185	35	37	25	16	05
Are being explored in lab experiments and animals	Are undergoing safety tests in healthy young individuals	Are being tested in broader groups of peoples	Are in large international trials to test their impacts on COVID-19	Are currently being offered to the general population	Are being monitored in the wider population after being approved.

## **Types of Vaccine**

The detailed of types of vaccines is as follows,

**1. Covaxin:** Covaxin was developed by Indian pharmaceutical company Bharat Biotech in collaboration with the Indian Council of Medical Research, a government funded biomedical research institute, and its subsidiary the National Institute of Virology. The vaccine is similar to CoronaVac (the Chinese vaccine developed by Sinovac) in that it uses a complete infective SARS-CoV-2 viral particle consisting of RNA surrounded by a protein shell, but modified so that it cannot replicate. Covaxin comes as a two-dose regimen, recommended to be taken 28 days apart. A "first interim analysis" in March, indicated Covaxin vaccine was 81 per cent effective in preventing COVID-19 in those without prior infection after the second dose. Among total vaccination in India, around 3.2 crore of those were Covaxin doses.

**2. Covishield:** The Oxford-AstraZeneca vaccine is being manufactured locally by Serum Institute of India. The vaccine is made from a weakened version of a common cold virus (known as an adenovirus) from chimpanzees. It has been modified to look more like coronavirus - although it can't cause illness. Its efficacy after second dose is considered to be around 90%. Among total vaccination in India, around 17.5 crores of those were Covishield doses.

**3. Sputnik-V:** It is developed by Moscow's Gamaleya Institute, Russia. It uses a cold-type virus, engineered to be harmless, as a carrier to deliver a small fragment of the coronavirus to the body. After being vaccinated, the body starts to produce antibodies especially tailored to the virus. It can be stored at temperatures of between 2 and 8C degrees (a standard fridge is roughly 3-5C degrees) making it easier to transport and store. Unlike other similar vaccines, the Sputnik jab uses two slightly different versions of the vaccine for the first and the second dose - given 21 days apart. They both target the coronavirus's distinctive "spike", but use different vectors - the neutralised virus that carries the spike to the body.

### **4. PfizerBioNTech:**

It is RNA based vaccine. In December 2020, the UK became the first country in the world to approve this vaccine and began rolling out an initial 800,000 doses at the start of the month. BioNTech, working together with Pfizer, started testing its BNT162 vaccine in humans in global trials, initially in Germany, and then started trials in the USA. In its final efficacy analysis, its data showed a vaccine efficacy rate of 95% (even in adults over 65 years efficacy was more than 94%, which is reassuring as older people don't always have a strong immune response to vaccines).

**Comparison of Different COVID-19 vaccines (Wellcome.org):**

<b>Technology / Company</b>	<b>Suitable of people with weak immune systems</b>	<b>Number of doses</b>	<b>Storage</b>	<b>Other vaccines using this technology</b>
<b>RNA</b> Pfizer-BioNTech Moderna	Yes	2	<b>Pfizer-BioNTech:</b> -70C and 2-8C for upto 5 days <b>Moderna:</b> -20C for 6 months and 2-8C for for 30 days	No other licensed vaccines
<b>Viral vector</b> Oxford- AstraZeneca, CanSino-Biologics, Gamaleya Research Institute, Johnson & Johnson	Yes (Depending on viral vector used)	1 to 2	2-8C	Ebola
<b>'Whole"virus</b> Sinovac (inactivated) Bharat Biotech (inactivated) Sinopharm (inactivated) Medicago Inc. (virus-like particle)	Yes	2	2-8C	Whooping Cough (inactivated) Rabies (inactivated) Hepatitis A (inactivated) HPV/ cervical cancer (virus like particle)
<b>Protein subunit</b> Novavax Chinese Academy of Sciences	Yes	2	2-8C	Hepatitis B

**Vaccination drive in India and world:**

In India, two vaccines were granted emergency use authorization by the Central Drugs Standard Control Organization (CDSCO), Covishield® (AstraZeneca's vaccine manufactured by Serum Institute of India and Covaxin® (manufactured by Bharat Biotech Limited). Sputnik – V has been granted EUA in the month of April 2021. 2.7 B peoples were vaccinated at least one dose worldwide yet, of that India contributed 283.31 M who is at 7<sup>th</sup> rank.

	<b>Doses Given</b>	<b>Fully vaccinated</b>	<b>% of population fully vaccinated</b>
<b>World</b>	270 Cr	78.3 Cr	10.0 %
<b>India</b>	28.3 Cr	5.06 Cr	3.7 %

(Google.com 23 June 2021)

**Effect of vaccination on peoples:** It is divided into two

**1. Beneficial effects:**

Once you get the first vaccine, your body will begin to produce antibodies against the coronavirus. When a virus is infected, these antibodies can help your immune system fight the virus, thereby reducing your chance of being infected. Receive the COVID19 vaccine, make antibodies against the virus, and transfer it to the fetus through the placenta. Mothers have also been shown to be able to transmit antibodies to their newborns through breast milk. Studies have shown that vaccines can effectively prevent serious diseases caused by COVID19. Therefore, even if you are vaccinated and infected, you are unlikely to get a serious illness. Vaccination can also protect those around you, especially those who are at increased risk of serious illness due to COVID19. In addition, new data shows that vaccinators who may be infected with the coronavirus have fewer virus particles in the mouth and nose and are less likely to pass them on to others.

**2. Side Effects:**

According to the Ministry of Health and Family Welfare, four common side effects are expected after corona vaccination (i) mild headache, (ii) pain or swelling at the injection site, (iii) mild fever, and (iv) Irritable. ...With the widespread distribution of vaccines and in certain countries for all ages, genders, and races, the threshold for vaccine-related adverse reactions is very low. Johnson & Johnson's COVID19 vaccine is even more risky. It continues to claim hundreds of thousands of lives every day, and the threat of new choices makes vaccination a priority. Johnson also appears to be present in the Oxford AstraZeneca COVID19 vaccine. As part of the coconut planting program, this vaccine has been used in Europe and most parts of the world. Side effects after vaccination are an important step in determining the potential trend of vaccine reaction trends, improving patient safety, and identifying areas that require vaccine safety research.

### Conclusion:

Vaccines are an effective way to prevent from coronavirus. Monitoring vaccine safety is paramount to any vaccination program. “The rapid identification of blood clot cases with low levels of blood platelets underscores the importance of reporting any adverse events and quickly determining if there is a plausible link to the vaccine. At the same time, every medical intervention comes with some level of risk, and an essential role of public health officials is to assess the balance and to effectively communicate both the benefits and the risks to the public.” In the words of Elliot (2011), “The importance of vaccines cannot be overstated and millions of people are alive today due to the vaccinations that they and the people around them received either as children or as adults”.

### References:

1. Elliott, A.Y. 2011. Vaccines. In Murray Moo-Young: Comprehensive Biotechnology, 2<sup>nd</sup> Edition, 3, pp 347-355, Elsevier.
2. Gao G.F. 2018. From “A”IV to “Z”IKV: attacks from emerging and re-emerging pathogens. Cell, 172 (6), pp 1157-59.
3. Hinman A. 1999. Eradication of vaccine-preventable diseases. Annual Review of Public Health, 20, pp 211-229.
4. van Riel D., de Wit E. 2020. Next-generation vaccine platforms for COVID-19. Nature Materials, 19, pp810-812.
5. Veve M.P., Athans V. 2019. A Worldwide yearly survey of new data in adverse drug reactions. In Side effects of drugs annual, Volume 41, pp 351-372, Elsevier.
6. [https://www.gavi.org/vaccineswork?gclid=Cj0KCQjwIMaGBhD3ARIsAPvWd6jaLaiBJOJT93dTGLqbUqM2SKKixOu8l3jiWm3gYgU0aD9ZUdVh23QaAh\\_wEALw\\_wcB](https://www.gavi.org/vaccineswork?gclid=Cj0KCQjwIMaGBhD3ARIsAPvWd6jaLaiBJOJT93dTGLqbUqM2SKKixOu8l3jiWm3gYgU0aD9ZUdVh23QaAh_wEALw_wcB)
7. [https://www.path.org/articles/weighing-risks-and-benefits-vaccines/?gclid=Cj0KCQjwIMaGBhD3ARIsAPvWd6ivakwZSUsH9cmxSwd4nHy7-yyj8N-vdDiZ9LaOKA44sfCslFn3rMMaAkrZEALw\\_wcB](https://www.path.org/articles/weighing-risks-and-benefits-vaccines/?gclid=Cj0KCQjwIMaGBhD3ARIsAPvWd6ivakwZSUsH9cmxSwd4nHy7-yyj8N-vdDiZ9LaOKA44sfCslFn3rMMaAkrZEALw_wcB)
8. <https://www.gavi.org/vaccineswork/covid-19-vaccine-race>
9. <https://www.mohfw.gov.in/>
10. <https://www.sciencedirect.com/topics/medicine-and-dentistry/vaccination>
11. [https://ourworldindata.org/covid-vaccinations?country=OWID\\_WRL](https://ourworldindata.org/covid-vaccinations?country=OWID_WRL)

12. <https://www.ndtv.com/india-news/covaxin-77-8-effective-in-phase-3-trial-data-in-review-by-expert-committee-sources-2469685>
13. <https://www.bmj.com/content/373/bmj.n997>
14. <https://www.mpnrc.org/covishield-vaccine-registration/>
15. <https://wellcome.org/news/what-different-types-covid-19-vaccine-are-there>
16. <https://www.immune.org.nz/vaccines/vaccine-development/brief-history-vaccination>
17. <https://www.muhealth.org/our-stories/should-pregnant-and-breastfeeding-women-get-covid-19-vaccine>
18. <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/vaccine-benefits.html>
19. DRAFT Landscape of COVID-19 Candidate Vaccines (WHO, 2020); <https://www.who.int/who-documents-detail/draft-landscape-of-covid-19-candidate-vaccines>.

## HANDLING ETHICAL ISSUES AND DOCUMENTS IN ICU FOR COVID 19 PATIENTS

**Debajani Nayak**

SUM Nursing College

Siksha 'O' Anusandhan Deemed to be University,

Bhubaneswar, Odisha

\*Corresponding authors E-mail: [debajani1986@gmail.com](mailto:debajani1986@gmail.com)

---

### **Introduction:**

The intensive care unit (ICU) is an ethically charged environment: life and death decisions are made daily. Particularly when medical criteria alone are insufficient in deciding what is the right thing to do, healthcare professionals can be faced with an ethical dilemma. Care in the ICU is more highly technological and more intensive than in the general ward. Ethics and ethical issues related to nursing are an important area of concern while dealing with COVID 19 Patients in ICU.

### **Ethical Issues and decision-making regarding Life sustaining Treatment for COVID 19 Patients:**

As the pandemic progresses and intensive care resources become even more limited it may be necessary to review and adapt the decision-making approach accordingly. For example, as pressure increases on intensive care capacity, it may be necessary for a higher threshold to be applied in relation to which patients can access intensive care treatment. It is vital that decisions relating to the allocation of life-saving equipment do not become the responsibility of single individuals. Decisions to prioritise or deny access to critical care interventions should ideally always be discussed by at least two senior clinicians with experience of respiratory failure in ICU (where possible).

- There is increased number of COVID 19 patients admitted to the ICUs has led to the evaluation and the management of each patient according to his/her condition.
- Usually there are two levels of treatment to consider is
  - **Ordinary Care** (Non-Invasive and Treatment)
    - Providing Nutrition

- Hydration
- Antibiotic Therapy
- **Extraordinary Care** (Complex, Invasive & Experimental Treatments)
  - CPR, Advanced Life Support,
  - Other Therapies
- The ICU Nurse should believe that any treatment can become extraordinary whenever the patient decides that the burdens outweigh the benefits.

### **Ethical Issues and Decision Making**

- **Critically ill patients with covid 19 tend to be**
- Older (>60 years)
- Respiratory failure
- Multiple organ dysfunction
- Presence of Comorbidity
- The limited availability of ventilators and ICU beds

### **Decision For Providing Ventilation Support**

- patient with COVID-19 may derive after considering and evaluating the presence of
  - Comorbidities,
  - The severity of respiratory failure,
  - Estimated time of intubation.
- The physicians and ICU nurse appear to value most saving patients who have the greatest chance to survive over those who do not.

### **Need for Ethical decision making**

To more effectively solve such ethical dilemmas,

- The nurses in the ICUs caring for patients have to be sufficient in numbers
- Physically and psychologically supported by the administration.
- The medical staff should be well-informed
- Trained regarding the procedures and the decisions that need to be made.
- The ICUs, should be connected via telephone and other online technologies to exchange information.
- Cooperation among medical staff could lead to better prognosis, evaluation, and treatment decision for patients with covid-19, thus enhancing their chances of survival.

### **Points to remember for Ethical decision making**

- Identify source of authority for decision making
- Achieving effective communication with patient and families
- Carryout early determination and ongoing revive of patient's desire
- Clearly recognize the patients' rights
- Carryout hospital policies
- Protect the nurses own standards of care

### **Futile care**

Futile medical care is the continued provision of medical care or treatment to a patient when there is no reasonable hope of a cure or benefit.

### **Cardiopulmonary Resuscitation Decisions**

Resuscitation efforts are used to reserve the clinical sign of death

- a. Loss of spontaneous respiration
- b. Loss of cardiac function
- c. Unconsciousness

Ethical question arise on use of CPR and emergency cardiac care.

- d. In what situations should resuscitation efforts be used?
- e. How long should efforts continue?

### **Do not Resuscitate (DNR):**

- It is a verbal communication between the clinician & the patient's relative or caregiver.
- The order is commonly implemented in the critical care setting as a prelude to end-of-life care. The autonomy of the patient also remains a weak concept.
- The law is silent or ambiguous on most issues related to end-of-life care.
- Withholding or stopping resuscitation efforts is ethically & legally appropriate if the patient/surrogate has previously made his preferences known through advanced directives.

### **Withholding or withdrawal of life support**

"Withholding" refers to never initiating a treatment.

"Withdrawing" refers to stopping a treatment once started.

- To stop a treatment once started Best made after careful discussion (Health care professional, patient and family)Ending of treatment for sound moral reasons does not violate professional obligations.
- Health care professionals may find it emotionally more difficult to withdraw a treatment than to withhold it.It is often important to start a treatment to evaluate whether it works, until a diagnosis is confirmed. It is better to start the treatment & later stop if it is ineffective.
- Decisions about treatment at the end of life are often difficult & best made after careful discussions between the health care professional & the patient (or surrogate).

