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COVID 19: IMPACT AND RESPONSE
VOLUME XI

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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.

- **Editors**

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IMPACT OF COVID-19 PANDEMIC ON BUFFALO PRODUCTION AND SUPPLY CHAIN MANAGEMENT

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Introduction:

The economic impact of covid-19 virus in India has been largely disruptive. The Indian economy was expected to lost over Rs. 32,000 crore (US\$ 4.5 billion) every day during the first 21-days of complete lockdown, which was declared following the corona virus outbreak (Wikipedia). Supply chains were put under stress with the lockdown restrictions in place. Initially, there was lack of clarity in streamlining what is an "essential" is and what is not. A large number of farmers around the country who produce perishable commodities like milk also faced uncertainty. More than 70 per cent of milk is being produced by small farmers; which provide immediate cash for their livelihood. It is presumed that these small farmers are worst hit due to lower demand and consequently partial procurement (Anonymous, 2020).

The Rs. 100,000 crore Indian dairy industry has suffered a 25-30 per cent dip in demand ever since the country was shut down for the COVID-19 lockdown over two weeks (Anonymous, 2020). It was noticed that buffalo owners were surely affected during this period because of reduction in procurement, sale etc. There was significant reduction in the sale of buffaloes also which affected the livelihood and is important source of income for the buffalo owners (Anonymous, 2020). In order to see the effects of COVID-19 on buffalo production and supply chain management Central Institute for Research on Buffaloes (CIRB) conducted an online survey during 2020. For this purpose the information was collected from 100 respondents belonging to Haryana and adjoining state. Out of these respondents selected for the study some of them are progressive farmers having large income from buffalo husbandry including sale and purchase of buffaloes.

Effects of Covid-19 on Buffalo production and management:

There was serious effect of covid-19 on buffalo production and supply chain during lockdown situation. The effects were spread over individual farmers, milk vendors, halwais and organization such as dairy co-operatives, private societies, Murrah Buffalo Breeders Associations etc. who have been involved in the buffalo production and supply chain

management. The effect of covid-19 on buffalo production management from purchase/sale of buffaloes to milk production and marketing was examined and discussed below.

Sale/Purchase of buffaloes:

During the lockdown situation sale/purchase of buffaloes was badly affected, as about 80 per cent farmers mentioned that they have neither purchased nor sold buffaloes due to restrictions on vehicle movement as well social distancing norms. However some of the progressive farmers who are engaged in large scale buffalo trading in Haryana also mentioned that before pandemic situation large numbers of animals were sold to other states. According to Murrah Buffalo Breeders Association before pandemic about 500 buffaloes were sold every month to other states like Madhya Pradesh, Gujarat, Rajasthan, Andhra Pradesh, Maharashtra etc. In buffalo husbandry sale/purchase is major source of income for individual farmers as they sell their buffaloes regularly particularly those which are true to Murrah breed to fetch premium price. During pos-lockdown situation market price of buffaloes was decreased by 30-40 per cent which was observed by major proportion of farmers (42%). It was attributed to the reason that reduction in price due to lack of buyers in the market. During this crisis the Murrah Buffalo Association also viewed that it should facilitate buying and selling through interface of interested parties as it had become difficult to locate farmers in the villages who were interested to sell their buffaloes. It was also interesting to note that the members of Murrah Buffalo Association were in constant touch with farmers and Department of Animal