### **Key Aspects for Ethical Decision Making**

#### **Equity**

- All patients requiring intensive therapy treated according to the same criteria
- No discrimination
- Fair allocation procedures

#### **Maximizing benefit**

- Preserving as many lives as possible
- Comorbidities and functional status
- Short-term survival
- Protection for health professionals

#### **Considering age/life span:**

- Age in itself is not a good criterion to decide on disproportionate care

#### **Additional criteria**

- Criteria such as lottery
- First come first served
- Social utility explicitly rejected

#### **Patients will termination of therapy**

- Decisions to withhold or withdraw life-sustaining treatments must always be discussed and shared among the healthcare staff, the patients, and their proxies

### **Additional recommendations**

- Initiate decisions as early as possible
- Transparent decision-making
- Documentation of reasons for forgone interventions
- Discuss risks, benefits, and possible likely outcomes with patients, families, and carers

### **Who decides?**

- Second opinion from coordination centers or designated experts in difficult cases
- Mobile intensive care team
- Communication strategy through hospitals
- Psychosocial support of teams
- Support all healthcare professionals
- Teleconsultation

### **Legal decisions in ICU for COVID 19 patients**

Legal decisions in ICU for COVID 19 patients

1. Medical documentation
  - i. Informed consent
  - ii. Advanced directives
  - iii. Incident Reports
2. Use of restraints
3. Declaring Brain death

### **Informed consent**

- Informed consent is based on the principle of autonomy
- Consent denotes voluntary agreement., permission or compliance.
- Consent problems arises because patients experiencing acute, life threatening illness that interfere with their ability to make decisions on treatment/participation in clinical research.

**In order to be considered legally effective, consent to medical treatment must meet the criteria:**

- Voluntariness
- Adequately informed or knowing
- Given by an individual with adequate mental capacity and legal authority
- Decision making

**When consent invalid?**

- Consent obtained from minor
- Consent obtained from fear, fraud or misrepresentation
- Consent obtained from the person who is not fit
- Consent obtained from language not understood by the person
- Consent obtained from person under sedation, intoxication or semiconscious
- Consent obtained from without providing adequate information on the possible risks

**Advanced directives**

- These are the legal document used to state certain future health care decisions only when a person becomes unable to make the decisions and choices on their own.
- The living will is only used at the end of life or permanently unconscious.
- It describes the type of medical treatment the person would want or not want to receive in these situations.
- It can describe under what conditions an attempt to prolong life should be started or stopped.
- It includes:
  - The use of breathing machines
  - If you want to be resuscitated if your breathing or heartbeat stops
  - Tube feeding

**Incident Report**

- Document the occurrence of anything
  - Out of the ordinary that results in
  - Or has the potential result in
  - Harm to a patient, employee or visitor.
- The nurse responsible for a potentially or actually harmful incident or who witnesses an injury is the one who fills out the incident form.

## **Documents**

- The proper documentation is legal safe guard for the nurses.
- Consent from patients before carrying out any procedure is mandatory legal, ethical & moral requirement.
- The document once prepared has also to be preserved for specified period of time.
- Good records are indispensable for proper care & treatment of patients.
- The record should be Correct, Clear, Comprehensive, Chronological and Contemporaneous.

## **Important Legal Documents**

- Specialist Consultation and referral slips
- Nurse's record, Treatment and investigation reports
- TPR Chart, BP Monitoring chart, OI Chart
- Progress note, Discharge summary, Follow up notes
- Photography, Death Certificate, Autopsy report etc.

## **Use Restraints**

- Intervention that limits a person's freedom to move
- Use of physical restraint can lead to:
  - Skin trauma, Muscular atrophy, Nosocomial infection, Constipation,
  - Incontinence, Limb injury, Contractures, Depression, Anger,
  - Decline in functional & cognitive state
  - Restraint can limit the movement and autonomy
  - Use only when all other methods of managing the problem have failed.
  - Employed with caution as a last reports
  - Use least restrictive method possible

## **Declaring Brain Death**

- Require a physician not involved in the patient treatment to document brain death and another physician to confirm the findings.
- Three essential findings in brain death are Coma, Absence of brainstem reflexes, Apnoea
- While declaring death plain language like dead, dying, death, and die may be used which are rarely misunderstood.

- Family members must be reassured that everything appropriate was done to help the patient.
- News of a patient's death should be given in person, whenever possible.
- When families must be contacted by telephone, special care should be taken how the information is to be disclosed.

### **Role of Nurse in handling ethical issues in Death of a COVID 19 patients**

- If death occurs in the ICU, the nurse in charge on duty must inform the CMO
- Nurse must get written instruction from the medical officer for handing over the body to mortuary/relative/police / Municipality officer with:
  - Complete name and signature
  - Complete address of the person from mortuary/relative/police/ BMC officer
  - Identification number
  - Signature of witness
- List of all articles of patient should be made in triplicate while handing over the body.
- Maintain the privacy of the dead body while attending last offices or care of the dead.
- All the articles should be disposed off, after making list and with approval of medical officer.

### **Ethical issues of most concern:**

The most frequently cited ethical issues reported by the nurse are:

1. Protecting patients' rights & human dignity
2. Providing care with possible risk to the health
3. Respecting/not respecting informed consent to treatment
4. Staffing patterns that limit patient access to nursing care
5. Use/non use of physical/chemical restraints
6. Prolonging the dying process with inappropriate measures
7. Working with an unethical/incompetent/impaired colleague
8. Providing care with possible health risk
9. Not considering a patient's quality of life

**Steps to resolve ethical problems in ICU for COVID 19 patients**

- Gather the relevant facts & identify the decision makers
- Identify the ethical problems
- Involve others in the process & use consultation resources as appropriate.
- Analyze the problem using ethical guidance & resources
- Deliberate about the action alternatives in light of guidance; choose one & justify the choice.
- Evaluate & reflect.

**Ways to resolve ethical problems in icu for covid 19 patients**

- Recognized patients' rights
- Infection Prevention and Control Policies and Training for Healthcare Personnel (HCP)

**ICU Admission and Infection Control Plan**

- Identification of area for admitting COVID-19 patients with clear entry and exit points.
- Identification of staff and place a patient with known or suspected COVID-19 in a single-person room with the door closed.
- Airborne infection isolation rooms (AIIRs), if available, should be reserved for patients who will be undergoing aerosol generating procedures.
- HCPs should strictly follow the basic infection control practices between patients (e.g., hand hygiene, cleaning, and disinfecting shared equipment).
- Limit transport and movement of the patients outside their room only for medically essential purposes. Consider providing portable X-ray/ultrasound /ECG equipment in patient cohort areas to reduce the need for patient transport.
- Ensure that environmental cleaning and disinfection procedures are followed consistently and correctly

**ICU triage:**

All the patients must be properly judged as to whether it can be admitted to ICU or not. Such decision must be transparent and unbiased regardless of ethnic and socio-economic status. Over triage is preferred to under triage.

**The triage policy shall be:**

- Patients would be admitted or discharged strictly on their potential to benefit from ICU care. In an environment where ICU admissions are rigorously screened for benefit, and discharge is ongoing and continuous, the need for triage is minimized.
- When large number of patients arrives triaging must be carefully done to discriminate who requires immediate ICU and who can be managed in a HDU. If the availability of ICU is less in comparison to number of patients, such patients can be referred to some other ICU in the same hospital or other hospital after getting consent from patient relatives.
- Ethnic origin, race, sex, social status, sexual preference or financial status should never be considered in triage decisions. Triage decisions may be made without patient or surrogate consent, and can be made despite an anticipated untoward outcome.

**Handling shortage of beds:**

1. In case of bed shortages, this information is given to the Medical Superintendent immediately.
2. All stable patients will be transferred to other wards and the same will be intimated to the patient attendant. If the patient is stable and there is no bed available, he will be transferred to other hospital of patient's choices.
3. Unstable patients will be stabilized and transferred with the help of hospital ambulance to such hospital. At the time of transfer, transfer protocol is to be followed.

**Education**

- The ICU staff should have access to educational material in the form of slide shows presented by experts; videos from the websites of professional societies or journals and should be provided on-the spot training by other trained personnel present and mock drills.
- Weekly meeting on Clinical updates / Sensitisation of all staff of ICU organized by the ICU in-charge for better preparedness and efficiency for management in emergency.

**Ventilation Strategies**

- Ventilation strategies will primarily depend upon the severity of SARI/ARDS.

- Some patients may have normal lungs to begin with but during the course of ICU treatment may develop more severe changes.
- Patients should be ventilated with ARDS net protocol.
- Noninvasive ventilation in select patients with mild ARDS may be tried but have a low threshold for early intubation.

Intubate the patient (while taking utmost aerosol precautions) preferably with an endotracheal (ET) tube with subglottic suction.

### **Oxygen Supply and Ventilators**

- In the event of a large number of patients developing respiratory failure, the existing ICU beds are likely to be overwhelmed.
- Operation theaters, post-anesthesia care unit beds, emergency department critical care beds, and monitored beds in endoscopy suites can be used to create additional ICU beds.
- These areas have the advantage of having facilities for oxygen, suction, and monitoring.
- If ventilation is needed for two adjacent patients and if only one oxygen port is available, convert a singly oxygen supply to dual by using the “Y” connector at the outlet or preferably use an oxygen cylinder.

### **CPR in COVID-19**

“Crashes” should be avoided by close monitoring and anticipation aiming for an elective, unhurried intubation. The usual “code blue” should be replaced by a “protected code blue” to prevent unacceptable caregiver risk. Futility should be assessed and Do-Not-Attempt Resuscitation (DNAR) decisions taken in time.

### **Communication**

Communication is important to convey the right messages and prevent undue panic. When admission to ICU is required the patient and its family shall be communicated regarding:  
Reason for intensive care, Plan of management, Expected course of treatment in ICU, Risks and outcome, Anticipated expenses, Possible complications.

A written document as to the above, explained to patient shall be obtained.

### **Communicating with Patients and Families**

- Deliver information tactfully, accurately, promptly, and with empathy.

- Avoid speculative statements and complex language or medical jargon.
- Regular updates should be provided to the patients' relatives.
- All personnel must provide a common set of information regarding the patient's condition and prognosis to the family.

### **Communicating with the Media**

- Hospitals and the media must work together effectively to provide accurate information and avoid speculation and opinionated commentary.
- The media must be given timely, accurate information on the number of patients and deaths, hospital and public health response, and other clinical and epidemiological characteristics of COVID-19.

### **Documentation and Patient Medical Records**

It is essential to maintain patient records at every step of the process during the patient's time in hospital. It may be necessary to have a system for tracking anonymous patients when large volumes of patients turn up.

### **Monitoring**

Patients will be monitored daily for any clinical worsening and discharged after obtaining two consecutive negative RT-PCR results at least 24 hours apart from the oropharyngeal swabs

### **Discharge Criteria to Step-down Unit or Ward**

Only after obtaining a written discharge order by the attending physician, discharge can be done when:

1. The patient is stabilised and no longer requires mechanical ventilation or active support for more than one organ.
2. The patient is no more benefiting from the treatment available.
3. The patient or family members give in writing to shift the patient from the intensive care to normal ward/cabin.
4. When patient's physiological status has stabilized and the need for ICU monitoring and care is no longer necessary
5. A patient who has stayed in intensive care for longer period but clinically there is a minimal chance of survival, shall be considered for discharge after discussion of the team of doctors and the family members of the patient.

**Conclusion:**

The healthcare systems and workers are presently unable to provide the fundamental ethical principles of beneficence, non-maleficence, justice, and respect of autonomy in the ICUs during the COVID-19 pandemic. The major sources of conflicts are behavioral issues, like poor communication between physicians and nurses, and end-of-life care issues including a lack of respect for the patient's autonomy. Where intensive care resources become limited, it is ethically necessary, justifiable and proportionate to have decision in place to enable ICU nurses to triage and priorities access to those resources.

**References:**

1. Anesi GL. Coronavirus disease 2019 (COVID-19): Critical care and airway management issues. UpToDate. 2020 Mar;1.
2. Griffin KM, Karas MG, Ivascu NS, Lief L. Hospital preparedness for COVID-19: a practical guide from a critical care perspective. American journal of respiratory and critical care medicine. 2020 Jun 1;201(11):1337-44.
3. Joebges S, Biller-Andorno N. Ethics guidelines on COVID-19 triage—an emerging international consensus.
4. Juneja D, Savio RD, et al . Basic Critical Care for Management of COVID-19 Patients: Position Paper of Indian Society of Critical Care Medicine, Part-I. Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine. 2020 Nov;24(Suppl 5):S244.
5. Marron JM, Joffe S, Jagsi R, Spence RA, Hlubocky FJ. Ethics and resource scarcity: ASCO recommendations for the oncology community during the COVID-19 pandemic. J Clin Oncol. 2020 Apr 28;38(19):2201-5.
6. Maves RC, Downar J, et al. Triage of scarce critical care resources in COVID-19: an implementation guide for regional allocation An expert panel report of the Task Force for Mass Critical Care and the American College of Chest Physicians. Chest. 2020 Apr 11.
7. Mehta Y, Chaudhry D, et al. Critical care for COVID-19 affected patients: Position statement of the Indian society of critical care medicine. Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine. 2020 Apr;24(4):222.

8. Ozair A, Agrawal A, Siddiqui SS. Training and delivery of critical care medicine in India: Concerns revealed by COVID-19 pandemic. *Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine*. 2020 Apr;24(4):285.
9. Pattison N. End-of-life decisions and care in the midst of a global coronavirus (COVID-19) pandemic. *Intensive & critical care nursing*. 2020 Jun;58:102862.
10. Peterson A, Largent EA, Karlawish J. Ethics of reallocating ventilators in the covid-19 pandemic. *Bmj*. 2020 May 12;369.
11. Phua J, Weng L, Ling L, Egi M, Lim CM, Divatia JV, Shrestha BR, Arabi YM, Ng J, Gomersall CD, Nishimura M. Intensive care management of coronavirus disease 2019 (COVID-19): challenges and recommendations. *The Lancet Respiratory Medicine*. 2020 May 1;8(5):506-17.
12. Singh JA, Moodley K. Critical care triaging in the shadow of COVID-19: Ethics considerations. *South African Medical Journal*. 2020 May 1;110(5):355-9.
13. Vergano, Marco, et al. "Clinical ethics recommendations for the allocation of intensive care treatments in exceptional, resource-limited circumstances: the Italian perspective during the COVID-19 epidemic." (2020): 1-3.

## **FUNCTION OF MEDIA IN COVID-19 AWARENESS: ROLE, TRENDS, CHALLENGES, PROSPECTS, CAMPAIGNS**

**Abhishek Roy**

Hospitality Management, Amity School of Hospitality

Amity University, Haryana, India

\*Corresponding authors E-mail: [aroy@ggn.amity.edu](mailto:aroy@ggn.amity.edu)

---

### **Abstract:**

Coronavirus disease (COVID-19) is an infectious disease triggered by a recently revealed novel strain of coronavirus, SARS-CoV-2 (WHO, 2020). Maximum people infected with the COVID-19 will experience mild-to-moderate fever and respiratory illness with no particular treatment available. The COVID-19 is having a reflective outcome on all aspects of society like mental and physical health, economic status etc. These main concerns were address by UK Academy of Medical Sciences and the mental health research charity (Adhikari et al., 2020). This pandemic is affecting several nations (213), with over 9,994,311 cases and 498,833 confirmed deaths reported to date. Media always the most commended means for liberty of speech, democracy, truth and source of infotainment and the most-searched site for information-gathering. However, there are thousands of people spreading information, sensationalism, rumours, misrepresentation and half-truth making it vital for Governments and experts to fight against the epidemic as well as the hearsays. The researchers have tried to locate whether media is informing or misinforming the public the way people use the internet, social media, news, print media and the speed of informationspreads on media is unconceivable. Media are the primary source to spread information on latest approach in Corona Virus awareness, medication and safety measures. The researcher has explored the social, economic, biological, psychological, moral, spiritual and demographic characteristics of people awareness, investigate the various social and economic dimensions that lead to media uses, the nature of problems of media, the impacts on the minds of people, its role in addressing the mass audience and propose measures to address growing problems of modern era's physical and psychological disease issues. In this review, aspects were highlighted like the different steps taken by the government against CoVID- 19, such as designated hospitals, quarantine centres, testing facilities, treatments, public awareness and the response of local community and the response of the local community against COVID – 19 outbreak.

**Keywords:** New Media-Social Media, Pandemic, Covid-19, Information, Control, Current scenario, Facilitations.

## **Introduction:**

If an emergency situation takes place, people's craving for information is different from normal. If news broadcasting of information is not evident, comprehensive, and organised by the government and the media at this time, it may affect to people's psychological and emotional tension, unnecessary public panic, and economic loss (Liu and Chen, 2011).

On the other hand, if there is a clear network of information distribution and effective information broadcasting mode among the government, the media, and the public, this will be helpful to ease the social panic and check the development and broadcasting of contrary effects in the occasion. Similarly, the interactive stage can create the believability of the government and the media.

The COVID-19 epidemic was treated as a case of pneumonia with unknown etiology showed in the Wuhan city of China, at the end of December 2019, which blow-out through the country to globe with a high rate (Sahin *et al.*, 2020). The PRC (People's Republic of China) Centre for Disease Control (CDC) investigated the respiratory samples and confirmed that the pneumonia was initiated by a novel coronavirus which named the pneumonia as Novel Coronavirus Pneumonia (Wang *et al.*, 2020). The coronavirus is one of the main viruses that target the respiratory system of the human (Hoehl *et al.*, 2020). The Chinese researchers called the virus as 2019-nCoV (Zhu *et al.*, 2020). Subsequently, the International Committee on Taxonomy of Virus named the novel coronavirus as Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) (Zu, 2020). On other hand, February 11, 2020 the World Health Organization (WHO) name the Pneumonia as Coronavirus disease-19 (COVID-19) (Morales *et al.*, 2020).

The COVID-19 thought the third outbreak of the coronavirus which affected more than 213 countries including India. According to the World Health Organization (WHO), total of more than 9,994,311 confirmed cases and 498,833 confirmed deaths reported. To date, the number of highest positive cases encountered in USA.

On March'2020, per the direction of the Prime Minister of India, a high-level Group of Ministers (GOM) was organised to review, supervisor and evaluate the preparation and actions taken regarding management of COVID-19 in the country.

Community surveillance, quarantine, isolation wards, adequate PPEs, trained manpower, rapid response teams for COVID-19 are being strengthened further in all States and UTs.

The government has declared the COVID-19 outbreak in the country a "notified disaster", in a move called "a special one-time dispensation", to provide compensation and aid to infected people and the families of those who died due to the virus. Funds for this and other measures will be drawn from the Disaster Response Funds of each state (SDRF). Travel Advisories had been issued by govt. from time to time (WHO, 2020).

At the time of emergency, it will trigger or may trigger serious social destruction. In order to avoid losses, some actions must be taken as soon as possible in response to the sudden incidents, such as natural disasters, accident disasters, public health events, and social security incidents. Although, the key effect of media coverage is to spread science education, develop the identification of the unaware, lower the probability of the ignorant believing rumours, and thus reduce the spreading rate of rumour dissemination, rather than stop the spread of rumours. On the other side, when rumours break out, relevant emergency strategies can not only prevent individuals from believing in rumours, but also reduce the spreader's enthusiasm for dissemination (Huo *et al.*, 2011).

The spread of rumour not only initiated the people to panic, but also brought enormous economic losses. However, regulatory rumours are only the first goal. Saving control costs is equally important.

#### **Role of ICT during pandemic situation:**

Information and communication technology have widely unlocked its arms, and made anything accessible for everyone from any part at any time. Disaster events world-wide have recorded the distinguished role played by information and communication technology (ICT) in cautioning and response behaviours (Sophia B. Liu, 2007).

Enhancements of communication technologies and systems have formed new communication platforms that cause economic, political, social and cultural transformations. With Web 2.0 technologies getting common on the Internet, social networks have gained extreme importance, especially in the recent years (Kulakli and Mahony, 2014). Public contribution is developing as a wide-ranging space for computer-moderated communication with inferences for both informal and formal response (Leysia Palen, 2007).

Mass broadcasting leads established on conventional media, like newspaper, radio and television, have been taken over by individuals, public and/or private enterprises on social

media platforms, and these network-driven new media tools that allow direct broadcasting has proceeded in individual, cultural, social, legal, economic, and political consequences (Scaglione, Giovannetti, and Hamoudia, 2015).

Citizens are manipulated by these media expansions, in many ways. People on social media share threats as well as opportunities (Li, de Zubielqui, and O'Connor, 2015). ICT has changed the universal landscape of distribution information and improved the connection between public and governments.

### **Awareness of Covid 19 Information on Media:**

According to Government doctor it is understandable and likely for a people to panic in the time of a crisis, like Covid-19, and the amount of anxiety usually relates completely or undesirably with the level of mindfulness or being informed.

Generally, in a crisis situation our brains mostly put emphasis on the negative or worst, which leads to influences our reaction to the received information and comparatively, to the consequence of the crisis. It is very true, Governments, public health agencies, and media gather enormous amounts of data, but they do not always distribute all of it. Ethically, they conjointly work 'in the best interest of the public,' though scientific research and assumptions claim an assured amount of data, minimum required for conclusions to be made and implemented.

Crisis period, any data is appreciated, provided they are reliable. In addition, initially half- truth and fake news, start with coronavirus being a bioweapon and ending with a cure for it being found even beforehand the virus was discovered, widely spreading on Facebook, WhatsApp, Twitter and other media platforms. The trick, which most of the public might tested, i.e., taking a deep breath in and holding it for more than 10 seconds has nothing to do with coronavirus finding. With such news being spread time to time social media, print and news channel becomes a risky site generating confusions and recklessness, especially during a pandemic situation.

By quoting 'unfortunate the current situation' The private doctor said, when questioned about the information about coronavirus and linked issues on social media, doctor felt it was frightening to see people sharing unnecessary content related to the Covid-19. People are locked at home and mobile phones and television become more active. With social media, anyone is able to create and share for everyone around the globe, even with the government

reiterating the use of Government websites, official pages and apps for verified updates, people end up with false news and wrong information, primarily because media literacy is something which lacks in our population. People are more concentrating to emotionally- charged contented and end up sharing them without knowing the reliability. People are sharing to create themselves as knowledgeable among their peers and followers or to inform and safeguard their dear and near ones, to take protective actions. Even images from movies with dead bodies lying around were related to Covid-19 and people ended up sharing these on social media without confirming the truth behind those images.

As per the Government official, information that needs carefulness are often suppressed and barely ever reach the front end. Social media offers an online space which could be efficiently accessed to share credible information to improve outcomes in the current critical situation. But yes, many platforms like Facebook, Twitter, and WhatsApp have taken footsteps to direct their handlers to reliable sources, anticipation and dismissal of fabrication news has to be more effectual.

Awareness videos and blogs, preventive measures and do's and don'ts during the lockdown, social media empowering some sort of regulation over the matters to confirm truthful information to eliminate the dominating misinformation is the need of the situation. Police, medical staff and sanitation workers effectively enforcing the lockdown order of the Government. Police have to take step on people sharing messages against the Government or dispersal untruthful information about Government initiatives, officials, healthcare organisations as well as Covid-19 and misguide the public. Now, everyone should jointly hands to fight against coronavirus along with false information and fake news on media. It has become correspondingly significant to monitor people for mingling false information through social media. They said that they are equally fighting against the pandemic and the false information or rumours related to it. An academician said that researches and articles on Covid-19 related topics in various journals are verified information from trustable sources. But people do not generally look up for researches as a source for news or information. Social media opened doors for citizen journalism and this is altering the news business.

Traditional and broadcast media are finding ways to compete with social media content providers. No wonder, healthcare organisations can communicate instantly and directly with the public through social media which bypasses the gatekeeping of traditional media. Social

media is constantly evolving. It is most focused on how advertisers can use it to attract new consumers. Social media, with filters on content, can be best used to positively influence situations like the Covid-19 outbreak outcomes. Unfortunately, today in our world, where the misinformation surrounding coronavirus is going viral faster than the virus itself. Another academician specified that on one-side social media is a beneficial instrument for communication at the time of isolation. Discursion about coronavirus in a society can help us to come out from the stress situation in a collectively manner whereas with thousands of social media users scattering rumours, sharing false information, selling sensationalism, misinformation and disinformation, everything multiplied quickly through shares, it is posing a threat to the society. In terms of inconsistent information on Covid-19 seeking attention of users the most, half- truth and overstatement that misguide people are spread extreme online. Social media is not the right source for updating on Covid-19 as the material found there are mostly misleading. People look at social media for instant updates which is not always right.

It is very much understandable Government officials and employees are helping the community and are not in a position to monitor what is being shared on social media. It is the responsibility people, they should realise the situation, act responsibly, cooperate in all possible ways possible and do not act in any way to disrupt other's efforts towards the wellbeing of the civilisation. But in maximum time, people are not concerned about whether the information is true or not and what will be the end result of it. At the time of 21-day lockdown, news through social media spread at unthinkable speed. As a result of misinformation on lockdown extension, shortage of daily supplies, estimated increase of cost led to panic buying and over buying which ultimately led to shortage of products and the sellers increasing prices, comparatively. Although government repeatedly asking, through news channels, to stay calm as daily needs would be made available. In the current state, false information is reaching faster and wider and any news on social media related to coronavirus or Covid-19 have to be verified if it is true. People must think logically and analyse the situation before making decisions based on information shared on social media. Everyone is trying for solutions in such a situation. People think they reward an intellectual status by sharing new information first. And the common people believe the false information and fall prey to such news. These messages are useless, incorrect and at times, even harmful. Government helplines, websites, news applications and news channel websites should be accessed for any updates in situations like this. In some cases,

the fake news or wrong information misguiding the public could cause a setback to public health.

Social media offers both-way communication where people can comment and react to an information. Through Social media people can put their reaction but also our collective response to the coronavirus outbreak, both for good and bad. During the Covid-19 outbreak and lockdown in place, rarely active social media users are now facilitating important conversations about the virus, sharing content such that sensationalism and misinformation are spread. Moreover, the unparalleled information at our fingertips is a double-edged sword which can affect real-time smart decisions and can create a worried environment with indeterminate outcomes.

### **Discussion and Conclusion:**

This pandemic crisis is still forward of and around us and we are taking the situation for permitted without comprehending the practicality. Both, government and corporate organizations use social media more often than traditional media in responding to a crisis (Kim and Liu, 2012).

Though government is trying to direct the public towards consistent sources for confirmed information and updates, social media has converted the way people communicate around the world, instantly and borderless. In the new media age of inter-connectedness, the outburst of Covid-19, a pandemic caused by coronavirus, has been outpaced by the misinformation related to the pandemic spreading among millions of people globally. False information can result in widespread real-world impact, through the web and social media platforms, because it can be created and spread easily (Kumar and Shah, 2018).

It is proven that much of the fake news is spread by people purely on an entertainment viewpoint. Atlantic Council President and CEO, Frederick Kempe tweeted that information, including disinformation and misinformation about the novel coronavirus is spreading faster than the pandemic itself. It is hard to recognise if the true motive behind this news is whether or not to misguide people on a large scale, and if yes, who is really behind it.

With regard the coronavirus outbreak, more of user-generated or user-edited matter majorly add to misinformation than factual information. Misinformation spreads much faster than these platforms could possibly contain or control. An important question for today's

information users is that information on social media platforms fairly lacks professional gatekeeping to monitor the content and evaluate its credibility (Ruohan Li, Ayoung Suh, 2015).

In our country, Wikipedia, an online encyclopaedia can be editable by anyone, and surprisingly is still the most referred site and trusted source of information on an unimaginably wide range of topics.

Socially accountable citizens, the public should refrain from broadcasting incorrect information, learn to verify and validate information, and check the integrity of widespread information. The speed at which information spreads on internet is unconceivable but now may finally be the time for us to slow down.

### **References:**

1. Adhikari S. P., S. Meng, Y.-J. Wu, Y.-P. Mao, R.-X. Ye, Q.-Z. Wang, C. Sun, S. Sylvia, S. Rozelle, H. Raat, H. Zhou Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review *Infect. Dis. Poverty*, 17 (9) ((2020), p. 29 Google Scholar
2. Hoehl S., H. Rabenau, A. Berger, M. Kortenbusch, J. Cinatl, D. Bojkova, P. Neumann Evidence of SARS-CoV-2 infection in returning travelers from wuhan, China *New England J Med*, 382 (13) (2020), pp. 1278-1280
3. Huo L.-A., P. Huang, and X. Fang, "An interplay model for authorities' actions and rumor spreading in emergency event," *Physica A: Statistical Mechanics and its Applications*, vol. 390, no. 20, pp. 3267–3274, 2011.
4. Kim Sora and Brooke Fisher Liu (2012) Are All Crises Opportunities? A Comparison of How Corporate and Government Organizations Responded to the 2009 Flu Pandemic, *Journal of Public Relations Research*, 24:1, 69- 85, DOI: 10.1080/1062726X.2012.626136
5. Kulakli, A., and Mahony, S. 2014. Knowledge Creation and Sharing with Web 2.0 Tools for Teaching and Learning Roles in So-called University 2.0. 10th International Electronic copy available at: <https://ssrn.com/abstract=3596058> Strategic Management Conference 2014. 150, pp. 648-657. *Procedia - Social and Behavioral Sciences*.
6. Leysia Palen and Sophia B. Liu, Citizen communications in crisis: anticipating a future of ICT-supported public participation, CHI '07: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, April 2007, Pages 727– 736 <https://doi.org/10.1145/1240624.1240736>
7. Leysia Palen and Sophia B. Liu, Citizen communications in crisis: anticipating a future of ICT-supported public participation, CHI '07: Proceedings of the SIGCHI Conference on

- Human Factors in Computing Systems, April 2007, Pages 727– 736  
<https://doi.org/10.1145/1240624.1240736>
8. Li, H., de Zubieli, G., and O'Connor, A. (2015). Entrepreneurial networking capacity of cluster firms: a social network perspective on how shared resources enhance firm performance. *Small Business Economics*, 45(3), 523-541.
  9. Liu D. and X. Chen, "Rumor propagation in online social networks like Twitter - A simulation study," in *Proceedings of the 3rd International Conference on Multimedia Information Networking and Security, MINES 2011*, pp. 278–282, China, November 2011.
  10. Rodriguez-Morales A., R. Tiwari, R. Sah, K. Dhama COVID-19, an emerging coronavirus infection: current scenario and recent developments-an overview *J Pure Appl Microbiol*, 14 (2020), p. 6150
  11. Ruohan Li, Ayong Suh, Factors Influencing Information credibility on Social Media Platforms: Evidence from Facebook Page, *Procedia Computer Science*, Volume 72, 2015, Pages 314-328
  12. Sahin A. R., A. Erdogan, P.M. Agaoglu, Y. Dineri, A.Y. Cakirci, M.E. Senel, A.M. Taşdoğan 2019 novel coronavirus (COVID-19) outbreak: a review of the current literature *EJMO*, 4 (1) (2020), pp. 1-7
  13. Scaglione, M., Giovannetti, E., and Hamoudia, M. (2015). The diffusion of mobile social networking: Exploring adoption externalities in four G7 countries. *International Journal of Forecasting*, 31(4), 1159-1170.
  14. Srijan Kumar and Neil Shah, False Information on Web and Social Media: A Survey, 1, 1 (April 2018), 35 pages. <https://doi.org/10.1145/nnnnnnn.nnnnnnn>
  15. Wang L.S., Y.R. Wang, D.W. Ye, Q.Q. Liu A review of the 2019 Novel Coronavirus (COVID-19) based on current evidence *Int J Antimicrob Agents* (2020), p. 105948
  16. World Health Organization 2020, the CC BY-NC-SA 3.0 IGO licence.
  17. World Health Organization. Novel coronavirus (2019-nCoV): situation report-13. Published February 2, 2020. Accessed March 16, 2020 <https://www.who.int/docs/default-source/coronaviruse/situationreports/20200202-sitrep-13-ncov-v3.pdf>
  18. Zhu N., D. Zhang, W. Wang, X. Li, B. Yang, J. Song, P. Niu A novel coronavirus from patients with pneumonia in China, 2019 *New England J Med*, 382 (8) (2020), p. 727
  19. Zu Z.Y., M.D. Jiang, P.P. Xu, W. Chen, Q.Q. Ni, G.M. Lu, L.J. Zhang Coronavirus disease 2019 (COVID-19): a perspective from China *Radiology* (2020) 200490-200490.

## FLUCTUATIONS OF WEST TEXAS INTERMEDIATE (WTI) OIL PRICE – PRE AND DURING COVID-19 TIMES: AN EVENT STUDY

G. Chandrakala<sup>1</sup> and P. Sathish<sup>2</sup>

<sup>1</sup>School of Commerce and Management Studies,  
Dayananda Sagar University Bangalore, Karnataka, India

<sup>2</sup>School of Business and Management,  
Christ (Deemed to be University) Bangalore, Karnataka, India

\*Corresponding authors E-mail: [chandrakala-socm@dsu.edu.in](mailto:chandrakala-socm@dsu.edu.in), [sathish.p@christuniversity.in](mailto:sathish.p@christuniversity.in)

---

### Abstract:

The Novel Corona virus pandemic or COVID-19 pandemic is an ongoing disease caused by severe acute respiratory syndrome. As the virus continues to spread across the world, led most of the powerful economies on the brim of collapse and forced to go into a state of lockdown by shutting down all of its major operations, which affected various sectors and created shocks in the stock market. Due to pandemic, it is observed that there is lesser demand for crude oil though huge supply persists. Based on this backdrop, the study has examined the fluctuations of West Texas intermediate oil price during pre and during Covid-19. Further, the study has considered COVID-19 as an “Event” in which daily observations on West Texas intermediate oil prices over a period of total ten months was considered from 1<sup>st</sup> June 2019 to 30<sup>th</sup> March 2020 and classified time period from June 1<sup>st</sup> 2019 to October 30<sup>th</sup> 2019 (Pre COVID) and 1<sup>st</sup> November 2019 to March 30<sup>th</sup> 2020 (During COVID). This empirical study has found using paired t test that there is statistically significant difference in West Texas intermediate oil price during pre and during Covid-19.

**JEL Classification:** C1, C12, F1, F6

**Keywords:** Covid-19, WTI oil price, Paired t test, Oil Price fluctuation.

---

### Introduction:

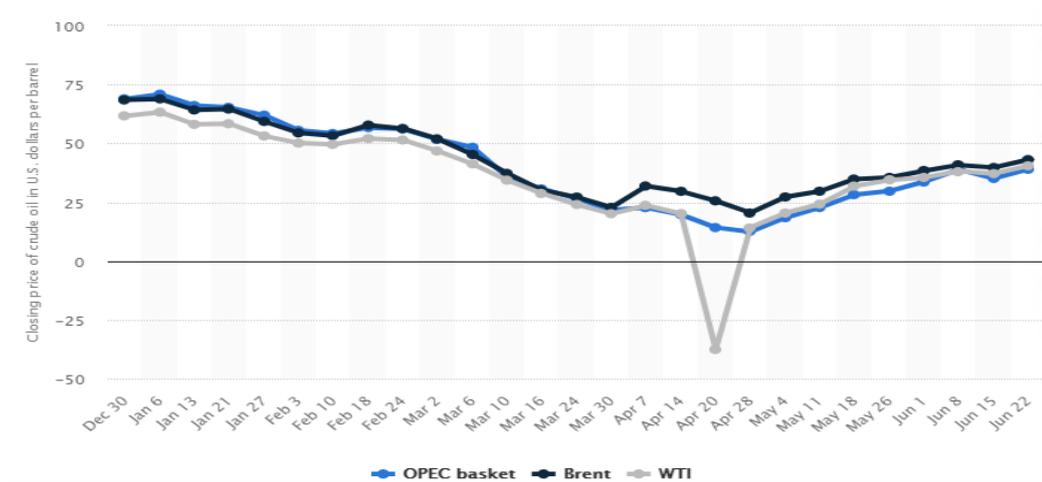
The Novel Corona virus pandemic or COVID-19 pandemic is an on-going disease caused by severe acute respiratory syndrome. The outburst was first identified on 1<sup>st</sup> November 2019 in Wuhan, China, although it was not documented until late December 2019. This outbreak was announced by World Health Organization as a *Public Health Emergency of International Concern* on 30<sup>th</sup> January, 2020. Later on 11<sup>th</sup> March 2020 announced it as a pandemic.

The virus continued mushrooming across the world leads most of the powerful economies on the brim of collapse and forced to a state of lockdown by shutting down all of its major operations, which affected various sectors eventually creating shocks in the stock market. The pandemic has also caused severe shortage of supply of various essential commodities to precious energy commodities like oil. As, oil in its crude oil form can be refined into petroleum, diesel and other fuels required to power vehicles for transportation which is vital for the movement of goods for export and import.

West Texas intermediate (WTI), is a crude oil that aids as a key global oil benchmarks. It is mainly obtained from Texas and is considered to be one of the superior quality oils in the world. Due to low density and low sulphur content it is also called 'Texas light sweet'. In New York Mercantile Exchange's (NYMEX) it is an essential commodity of oil futures contracts. The price of WTI oil is normally refer to the spot and future price of barrel of benchmark crude oil and a reference price of vendor and customer of crude oil. The difference in price of a barrel of oil is based on grade and ascertained by various elements like sulphur content, specific gravity and location.

As pointed out by Economic times March 30<sup>th</sup> 2020; the travel industry globally halted due to coronavirus pandemic with demand declining, lead to free fall in Crude oil prices with the WTI oil price of US decreasing below the \$20 per barrel and benchmark Brent crude price reaching its 18year-low. Besides, this continued fall can be indorsed resulting in rise of supplies and decline in demand. Further, experts believe that demand would fall substantially in the upcoming months which may lead prices of crude oil nearer to \$15 mark as corona outbreak is still ongoing.

As OPEC's talk of deeper production cut with Russia failed; the flow of supply in Saudi Arabia has increased burden of oil prices. The present market is overstocked because of dwindling in demand leading to free fall state for crude. As, oil price touched a point which is increasingly becoming harder for higher cost producers to continue its operations may lead in declaration of insolvency .Thus as Many U.S. shale producers are facing difficulties in terms of low oil price for upcoming months may lead to a wave of bankruptcies in United States. With global demand presently estimated to drop 15 or 20 million barrels per day, it is understood that a 20 per cent plunge from 2019 isleading to solid production cuts and the analyst forecast that if Russia and South American producers and Africa don't collaborate to fight with production cuts, further the oil market leads to massacre.



**Figure 1: Weekly Closing Price of Crude Oil in U.S. Dollars per Barrel during Dec 2019 to June 2020** Source: <https://www.statista.com/statistics/326017/weekly-crude-oil-prices/>

Figure 1 depicts weekly closing price of OPEC basket, Brent oil and WTI oil prices which gradually decreased since December 2019, while the WTI oil prices suddenly had a severe downward movement of the prices moving to negative value during the mid of April 2020 and later in the following months it's slowly resuming back to the usual state.

In the line of existing work, the study has carried out and framed two objectives. The first objective is to understand movement of WTI oil price in U.S. with respect to various factors and events. By considering the Covid-19 as an event, the second objective is edged to explore the significant difference between fluctuations of WTI oil prices during Pre-COVID and during COVID -19.

**Literature review:**

Previous literature has discoursed on fluctuations in oil price of WTI based on the various factors and events occurred in the world. On the basis of the existing literature, the study has progressed further and few important literatures are stated here. In the recent work carried out by Wu *et al.* (2020) have mentioned that forecasting the accurate crude oil prices is a biggest challenge.

Drachal (2016) analysed monthly spot oil prices (WTI) between 1986 and 2015. In this context, Dynamic Model Averaging and Dynamic Model Selection framework was used as a methodology and found that the stock market, exchange rate were seen as major drivers in oil price during 2008 oil price peak and oil import or production were considered as minor drivers. Besides, changing role of inventories were found but not larger than the one which took place in 1991.

The study made by Jiang *et al.* (2014) to evaluate the Hurst indexes in crude oil futures prices of WTI during 1983–2012 and statistical analysis in the crux of bootstrapping was placed to validate the weak state of market efficiency hypothesis. Further, outcome indicates that the whole period was considered resulted in efficient the crude oil futures market while, when full series was segregated into three sub-categories parted by the outbreak of the Gulf and Iraq War, it was identified that there was decreased efficiency in market. On signing date of the North American Free Trade Agreement, with samples bifurcated into two sub-series; the market was found inefficient in time period during which Gulf War broke out.

Wang and Liu (2010) have analysed the capability in WTI crude oil market throughout Hurst local exponents by rolling window based method and the sample being bifurcated into two subset based on multi-scale de-trended fluctuation. It was found that little fluctuations were persistent in WTI crude oil market whereas big fluctuations were seen with higher instability in longer and shorter time period.

Similarly, the study investigated by Wang and Xie (2012) used cross correlation for analyzing the United State stock market and crude oil market of WTI from econophysics context. During the period of study from Jan 2, 2002 to Jun 29, 2012, three United State major Stock indices were identified namely National Association of Securities Dealers Automated Quotations index (NASDAQ), Dow Jones Industrial Average (DJIA) and S&P 500 index. Further, Ljung-Box test was incorporated and found that WTI has significant relationship with DJIA, NASDAQ and S&P 500 index at five percent level. Further in the study employed multifractal de-trended cross-correlation and found their exists cross-correlated behaviour between United State stock market and WTI crude oil, further it is concluded as multifractal and nonlinear. Lastly, the rolling windows method was adopted which captured the changes in cross-correlations and found three specific periods exist which was time-varying Hurst exponents which were dissimilar with each other

A study conducted by Du and He (2015) investigated the spillover effect between stock market risk and crude oil in the United States of Nation. The study took daily observations on WTI oil futures return and S&P 500 stock index in which study applied Value at Risk to explore the market risk and found that there was a significant risk between crude oil market and stock market. In addition, granger causality test adopted and found there was bidirectional causality between each other.

Geman and Kharoubi, (2008) have analysed the variation in crude oil futures contracts in the United States. It indicates that documents were found negatively correlated between

commodities and equities which is different from crude oil futures and stocks indexes; whereas in case of distant maturities Futures, the negative relationship effect is more obvious irrespective of increasing or decreasing stocks. Lastly, empirical evidence shows that a database repository has 15 year time period of data consisting of S&P 500 index and NYMEX WTI crude oil Futures

Wang and Wei (2011) have analyzed by employing several Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models which captured the reminiscence of volatility of WTI crude oil returns. The study carried out to know the volatility of spot and futures returns. In this study, de-trended volatility analysis along with rescaled range analysis (R/S) which is non parametric method was adopted in comparison from recollection properties of contingent volatility series resulted from GARCH Class Model with actual volatility series. Finally, the study empirically found that GARCH-class models have capability to recapture properties of more than a year timescale. In fact, the GARCH class models were mis-specified though, time scale was lesser than a year.

Chiroma *et al.* (2015) have explored Genetic Algorithm and Neural Network in speculating WTI oil price at United Nations. In their study, results of projected Genetic Algorithm and Neural Network were better in comparison with baseline algorithms in terms of computational efficiency as well as prediction accuracy. Further, the projected model can be helpful in formulation of policies pertaining to estimations of international prices for crude oil, industrial production and associated development plans

Albulescu (2020) has investigated the effect of COVID-19 numbers on crude oil prices and its impact on financial volatility. Concurrently, uncertainty is seen in the United States (US) economic policy. The study incorporated Auto Regressive Distributed Lag and the estimation revealed during the COVID-19 Outbreak which is based on daily reported cases of new infections have a peripheral negative effect in longer run on the crude oil prices. Yet, by magnifying the volatility of financial markets; COVID-19 has severe indirect effect on recent changes in crude oil prices

After extensive literature review, it was found that there is limited research work related to WTI oil prices variations during covid times. So, this study is an effort which adds value to academic literature and research fraternity which addresses the fluctuations of WTI oil price during pre and during COVID times.

**Hypothesis:**

**H<sub>0</sub>**- There is no significant difference between CAAR and WTI Oil prices Pre and Post COVID-19

**H<sub>1</sub>**- There is a significant difference between CAAR and WTI Oil prices Pre and Post COVID-19

**Methodology:**

The study is descriptive and analytical in nature. The entire world is impacted by Corona virus pandemic and the first case was recorded on 1<sup>st</sup> November, 2019 in China. Keeping this in view; this study focused on the movement of oil prices for West Texas Intermediate by spread of Corona Virus. To check the impact level, the study has considered COVID-19 as an “Event” as it took daily observations on WTI oil prices over a period of ten months from 1<sup>st</sup> June 2019 to 30<sup>th</sup> March 2020. Further, the study period was segregated into two periods namely Pre Covid Period (June 1<sup>st</sup> 2019 to October 30<sup>th</sup> 2019) and Post Covid Period (1<sup>st</sup> November, 2019 to 30<sup>th</sup> March, 2020). The closing value of WTI oil prices has been gathered from the energy information administration of United States

The study computed actual return of WTI oil prices with help of the following formula:

$$\text{Return} = (P_1 - P_{t-1}) / P_{t-1} * 100$$

$P_1$  = Closing value of the day;  $P_{t-1}$  = Closing value of the preceding day

Also, the study has been estimated Average Abnormal Return, the return prevailed besides the actual return due to the occurrence of an event.

Further, Cumulative Average Abnormal Return is calculated by summing the Average Abnormal Return. The purpose of this is to obtain the total of AAR.

To test the hypothesis statistically, this study applied paired t test for analysis. Also, calculated t-value for AAR and CAAR by using following formula.

***T Value (AAR) = AAR/Standard Deviation of AAR***

***T Value (CAAR) = CAAR/Standard Deviation of CAAR***

The Cumulative Average Abnormal Return is another beneficial calculation as well as Average Abnormal Return (AAR) as it assists to get the cumulative effect of abnormal returns predominantly though outcome during the window is not wholly reflected during event date itself.

**Data analysis and interpretation:**

The outcome pertaining to the significance differences of WTI oil price Pre and Post Covid- 19 are given below.

The paired t test results shows that the pre-test mean score is 26.059 with S.D of 12.853 and post-test mean score is 58.607 with S.D of 18.732 which are displayed in table 1. The study also found that the fact that a negative and significant relationship between the Pre and Post Covid -19 by -0.312 percent in table 2. It explains WTI oil price is decreased due to the spread of

Covid-19 in pre and post is significant. Table 3 depicts that there is significant difference between pre and post Covid-19 fluctuations of WTI oil price. Hence, the study proved the alternative hypothesis.

**Table 1: Paired sample statistics**

Pair	Mean	N	Std. Deviation	Std. Error Mean
Before Covid-19	26.059	109	12.853	1.231
After Covid -19	58.607	109	18.732	1.794

**Table 2: Paired samples correlations**

Pair	N	Correlation	Sig.
Before Covid-19	109	-.312	0.001
After Covid -19	109	-.312	0.001

**Table 3: Paired sample test**

Pair	Paired Differences					t	Df	Sig (2-tailed)
	Mean	Std. Deviation	Std Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Before – After Covid -19	-32.548	25.814	2.472	-37.450	-27.647	-13.16	108	0.000

**Conclusion:**

This study recaps the fact that countries such as U.S. Brazil, Russia and India is predominantly affected by COVID-19 which has huge impact on various sectors of the economy. In this context, among the various sector; oil industry is one of the crucial sector which is majorly affected. This study has addressed the various aspects of WTI through various existing studies. Besides, this study examined the movement of WTI oil price during pre and post Covid-19 using paired t-test and took the daily observations of WTI oil price in time period of ten months from 1<sup>st</sup> June , 2019 to 30<sup>th</sup> March 2020 by segregating into two period of time i.e., Pre Covid Period (June 1<sup>st</sup> 2019 to October 30<sup>th</sup> 2019) and Post Covid Period (1<sup>st</sup> November, 2019 to

30<sup>th</sup> March, 2020). Finally, this study empirically provided the evidence indicating that there is a statistically significant difference between the WTI oil prices during pre and post Covid-19.

#### **Limitations and scope for further research:**

The study is conducted using only one event i.e, Covid -19. Therefore, one could not generalize that this outcome represents fluctuations of WTI oil prices based on Covid-19 alone. There may be other factors which has influence on movement of WTI oil prices. Besides, the study has considered only 10 months which examined the difference of WTI oil price during pre and post Covid-19. The study can be further extended to check long term effect of Covid-19 on WTI oil prices.

#### **References:**

1. Albulescu, C. Coronavirus and oil price crash. Available at SSRN 3553452. <https://dx.doi.org/10.2139/ssrn.3553452> (2020).
2. Chiroma et al.(2015): Evolutionary Neural Network model for West Texas Intermediate crude oil price prediction, Applied Energy, 13 (1) : 266-273
3. Drachal K (2016): Forecasting spot oil price in a dynamic model averaging framework—Have the determinants changed over time? , Energy Economics, 60(1):35-46
4. Du, L., and He, Y (2015): Extreme risk spillovers between crude oil and stock markets. Energy Economics, 51(1) : 455-465.
5. Geman, H., and Kharoubi, C. (2008): WTI crude oil futures in portfolio diversification: The time-to-maturity effect. Journal of Banking and Finance, 32(12) : 2553-2559.
6. Jiang, Z. Q., Xie, W. J., and Zhou, W. X. (2014): Testing the weak-form efficiency of the WTI crude oil futures market. Physica A: Statistical Mechanics and its Applications, 405(1) : 235-244.
7. Wang, G. J., and Xie, C.(2012): Cross-Correlations between WTI Crude Oil Market and U.S Stock Market: A Perspective from Econophysics. Acta Physica Polonica B, 43(10): 2021-2036.
8. Wang, Y., and Liu, L.(2010): Is WTI crude oil market becoming weakly efficient over time?: New evidence from multiscale analysis based on detrended fluctuation analysis. Energy Economics, 32(5) : 987-992.
9. Wang, Y., Wu, C., and Wei, Y. (2011): Can GARCH-class models capture long memory in WTI crude oil markets?. Economic Modelling, 28(3) : 921-927.
10. Wu, J., Miu, F., and Li, T. (2020): Daily Crude Oil Price Forecasting Based on Improved CEEMDAN, SCA, and RVFL: A Case Study in WTI Oil Market, Energies, 13 (7) : 1852-1863.

## **SCOPE OF LIBRARIES DURING COVID-19 PANDEMIC**

**Pratibha Pandey**

Librarian,

Post Graduate Govt. College,

Sector - 46, Chandigarh, India

Corresponding authors E-mail: [pratibhapandey81@gmail.com](mailto:pratibhapandey81@gmail.com)

---

### **Abstract:**

COVID-19 pandemic has impacted every institution, public and private industries and public domain. In this pandemic situation, libraries have been the gateways of information and knowledge required for conducting research in different subject areas. The Library and Information services started to gain importance by providing researchers the opportunity to explore medical and scientific research, while prevention of the disease. This Article focuses on the recent technological advancements and preventive guideline measures taken in order to enhance the knowledge of library and information professionals to promote library resources and services.

**Keywords:** Library resources, Library Services, Information technology, COVID-19 Pandemic.

---

### **Introduction:**

Due to lockdown in various parts of India, Libraries around the world have been facing problems in providing access to its collections and services. Libraries are promoting their digital services during the corona virus pandemic situation to satisfy their user's needs. Libraries having good collection of e-resources are able to serve their users in the most effective way even in the lockdown period throughout the world. Libraries are focussing on digital services by organizing virtual exhibitions, through websites, webinars and Lets Read Together online campaign. Efforts to focus on giving access to the library resources through online as well as offline is also increasing, for example the number of e- Books/ e-Journals/CD-DVD, collection is enriched etc. in order to lower the risk of virus spread.

### **Objectives of the study:**

1. Focussing on innovative ways to reach out library users
2. To explore opportunities to tackle pandemic situation
3. To enhance professional skills
4. Preparation for New Normal Scope of the libraries after COVID 19 Pandemic

The technological advancements and innovations in the field of library science have transformed the traditional libraries to the smart Libraries. Libraries are offering wide range of innovative services to satisfy the information need of the users in the pandemic situation. Libraries are playing important role in selective dissemination of Information and knowledge. Libraries are the store houses of knowledge resources in physical/digital medium. Libraries are growing organism and therefore they keep on increasing the library collection and services. Present libraries are focussing on enriching digital/virtual mode of library collection and also offer remote access facility for their users. The application of Information and Communication Technologies (ICT), the Internet and particularly the World Wide Web has revolutionized library activities. The present libraries have library resources includes e books, e-resources, digital library, e- services etc. Present smart libraries involve utilization of skill and knowledge whereas the information is stored, retrieved and disseminated in the e-format.

**Present trends of library services:**

COVID-19 Pandemic does not seem to be eradicated completely. Librarians are discovering new services and opportunities to build a stronger library-user interface in the future. In order to achieve these goal libraries need to be equipped with latest infrastructure, information communication technologies and skilled manpower.

**Virtual library services:**

1. Virtual Reference services like chat/e-mail
2. Scanning of chapters from books, journals articles for remote users
3. Self check-in and checkout of books
4. LibGuide- List of resources available in the library
5. Update library website and giving information about COVID-19 Virus and its spread.

COVID-19 or Coronavirus Disease is caused by a newly discovered coronavirus. Old age people suffering from underlying medical problems like diabetes, cardiovascular disease, chronic respiratory disease, and cancer are more likely prone to serious illness. The Common symptoms of COVID-19 include high fever, tiredness and dry cough. Other symptoms include shortness of breath, body aches and pains, sore throat, and very few people will report diarrhoea, nausea or a runny nose. Coronavirus spread to people through spread of droplets

when infected person sneeze in the public domain. The chances of virus transmission in case of libraries can occur by direct contact with infected user and indirect contact with surfaces in the library or with objects used by the infected user/staff. To understand and know more about the disease World Health Organization is releasing daily updates on the situation at the global level.

#### **Handling of study materials in the libraries:**

Inspite of huge risk of infection through objects carrying coronavirus, the use of library resources is equally important to carry out research on the on-going projects. Librarians now a days are extending library services on a safer mode and are following standard operation procedure according to the Government Guidelines. Libraries are imposing a waiting period (quarantine) for Issue/ return of books. Different countries have their own operating procedure to handle the Library resources, for example Australian Library and Information Association has suggested cleaning DVDs with plastic covers with alcohol wipes.

#### **Preventive Measures and Guidelines / SOP for Libraries during COVID-19 Pandemic:**

Libraries are effectively working on providing its services to users during the lockdown. Governments regularly are taking different approaches, sometimes ordering the full closure of all institutions, in situations like these library professionals can follow below mentioned preventive measures to curb the spread of COVI-19 through the libraries:

1. Staying at home in case of sickness
2. Using appropriate sanitizer frequently
3. Roster of library staff duty
4. Maintaining social distancing norms
5. Following healthy and hygiene habits
6. Keeping books at separate place for at least 48 hours when check in/check out
7. Limiting of users in reading room allowing just one table per user
8. Using mask and cover while sneezing or coughing
9. Avoid sneezing or coughing while handling of books
10. Keeping surfaces clean, including library computers surface like door knobs, switches and railing etc.
11. Using online platforms or social media for sharing Knowledge/Information.
12. Providing remote access of library resources to the users

13. Promoting paperless work culture

14. Frequently used items such as magazines and newspapers may only be accessible to people with gloves and masks, etc.

### Important/Useful links for Digital Library and E-resources:

Library users who have online reading habits, can access several digital libraries offering reading material free of cost. The links are given below:

Sr. No.	Title/Name	Description	Web Address/URL
1.	NDL	Educational materials available for all subject areas like Technology, Social Science, Literature, Law, Medical, etc	<a href="https://ndl.iitkgp.ac.in/">https://ndl.iitkgp.ac.in/</a>
2.	Internet Archive	Internet Archive: is a non-profit library of millions of free books, movies, software, music, websites, and more	<a href="https://archive.org">https://archive.org</a>
3.	Hathi Trust	HathiTrust is a partnership of academic and research institutions, offering a collection of millions of titles digitized from libraries around the world.	<a href="https://www.hathitrust.org/">https://www.hathitrust.org/</a>
4.	The World Digital Library	The World Digital Library provides free access to manuscripts, rare books, maps, photographs, and other important cultural documents from all countries.	<a href="https://www.wdl.org/en/">https://www.wdl.org/en/</a>
5.	Khan Academy	Khan Academy non-profit educational organization. It provides short lessons in the form of videos.	<a href="https://www.khanacademy.org">https://www.khanacademy.org</a>
6.	Open Library	Open Library is an open source towards a web page for every book ever published.	<a href="https://openlibrary.org/">https://openlibrary.org/</a>
7.	Project Gutenberg	Project Gutenberg is a volunteer effort to digitize and archive cultural works.	<a href="https://www.gutenberg.org/">https://www.gutenberg.org/</a>

### **Opportunities of Learning with the Virtual Platform/Webinar in the Libraries:**

In the COVID times, Library professionals can avail opportunities and improve their skills/ability for giving effective services in virtual environment. Librarians can organize virtual webinars. Now a days, trend of webinars is increasing and there are some specialized applications / software to conduct virtual meeting, webinars, video conferencing, live chat, etc. Virtual seminar platform are used to conduct online meetings, online lectures and online conferences. Webinar software provides online platform, where mutual interaction between the speakers and attendees takes place to carry out audio-visual communication. Webinar software provides real- time interactive features like multiple-hosts/clients, polls/voting, live chat, questions & answers, screen sharing. Libraries can use below mentioned facilities for knowledge sharing purpose among the staff/researchers/users.

### **Following are widely used webinar hosting software's used worldwide:**

1. **Google Meet**                    <https://meet.google.com/>
2. **GoToMeeting**                <https://www.gotomeeting.com/en-in>
3. **Business Hangouts**        <https://business-hangouts.com/>
4. **Join Me**                        <https://www.join.me/>
5. **Microsoft team**            <https://www.microsoft.com/enin/microsoft-365/microsoft-teams/groupchat-software>
6. **My Own Conference**       <https://myownconference.com/>
7. **Skype for Business**        <https://www.skype.com/en/get-skype/>
8. **CISCO Webex**                [https://www.webex.com/content/webex/c/e%20n\\_US/index/downloads.html/](https://www.webex.com/content/webex/c/e%20n_US/index/downloads.html/)
9. **Zoho Meeting**                <https://www.zoho.com/meeting/>
10. **Zoom**                         <https://zoom.us/signin>

### **Conclusion:**

Library services in digital era are revolutionized due to technological advancements. Libraries using online medium for its library services have become more competent in terms of resource management and digitalization. Information seekers are seeking information in digital format, therefore, library services needs skilled professionals. Libraries are playing vital role in data acquisition, storage, analysis, interpretation and dissemination of information among the

library users. This Article focuses on opportunity to learn recent technological advancements for maximizing the usage of library resources and services in lockdown and pandemic. This article provides an overview on preventive measures and current trends in libraries to play proactive role in the present and post pandemic situation.

**References:**

1. Asif M, Singh KK, Trends, opportunities and scope of libraries during Covid-19 pandemic. IP Indian Journal of Library Science Information Technology 2020;5(1):24-7.
2. COVID-19 and the Global Library Field accessed on 30/06/2021 from <https://www.ifla.org/covid-19-and-libraries>
3. Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations accessed on 30/06/2021 from <https://www.who.int/newsroom/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations>
4. Paramanik, Amiya (2015) The Prospects of Library and Information Science Professionals in Post-Industrial Era, International Journal of Interdisciplinary Multidisciplinary Studies 2015;2(9):48-52.
5. Singh KK, Asif M, Emerging trends and technologies for digital transformation of libraries. IP Indian Journal of Library Science Information Technology 2019;4(2):41-3.
6. Top 10+Webinar Software in 2020 accessed on 08/06/2020 from <https://www.softwareworld.co/webinar-software/>

## HISTORY OF EPIDEMICS AND PANDEMICS IN INDIA

S. S. Nimgare\* and U. W. Fule

Department of Zoology,

Hutatma Rashtriya Arts and Science College,

Ashti, Dist. Wardha (M.S.)

\*Corresponding authors E-mail: [patankar.kargi@gmail.com](mailto:patankar.kargi@gmail.com)

---

### Abstract:

Epidemic is an unusual occurrence in a community or region of disease, specific health related behaviour or other health-related events clearly in excess of expected occurrence. It is a sudden, severe widespread outbreak of a disease pre-existing in the community. When the spreading of diseases is worldwide then it is known as Pandemic. Variety of epidemics and pandemics were found in India through time. Several accounts of Influenza, Cholera, Swine flu, H1N1 flu, Plague, SARS and now COVID-19 Pandemics as well as Polio, dengue, Smallpox, Jaundice, Chicken-gunia, and several other epidemics have been recorded throughout history. We have been able to eradicate some of them still many diseases still continue in India and they pose a threat to the community. Nowadays COVID-19 Pandemic is spreading worldwide due to lack of proper medicine and vaccine. There is need of proper medical care and further research in this field.

**Keywords:** Pandemic, Epidemic, India, History, Community

---

### Introduction:

The ultimate cause of such epidemics may be malnutrition, lack of sanitation and lack of a proper public health system. Cholera outbreaks in India have been due to the breakdown of sanitation during natural disasters [1]. A study by Moore *et al.* displays that the epidemic trends modify when the transmission exceeds the threshold station the infectious nature of it [2].

There are only two major and major epidemics in Indian history. Although cholera was prevalent in the 19<sup>th</sup> century and the number of deaths increased year by year, a pandemic influenza occurred in the late 20<sup>th</sup> century [3]. The flu pandemic is short but destructive. After a long H1N1 flu pandemic, it started recently [4]. Although it is almost impossible to analyze all epidemics and pandemics in Indian history, efforts have been made to include most of them.

## **Epidemics and Pandemics in 19<sup>th</sup> Century:**

### **Cholera Pandemic (1817):**

It is considered to be the first major epidemic of the British colonial empire in India in the 19th century, and is described as possibly the most serious of them. [5] On August 23, 1817, a civilian surgeon in Jessore reported the first case [6]. Since India started collecting data much later, probably in the late 1860s, it is impossible to make an overall estimate of the mortality rate. In terms of geography, it is important to note that 1817 brought very heavy rainfall, which resulted in floods that could cause such rainfall. Spread quickly [7]. Although Europeans and elites living in India were not severely affected at the time, slum dwellers and those living in rural poverty were the hardest hit. [8] In daily life, personal hygiene and practice. In 1826, 1852, 1860, 1863 and 1899, cholera broke out II, III, IV, V and VI.

### **Bombay Plague Epidemic (1896):**

The plague began in the colony of Mumbai in September 1896, triggering a social and political frenzy. The rapid growth of Mumbai's trade leads to population growth, which leads to overpopulation. The plague movement was launched to fight this epidemic, based on the belief that slums are hotbeds of infection. The plague killed thousands of people and many were forced to leave the city[9].

## **Epidemics and pandemics in 20<sup>th</sup> Century:**

### **Influenza Pandemic (1918):**

It is also called 1918-19 Spanish flu. As we all know, it has caused about 200 to 50 million deaths worldwide and is considered the most destructive [10]. It is caused by the H1N1 influenza virus and is very serious. The disease began in early 1918 and spread worldwide in late autumn. India is considered to be the outbreak site of the disease.

### **Polio Epidemic (1970-1990):**

India was the worst affected by polio among the developing countries until the late 1990s after which the EPI was initiated [11]. The incidence of polio in India was very high in both urban and rural states and the most affected was the state of Uttar Pradesh [12].

### **Small Pox Epidemic (1974):**

It is considered to be one of the worst smallpox epidemics in the 20th century. India is responsible for approximately 85% of this epidemic worldwide. The disease has been brought

to different regions from different sources. Although more than 15,000 people have died in this epidemic, thousands have survived, but most of them are still disabled and blind [13]. Smallpox has been eradicated through the WHO Smallpox Eradication Program. It was the first disease in the world to fight against the disease and was declared eradicated by the World Health Organization in 1980.

**Surat Plague Epidemic (1994):**

Plague cases in Surat were first reported in Sept 1994 and which it spread to other cities in India. Fewer than 1,200 people were found positive and it lasted for less than two weeks but it is considered important due to its high fatality and created worldwide repercussions. It is said to have been initially difficult for doctors to diagnose it but when they did, all necessary precautions are taken to contain its spread [14].

**Epidemics and Pandemics in 21<sup>st</sup> century**

**Dengue Epidemic (2003):**

In 2003 during September, there occurred an outbreak of DF/DHF in Delhi. It reached its peak around October-November and lasted until early December. The mortality rate was around 3%. It became a major outbreak in India in spite of the widespread preventive measures taken to control DF [15].

**SARS Epidemic (2003):**

SARS (severe acute respiratory syndrome), is considered as the first serious infectious disease outbreak of the twenty-first century. It initially started in the Guangdong province of China in 2003 and spread quickly to about 30 countries across Asia, Americas and Europe and accounted for a total of 8,439 cases and 812 deaths, within 7 to 8 months [16].

**Chikungunya Outbreak (2006):**

Around 3.4 million cases of Chikungunya were reported in Ahmedabad 2006 with 2,944 death estimated. The mortality rate in 2006 epidemic was substantially increased when compared with that in the previous four years [17]. In December, there occurred another epidemic in South India where the states of Andhra Pradesh, Karnataka and Tamil Nadu were affected.

**Dengue Outbreak (2006):**

The outbreak began in early September of 2006 and the first case was reported from Delhi. By the end of September, it began to spread to other states like Rajasthan, Kerala,

Gujarat, Chandigarh and Uttar Pradesh [18]. The ministry of health set up a control room to monitor the outbreak and provide technical assistance that led to the efficient management of the disease.

**Gujarat Jaundice epidemic (2009):**

Modasa town in Gujarat witnessed the outbreak of hepatitis B in 2009[19]. This is of significance because almost all outbreaks of viral hepatitis in India were considered to be due to hepatitis E which is feco-orally transmitted.

**H1N1 Flu Pandemic (2009):**

The H1N1 Flu pandemic began in May 2009 and spread globally by July 2009. By August 2010 it was declared pandemic and around 18,500 deaths were reported from all around the world. Three strains of influenza viruses were circulating then of which the Inf A (H1N1) and Inf A (H3N2) viruses were largely replaced by the pdm H1N1 strain.

**Odisha Jaundice Epidemic (2014):**

The outbreak began in November 2014 in Kantalbai, a remote village in Odisha. This led to a district level investigation and it was confirmed to be jaundice caused by the Hepatitis E virus. This 2014 Odisha Jaundice epidemic was one of the many outbreaks in Odisha and the most common cause being HEV.

**Swine Flu Outbreak (2015):**

It refers to the outbreak of the 2009 H1N1 flu pandemic in India which was still present as of March 2015. This outbreak in 2015 is considered as a resurgence of the infection and the most plausible reasons are considered to be low temperature, decreasing host immunity and failure of vaccination campaign after 2010 [20].According to the NCDC data in India, Rajasthan, Maharastra, and Gujarat were the worst affected states in India during this pandemic.

**COVID-19 Pandemic (2019):**

The first case was observed in Wuhan of China in December 2019 and then it is continuously spreading in all other countries including India. It causes due to novel Corona virus and spreads from human to human. There is no vaccine and proper medicine discovered till date. Continuous measures are being taken by Indian Government to control it

**Conclusion:**

India has stood strong through several epidemics and pandemics. Good medical care and efficient researches have made it possible to fight every infection and luckily, we have been able to even eradicate a few. It can be established that throughout time, many infectious diseases have become widespread due to the mere lack of sanitation and crowded environment. The tropical climate and the seasonal rains in India is yet another important factor contributing to several vector-borne infections outbreaks in the past and many more to come. Though it has been difficult to compile all the epidemics and pandemics due to lack of sufficiently available data and errors in data preservation, sincere efforts have been put into including most of the important, notable ones. This is written with a hope that it may help medical

**References:**

1. Sen S, Srabani. Indian cholera: A Myth. *Indian Journal of History of Science* 47.3 (2012): 345-374.
2. Moore, Cristopher, and Mark EJ Newman. Epidemics and percolation in small-world networks. *Physical Review E* 61.5 (2000):56
3. Ramamurthy T, Sharma NC. Cholera outbreaks in India. In *Cholera Outbreaks 2014* (pp. 49-85). Springer, Berlin, Heidelberg.
4. Mishra B. 2015 resurgence of influenza a (H1N1) 09: Smoldering pandemic in India?. *Journal of global infectious diseases*. 2015;7(2):56.
5. Arnold, David."Cholera and colonialism in British India." *Past and Present* 113(1986):118-151.
6. Pollitzer, Robert."Cholera studies:1. History of the disease." *Bulletin of the World Health Organization* 10.3 (1954):421.
7. Collins, A. E. "The geography of cholera." *Cholera and the Ecology of Vibrio cholerae*. Springer, Dordrecht, 1996. 255-294.
8. Pollitzer R, Swaroop S, Burrows W. *History of the disease. Cholera*. World Health Organization, Geneva, Switzerland.1959:11-50.
9. Kidambi P. 'An infection of locality': plague, pythogenesis and the poor in Bombay, c. 1896–1905. *Urban History*. 2004;31(2):249-67.

10. Patterson KD, Pyle GF. The geography and mortality of the 1918 influenza pandemic. *Bull Hist Med.* 1991;65:4–21.
11. John, T. Jacob, and Vipin M. Vashishtha. Eradicating poliomyelitis: India's journey from hyperendemic to polio-free status. *The Indian journal of medical research* 137.5 (2013): 881.
12. John TJ. Understanding the scientific basis of preventing polio by immunization. Pioneering contributions from India. *Proc Indian Natl Sci Acad.* 2003; B69:393–422.
13. Greenough P. Intimidation, coercion and resistance in the final stages of the South Asian smallpox eradication campaign, 1973–1975. *Social science and medicine.* 1995;41(5):633–45.
14. Gupta, Manohar Lal, and Anuradha Sharma. Pneumonic plague, northern India, 2002. *Emerging Infectious Diseases* 13.4 (2007):664.
15. Singh N P, Jhamb R, Agarwal S K, Gaiha M, Dewan R, Daga M K, Chakravarti A, Kumar S. The 2003 outbreak of dengue fever in Delhi, India. *Headache.* 2005 1; 114:61-.
16. Dikid, T. Emerging and re-emerging infections in India : An overview .*The Indian journal of medical research* 138.1 (21-23)
17. Mavalankar, Dileep, Priya Shastri and Parvathy Raman. "Chikungunya epidemic in India: a major public-health disaster." *The Lancet infectious diseases* 7.5 (2007):306-307.
18. More dengue, chikungunya cases reported, NDTV Web Version, Accessed on: 9 October 2006
19. Patel DA, Gupta PA, Kinariwala DM, Shah HS, Trivedi GR, Vegad MM. An investigation of an outbreak of viral hepatitis B in Modasa town, Gujarat, India. *Journal of global infectious diseases.* 2012;4(1):55.
20. Galwankar S, Clem A. Swine influenza A (H1N1) strikes a potential for global disaster. *J Emerg Trauma Shock.* 2009;2:99–105.

## **GOOD ABOUT COVID-19**

**Pallavi K. Pantawane\* and Bhuneshwari A. Mehere**

Department of Biochemistry

Dr. Ambedkar College, Deekshabhoomi, Nagpur, MS, India

\*Corresponding authors E-mail: [pallavi.pantavane@gmail.com](mailto:pallavi.pantavane@gmail.com)

---

### **Abstract:**

COVID-19 is global pandemic for World and became challenge for researchers. There is no as such treatment as far against COVID-19, only self care like hand sanitization, wearing mask and social distancing is the better way to protect you from COVID-19. To restrict the spread of COVID -19 most of the countries like India declared self isolation for people which give rise of new term for that as “lockdown” and people were lockdown in their home, in their villages in cities where they were working. Due to sudden lockdown in India most of the workers, poor peoples and small business and other peoples face so many problems and also education affected mostly. During this lockdown only hospitals and emergency services were open. Doctors, nurses, police and safai workers are working hard and serving for humanity during this pandemic situation. Suddenly due to COVID -19 pandemic condition not only India but also world stop for some time and it give us opportunity to think, to realize, to recollect, to reconnect with our culture , with people, friends, relatives and most importantly to connect with yourself. As every coin have two sides, same every situation and condition have two sides. As after every night there is hope of shiny day like that COVID -19 comes with bad conditions along with good. People suffer during this pandemic, which is really sad. Good about COVID-19 certainly not that many private companies making business over this condition or using different apps mostly during lockdown period are making profit out of it. COVID-19 teaches many things which we were forgotten by giving reason that lack of time. It happened due to change in our life style to maintain yourself in competitive world. The present chapter will discuss all aspects about it.

**Keywords:** COVID-19, Lockdown, Doctors, Safai Workers, Humanity.

---

### **Introduction:**

The COVID-19 was first time reported in Wuhan, China (Gautam and Hens 2020). This novel Coronavirus disease labeled as COVID-19 by World Health Organization (WHO) on

December 31, 2019. It is highly contagious and spread all over the world within short period hence, WHO declared it as global pandemic on 11 March 2020 and 4.5 million people has affected worldwide (WHO 2020; Gautam and Trivedi; Sharma et al. 2020). The first case of COVID-19 was reported in Kerala, India on 30<sup>th</sup> January, 2020. After that day by day number COVID-19 cases increasing rapidly all over the country (Rohit C. Kanha et al. 2020). First death by COVID-19 was reported on 12 March, 2020 in India. Till date worldwide 25,382,774 cases, 850503 death and 17,704,833 recovered. In India, 3,619,169 total COVID-19 patients, 64,617 total deaths and 2,772,928 recoveries reported and is on third rank after USA and Brazil (Worldometer 2020).

This pandemic COVID-19 spread by direct contact with affected person, there is no treatment available to kill the virus, hence to stop the spread of the disease, most of the countries along with India, declared lockdown and suddenly peoples are lockdown in their home, in villages, in town, and countries, place where they work and study (Jena 2020; Goutam and Hens 2020). On 24<sup>th</sup> March, the Prime minister of India announced nation-wide lockdown during that only essentials services functioning and government service except health, law and order, banking, power some other would remain closed. It is first time, when world come together to fight against COVID-19.

After that lots of inevitable changes come in life of the people. Due to sudden lockdown in India most of the workers, poor peoples and small business and other peoples face so many problems and also education system affected mostly. Worldwide many people affected and died, schools closed, many small business and companies face loses, many employees lose their jobs, stock markets collapse and number of people died accidently. Suicide cases also increased during Covid-19 (Leo Sher, 2020) which indicate, it becomes a huge stressor shaking up for people psyche, which result of fears and uncertainties.

It is very difficult to see brighter side of COVID-19 pandemic during this panic condition, but as the Monty Python song “Always look on the bright side of light” good thing happened should not be ignored. Still during this difficult condition only hospitals and emergency services were open. Doctors, nurses, police and safai workers are working hard and serving for humanity during novel Coronavirus pandemic lockdown. Like them many corona worriers come in front and work and contribute in this difficult condition for humanity. COVID-19 gives an opportunity to balance and fill the gaps of our life style and our relationship, universe and nature as well.

This lockdown gave time to stop, to take deep breath and relax, to recall, to reconnect you with world, friends, and family and specially connect with yourself and culture.

**Community connectivity:**

During this time the world come together and become global community to fight against COVID-19. Nations come together for common cause to find solution, treatment over this pandemic and helping each other. Not only world but also in India, despite of lockdown when most people are shut away in their homes for social distancing, still during that along with corona worriers like police, doctors, nurses, safai workers many volunteers come out and without any hesitation helps poor and old age people, migrants, physically handicap people and needy persons. It is that golden time of humanity when there were no class or religious differences, only humanity is seen everywhere. Humanity becomes connecting link for people to come close together to help each other's needs without counting their deeds without asking their name and caste. Government employees are also come forward and contribute part of their salaries for the social cause, even celebrities and industrialist also come in front to help and heal people in various way. It showed that now along with us humanity started breathing. Government also takes various steps to help people by giving relaxation in rent, payment plans in utilities, deferral in Bank EMI and such as. It is tame when everyone playing their part actively by consoling and helping each other to survive breaking boundaries of religions and class within countries and also around the world.

**Time to break in routine and to restructure life:**

While everyone is busy in maintaining themselves in race of competitive world for that our health, our family continuously compromising always at that time suddenly Coronavirus pandemic lockdown gives opportunity to human take a break, to relax, to rethink about lifestyle and reconstruct it and to balance life and fill the gaps of relationship, universe and naure as well. Due to lockdown family member come together, laugh together, all family members played game with children, did house work together, cook together, and eat together. First time many families got that golden chance to spend quality time with their loved one. Most of the people were doing their work from home that new concept accepted by many private and also government sectors without going to office, official work can be possible by work home facility and also official and educational meetings can be possible by online

mode. People take online gym and yoga classes online pursue their hobbies, many women got chance to pursue their hidden talent and get time to follow that and complete it. Lockdown give us time to connect you to yourself, to culture, to nature and to universe.

**Accepting innovation:**

Due to lockdown many private, small organizations face many problems like slow procedures of working, complex bureaucracies and rigid hierarchies making organizational life less than pleasant. The COVID-19 pandemic has forced many of them to break through these rigid systems and act instantly. Suddenly procedures can be skipped or accelerated, rules can be side-tracked and decisions can be made more autonomously without formal approval and employees are allowed to work from home without direct supervision. During lockdown most affected system is education but novel Coronavirus comes with lots of opportunities for education system also. It is first time all education is available online. For that teachers also worked hard for learning new tools for adapting this new scenario and accepting innovation. Teachers learned so many apps so that students get benefitted by these online classes (Jena 2020). Online webinars, online national and international conferences and national and international faculty development programs give chance to come together on common platform and exchange of knowledge never stop even in this pandemic lockdown. This brings the opportunity to create innovations now that can be maintained after the crisis and it also can help to keep the current speed and innovation mode afterward. Worldwide researchers trying and working hard to develop COVID-19 vaccine out of them few are on stage of clinical trial testing, India is leading among that.

**Cleaner environment:**

Due to coronavirus outbreak caused a shutdown and it lead to dramatical decrease of industrial activities. All small, big factories and companies were closed, also all services except essential services were not allowed to open as result road traffic has reduced and air traffic collapsed. As the tourism was also restricted as result it emptied the streets in overcrowded cities. This condition may be bad for most people and especially those working in the affected industries but this is also good news for our planet. During lockdown Covid-19 causes a significant reduction in green house gasses and other air, water and land polluting outputs. The Air quality index (AQI) in all states of India, indicate good quality air after this lockdown. Not only air but rivers of India like Ganga, Yamuna and Cauvery etc. have become clean and clear

showing marine life is visible (Lokhandwala and Gautam, 2020). Lock down period give also opportunity to environment to recover which is not yet possible by various steps taken for pollution control and to save environment. This lockdown not only give tome to breath human but also to breath environment, to animals and also to birds.

### **Health is always wealth:**

Covid-19 recalls us strong message that is Health is wealth. It teaches us that human can leave without luxurious facilities He required only food, cloth and shelter to live and it is proved by Covid-19 that we really don't need much to live. This disease can affect, it did not differentiate that the person is rich or poor, men or women and kids or old. The only way to protect from this pandemic is physical distancing, wearing mask and hand sanitization. By following these rules common people can help corona worriers in fighting against COVID-19. These are the ways by following them anyone can protect themselves than cure. These are the general hygiene habits, which are generally, should be followed by everyone to protect from any diseases but for COVID-19 comes to remind and recall these habits must be a part of our daily routine.

### **Respect for essential workers:**

Essential workers like safai workers working in hospitals , cleaning workers, milkman, delivery drivers, supermarket cashiers and shelf-stackers we never appreciate, acknowledge them for their work but during lockdown they give their services continuously and they becomes heroes . Before that we never realize importance of their work towards society. During Coronavirus pandemic, their work highlighted for essential role played by these key workers on them we all depends on them. And also understand that we are all connected, everyone's work is important and we are depends on each other.

### **Acceptance and modesty:**

COVID-19 teach us that no matter how we develop using various technology, how we are well planned and organized but we cannot control nature actually nature control us whenever we forget it nature remind us in various forms like SARS and oil crises but their impact was less sustainable. But this time the nowel coronavirus disrupts lives of people across the world. By that this COVID-19 teaches that we were living in illusion that we have control over all like health, safety, and food ets. The virus helps us to realize and aware that this cannot be possible. The virus come to give lesson to human that not all things are in his control and

also give chance to take more modest role and accept the thing that many things are beyond his control.

### Conclusions:

During this pandemic, fighting with this invisible coronavirus, not only in India but also from outside of India, people come together with maintain social distance help each other and started doing good things in their lives. The time spend by parents with their children, their connection, their love and many more such experiences by given the coronavirus which cannot be counted in terms of money on same line also give lesson and remind us human values, value of family and relationships, value of basic needs food, cloth and shelter and also realized us priorities of our life that materialistic things can able to give pleasure but not happiness and also remind us human have no control over nature. It is always a nature have control over human beings, human is not superior, every living being is important in this mother earth.

### References:

1. Gautam and Trivedi (2020): Global implication of bio-aerosol in pandemic, *Environment Development and Sustainability* 22, 3861-3865.
2. Gautam and Hens (2020): SARS-CoV-2 pandemic in India: what might we expect? : *Environment Development and Sustainability* 22(6), 3867-3869.
3. Leo Sher (2020): The impact of the COVID-19 pandemic on suicide rates: *QJM: An International Journal of Medicine*, 113(10), 707-712.
4. Sharma (2020): Effect of restricted emissions during COVID-19 on air quality in India : *The Science of The Total Environment*, 728,138878.
5. Pravat Kumar Jena (2020): Impact of Covid-19 on higher education in India :*International Journal of Advanced Education and Research*, 5(3), 77-81.
6. Lokhandwala and Gautam (2020): Indirect impact of COVID-19 on Environment: A brief study in Indian context, *EnvironmentalResearch*,188, 10987.
7. World Health Organization (2020): Coronavirus disease (COVID-19) situation reports : World Health Organization.<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/>.openinnewtab.
8. Worldometer, [www.worldometers.info/coronavirus/](http://www.worldometers.info/coronavirus/)

## IMPACT OF COVID-19 ON MENTAL HEALTH

**Apurba Biswas**

Department of Chemistry,

Surendranath College, 24/2, M. G. Road, Kolkata-700009, West Bengal, India

Corresponding authors E-mail: [apurbacu@yahoo.co.in](mailto:apurbacu@yahoo.co.in)

---

### **Abstract:**

The COVID-19 pandemic continues to put a massive burden on mental health services across the world, many of which were under-resourced before the pandemic. This pandemic has put humans at the highest physical and mental risk. Health care workers, students, children, women, youth, and the elderly all suffer various psychological problems and important mental health effects, including stress, anxiety, depression, frustration, and uncertainty. Isolation, movement restrictions, physical distance, fears of contracting the infection, lack of freedom, separation from family or friends, concerns for family or friends, disease experience, stigma, and discrimination are causing mental health problems and resulting in job losses. Countries are now struggling to meet the increased demand for vital mental health and psychosocial support services that has come about as a direct and indirect consequence of COVID-19.

**Keywords:** COVID-19; Pandemic; Quarantine; Mental health; Anxiety.

---

### **Introduction:**

The coronavirus (COVID-19) was first reported in Wuhan, China, in December 2019 but quickly spread throughout the world and was declared a pandemic on March 11, 2020 by the World Health Organization (WHO) (Spoorthya *et al.*, 2020). Patients with respiratory diseases and pneumonia needed hospitalization. The number of cases began to increase at an alarming rate. It has claimed millions of lives across the world. COVID-19 caused significant challenges to curb the spread of the infection and maintain global health security, such as direct transmission, contact transmission, and airborne transmission (Umakanthan *et al.*, 2020). Pandemics can cause a certain degree of fear, worry, and anxiety in the wider population, in addition to those directly affected by COVID-19 infection, especially among vulnerable groups and frontline healthcare workers treating COVID-19 patients (Spoorthya *et al.*, 2020; Semo and Frissa 2020; Serafini *et al.*, 2020). The WHO and global health authorities are working diligently to contain the outbreak. Quarantine has always proven a viable measure in infectious diseases outbreaks, but it is an unfavorable experience for the population (Al Dhaheri *et al.*, 2021). The behaviour of an individual as a part of society or a community has significant impact on the

dynamics of a pandemic, in terms of intensity, flow, and after effects (Javed *et al.*, 2020). Rapid human-to-human transmission of the COVID-19 led to regional lockdowns to control the disease's spread. Many countries also took anti-epidemic precautions to prevent the spread of the coronavirus, such as physical distance, wearing face masks, quarantine to stop the transmission and avoid contact with others due to the rapid spread of the coronavirus (Umakanthan *et al.*, 2020). Isolation, social distancing, and the closing of educational institutions, workplaces, and entertainment venues forced people to remain in their homes to break the transmission chain (Javed *et al.*, 2020). However, the restrictive measures have caused widespread negative impacts on social and mental health of individuals. Isolation, boredom, frustrations, movement restrictions, fears of contracting the infection, lack of freedom, separation from family or friends, concerns for family or friends, and fear of an uncertain future as well as depression, insomnia, and other social problems such as an increase in gender violence are all factors that can affect mental health during quarantine (Brooks *et al.*, 2020; Saraswathi *et al.*, 2020). Psychologists and mental health professionals predict that the pandemic will have an impact on the mental health of the population worldwide with the rise in depression, suicide, and self-harm, in addition to other symptoms that have been reported globally due to COVID 2019 (Cosic *et al.*, 2020; Kumar and Nayar, 2021). Recently, people of all ages have been negatively affected by the psychological effects of the Covid-19 second wave, presenting a new challenge to recovering patients as they try to return to normality. During the May 2021 World Health Assembly, governments from around the world recognised the need to scale up quality mental health services at all levels, and some countries have developed innovative methods for providing mental health care to their populations (WHO, 2021a).

This paper describes the impact of COVID-19 on mental health of children and adolescents, elderly, women and students.

### **Mental health of children and adolescents:**

The COVID-19 pandemic has caused unprecedented disruption in children's lives, potentially troubling their emotional, cognitive, and social development as well as restrictions on outdoor play, prohibition of social group activities, closure of sports clubs, restricting social interaction with close relatives, prohibition of contact with peers, closure of schools, loss of education time, and disruption of daily routines (Fegert *et al.*, 2020). Moreover, many known risk factors for mental health disorders in children have become worse, such as socioeconomic disadvantage, social isolation, and bereavement. The pandemic could have long-term negative

effects on child mental health, compounding pre-pandemic concerns about child mental health (Singh *et al.*, 2020). Their families have also faced multiple obstacles, such as the reorganization of daily life, the stress of quarantine and social distancing, home-schooling, the increased pressure to work from home and care for school-age children at home at the same time, and economic difficulties due to business closures (Fegert *et al.*, 2020). The lockdown and social isolation became particularly painful for people, especially children and their parents, and being shown to trigger mental health issues such as depression and anxiety (Ashikkali *et al.*, 2020). Children are spending more time with their families during lockdown, and when there is already domestic abuse or risk of it, this is even more likely to occur. Parents and carers should ensure their children feel safe, and COVID-19 should be discussed in an honest and age-appropriate manner, while keeping in contact with family and friends (The UFGMH, 2020).

### **Mental health of the elderly:**

During COVID-19, the new coronavirus infection, the elderly are particularly susceptible to infection, due to physiological changes associated with aging, weakened immune function, and co-morbidity. They are also more likely to suffer more severely from COVID-19 disease and be subject to more severe complications (Joshi, 2020). Research is showing that adults aged 60 years and over, especially those with pre-existing medical conditions such as heart disease, lung disease, diabetes, and cancer, are more likely to develop severe, or deadly coronavirus infection than other age groups (Arbaje, 2021). Currently, older people are at risk of falling victim to COVID-19 in care homes and hospitals. During this time, discrimination and elder abuse have also increased in number, and researches show that the compulsory self-isolation of elderly people to curtail the spread of the virus has made them more susceptible to mental health issues like loneliness, depression, and anxiety (The NHRC, 2020). Older persons living in precarious conditions, such as refugee camps, informal settlements, and prisons, are particularly at risk due to overcrowded conditions, inadequate access to health, water, and sanitation facilities, as well as possible challenges to obtaining humanitarian support and assistance (The United Nations, 2020). Physical distancing measures can have a profound effect on the mental health of older people, with older people less likely to be digitally included. Technology may have helped reduce the negative effects of the crisis in the general population, but it is more complex in the elderly population (Martins Van Jaarsveld, 2020).

**Mental health of women:**

There are concerns that the disease could disproportionately burden women in both a social and economic sense. In several areas, the Covid-19 pandemic has affected women more strongly than men, both at work especially in the health and social sector as well as at home with an increased workload due to lockdown and quarantine measures (Thibaut and van Wijngaarden-Cremers, 2020). Moreover, during crises, women are more vulnerable to problems because of the gendered nature of the health workforce, which includes women fighting the disease at the forefront, and are limited in both work and economic opportunities (Malik and Naeem, 2020). After the viral outbreak, many countries have reported a rise in domestic violence cases (Thibaut and van Wijngaarden-Cremers, 2020). As a response to the disease, quarantine measures also cut women off from critical protection services and networks they had before the measures were instituted, which will further entrench gender inequality and put women under more pressure on physical and mental health (Malik and Naeem, 2020). The risk of anxiety, depression, and post-traumatic stress disorder is also much higher in women (Thibaut and van Wijngaarden-Cremers, 2020). In addition, it is particularly important to determine whether pregnant women are more likely to be infected with COVID-19 or to have more severe health outcomes (Kotlar *et al.*, 2021). Women with a medically high-risk pregnancy are at even greater risk. Because of the lack of definitive data on COVID-19's effects during pregnancy, the COVID-19 pandemic creates higher anxiety and a lower sense of control for pregnant women (Almeida *et al.*, 2020). The implications of the pandemic and pandemic control policies on healthcare, societies, and the global economy, outside of direct infection, may also affect maternal health.

**Mental health of health care workers:**

Health care workers who are directly involved in the diagnosis, treatment, and care of COVID-19 patients on the front line are particularly vulnerable to psychological distress, fatigue, occupational burnout, stigma, and physical and psychological violence in the face of this daunting environment (WHO 2021b). The ever-growing number of confirmed and suspected cases, the overwhelming workload, the depletion of personal protection equipment, the widespread media coverage, the lack of specific drugs, and the feeling of being inadequately supported can all contribute to this mental burden on these health care workers (Lai *et al.*, 2020). They also experienced uncertainty and stigmatization, high levels of stress, anxiety, and depression, which could have long-term psychological implications. The Covid-19 pandemic

triggered an increase in the volume and intensity of work, manifestations of stigma, and additional responsibilities of healthcare workers. These changes in protocols and the "new normality" have had a psychosocial impact on them. Doctors and nurses were forced to leave their premises, and health care workers were reportedly victimized in many parts of the country, as stress, anxiety, depression, and sleep problems were all reported by Health care workers (Kirk *et al.*, 2021).

### **Mental health of students:**

The coronavirus pandemic has slowed down communication among students, resulting in frustration, loneliness, and depression that affect their mental health as the family crisis becomes visible (Uddin and Uddin, 2021). The shutdown of educational institutions in India has had a direct impact on students' mental health, resulting in mental depression, stress, and fears about their studies. The pandemic created the Indian students more anxious and frustrated as well as many continue to feel uncertain about how their classes will be restored after the crisis (Sahu, 2020). More than half of Indian college students experienced a significant increase in their stress levels and a serious decline in their feelings of anger, anxiety, loneliness, hopelessness, and happiness. It can be confirmed that academic and daily obstacles have resulted in high levels of anxiety and mental health problems, which are linked to difficulties in focusing on academic work and sometimes job loss.

### **Conclusion:**

The COVID-19 pandemic has put humans at the highest physical and mental risk, especially for vulnerable groups such as health workers and other frontline workers, students, people living alone, and people with pre-existing mental health conditions. It is therefore becoming a priority to study mental health concerns in different populations during the pandemic. People worldwide have suffered serious injuries and losses from Covid-19, including loss of their jobs, families, financial damages, poor health, isolation, lockdown, and the list of problems is endless. As a result, the number of depressions, anxiety disorders and other mental health problems has increased significantly. The disruption of routines, education, recreation, as well as concerns for family income and health, has left many young people feeling nervous, angry, and anxious about their future. Students who are suffering from psychological health problems caused by the pandemic that have a significant impact on their academic development must receive prompt and effective treatment. The elderly population was among the hardest hit by the pandemic, suffering from harsher lockdown measures and higher risk of

mental and physical health problems. The digital divide has demonstrated that the effects of these measures have not been minimized. Governments must take urgent steps to increase access to technology and implement digital literacy programs in elderly populations. Female health care workers are much more likely to suffer from anxiety and depression than men. In addition to rapidly establishing informational programs on the virus, health care workers should receive timely psychological counseling and intervention to relieve their stress and improve their general mental health.

### References:

- Al Dhaheri A. S., Bataineh M. F., Mohamad M. N., Ajab A., Al Marzouqi A., Jarrar A. H. (2021). Impact of COVID-19 on mental health and quality of life: Is there any effect? A cross-sectional study of the MENA region. *PLoS ONE* 16(3): e0249107. <https://doi.org/10.1371/journal.pone.0249107>.
- Almeida, M., Shrestha, A. D., Stojanac, D., Miller, L. J. (2020). The impact of the COVID-19 pandemic on women's mental health. *Archives of Women's Mental Health*, 23,741-748.
- Arbaje, A. (2021). Coronavirus and COVID-19: Caregiving for the elderly. Available at <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/coronavirus-caregiving-for-the-elderly>.
- Ashikkali, L., Carroll, W., Johnson, C. (2020). The indirect impact of COVID-19 on child health. *Paediatric and Child Health*, 30(12), 430–437.
- Brooks S. K., Webster R. K., Smith L. E., Woodland L., Wessely S., Greenberg N., Rubin G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet*, 395:10227, 912-920.
- Cosic, K., Popovic, S., Šarlija, M., Kesedžic, I. (2020). Impact of human disasters and COVID-19 pandemic on mental health: Potential of digital psychiatry. *Psychiatria Danubina*, 32(1), 25-31.
- Fegert, J. M., Vitiello, B., Plener, P. L., Clemens, V. (2020). Challenges and burden of the Coronavirus 2019 (COVID-19) pandemic for child and adolescent mental health: A narrative review to highlight clinical and research needs in the acute phase and the long return to normality. *Child Adolesc. Psychiatry Ment. Health*, 14, 20.
- Javed, B. Sarwer, A., Soto, E. B., Mashwani, Z. R. (2020). The coronavirus (COVID-19) pandemic's impact on mental health. *Int J Health Plann Mgmt.*, 35, 993-996.

- Joshi, S. (2020). COVID-19 and elderly in India: Concerns and challenges. *Manpower Journal*, Vol. LIV(3 & 4), 41-56.
- Kirk A. H. P., Chong, S. L., Kam, K. Q., Huang, W., Ang, L. S. L., Lee, J. H., Sultana, R., Hon, K. L., Wong, J. J. M. (2021). Psychosocial impact of the COVID-19 pandemic on paediatric healthcare workers. *Ann Acad Med Singap.*, 50(3), 203-211.
- Kotlar, B., Gerson, E., Petrillo, S., Langer, A., Tiemeier, H. (2021). The impact of the COVID-19 pandemic on maternal and perinatal health: A scoping review. *Reprod Health*, 18(10), 1-39.
- Kumar, A., Nayar, K. R. (2021). COVID 19 and its mental health consequences, *Journal of Mental Health*, 30(1), 1-2. doi: 10.1080/09638237.2020.1757052.
- Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., Wu, J., Du, H., Chen, T., Li, R., Tan, H., Kang, L., Yao, L., Huang, M., Wang, H., Wang, G., Liu, Z., Hu, S. (2020). Factors associated with mental health outcomes among health careworkers exposed to coronavirus disease 2019. *JAMA Network Open.*, 3(3):e203976. doi:10.1001/jamanetworkopen.2020.3976.
- Malik, S., Naeem, K. (2020). Impact of COVID-19 pandemic on women health, livelihoods & domestic violence. *Policy Review*. Sustainable Development Policy Institute. <http://hdl.handle.net/11540/11907>.
- Martins Van Jaarsveld, G. (2020). The Effects of COVID-19 among the elderly population: A case for closing the digital divide. *Front. Psychiatry*, 11:577427. doi: 10.3389/fpsy.2020.577427.
- Sahu, P. (2020). Closure of universities due to coronavirus disease 2019 (COVID-19): Impact on education and mental health of students and academic staff. *Cureus*, 12(4), e7541.
- Saraswathi, I., Saikarthik, J., Kumar, K. S., Srinivasan, K. M., Ardhanaari, M., Gunapriya, R. (2020). Impact of COVID-19 outbreak on the mental health status of undergraduate medical students in a COVID-19 treating medical college: a prospective longitudinal study. *Peer J*, 8:e10164. doi 10.7717/peerj.10164.
- Semo, B.-W., Frissa, S. M. (2020). The mental health impact of the COVID-19 pandemic: Implications for sub-Saharan Africa. *Psychol Res Behav Manag.*, 13, 713-720.
- Serafini, G., Parmigiani, B., Amerio, A., Aguglia, A., Sher, L., Amore, M. (2020). The psychological impact of COVID-19 on the mental health in the general population. *QJM.*, 113(8), 531–537.

- Singh, S., Roy, D., Sinha, K., Parveen, S., Sharma, G., Joshi, G. (2020). Impact of COVID-19 and lockdown on mental health of children and adolescents: A narrative review with recommendations. *Psychiatry Research*, 293, 113429.
- Spoorthya, M. S., Pratapa, S. K., Mahant, S. (2020). Mental health problems faced by healthcare workers due to the COVID-19 pandemic—A review. *Asian Journal of Psychiatry*, 51:102119. <https://doi.org/10.1016/j.ajp.2020.102119>.
- The NHRC (2020). Human rights advisory on rights of elderly persons in context of COVID -19. Available at National Human Rights Commission, File no.R-17/8/2020-PRP&P-Pt(7).
- The UFGMH (2020). The impact of covid-19 on global mental health: A brief. 1-12.
- The United Nations (2020). Policy Brief: The Impact of COVID-19 on older persons. 1-16.
- Thibaut, F., van Wijngaarden-Cremers P. J. M. (2020). Women’s mental health in the time of COVID-19 pandemic. *Front. Glob. Womens Health*, 1:588372. doi: 10.3389/fgwh.2020.588372.
- Uddin, M., Uddin, B. (2021). The impact of Covid-19 on students’ mental health. *Journal of Social, Humanity, and Education*, 1(3), 185-196.
- Umakanthan, S., Sahu, P., Ranade, A.V., Bukelo, M. M., Rao, J. S., Abrahao-Machado, L. F., Dahal, S., Kumar, H., Kv, D. (2020). Origin, transmission, diagnosis and management of coronavirus disease 2019 (COVID-19). *Postgrad. Med. J.*, 96, 753–758.
- WHO (2021a). World mental health day 2021. Available at <https://www.who.int/campaigns/world-mental-health-day/2021>.
- WHO (2021b). Coronavirus disease (COVID-19) outbreak: Rights, roles and responsibilities of health workers, including key considerations for occupational safety and health.



## COVID 19: Impact and Response Volume III

ISBN: 978-81-953600-9-3

### About Editors



Dr. (Smt) Saroj Mahajan is currently working as Associate Professor of Botany in Mata Jijabai Govt. Girls P.G. College, Moti Tabela, Indore (M.P.). She has 26 Years of teaching experience in U.G. and P.G. She specializes in the field of limnology and holds a Ph. D. in the same field from DAVV, Indore. She has published more than 30 research papers in renowned national and international journals and has participated, presented papers in multiple conferences, symposium, and seminars. She is also a member of both Research Advisory Committee (RAC) of DAVV Indore and Board of Studies of Autonomous College Indore.



Dr. Tejendra Amrut Rajput did his Ph.D. from North Maharashtra University, Jalgaon and is currently engaged as an Assistant Professor of Department of Chemistry at Art's, Commerce and Science College, Onde, Vikramgad, Palghar, Maharashtra. Dr. Rajput has significantly contributed in the field of Phytochemistry, Organic Synthesis, Natural products, Nanotechnology and Soil and Water analysis. His topic of Research is Phytochemistry, Isolation and Characterization of Natural products and Biological and Pharmacological activities. Dr. Rajput had been awarded with the best paper presentation at various National and International Conferences. He has four numbers of Patents in his credit. He had published a number of research papers in National and International Journals. He is also a member of many scientific professional bodies and besides that he is also reviewer of many Internationals and National journals.



Prof. Neha Sharma, B.Ed. B.Com. M.Com. L.L.B. - a keen learner herself, she has multiple degrees and diplomas including an LLB from one of India's topmost law schools ILS Law College, Pune. Prof. Neha Sharma has varied experience in the field of teaching and is presently an assistant professor in Commerce and Management department of Adv. S. A. Baheti College, Jalgaon where she teaches UG and PG students and a counselor with YCMOU, Nasik. She is a visiting faculty at Symbiosis Institute of Management Studies, Pune and a translator with IIT Madras under NPTEL. She has many articles and research work to her credit published in national and international journals as sole author and has authored a student references book on Entrepreneurship Development for which introduction was penned down by vice chancellor of YCMOU. A regular participant and paper presenter at conferences, she has bagged the best paper award as well. She enjoys wearing multiple hats in life and is known for her popularity amongst students as an educator.



Dr. Pollobi Duara did her Ph. D. (Zoology) from Gauhati University in the year 2018. She is the Head of Zoology, Majuli College, Assam. She published eight numbers of papers in National and International Journals and sixteen abstracts published in various conference proceedings. She presented in 10 International conferences and 20 national level seminars. She did nine workshops/Faculty development Programs and two online training programs. Successfully completed a MOOC on statistical analysis of one month duration. Dr. Duara published two book chapters and organised two National Webinars as Convenor. Her research interest is entomology especially pollinating insects. She has been selected as fellow of Science Frontier Research Council by Open Association of Research Society, USA. She is Bachelor in Music from Lucknow Sangeet Vidyapith.

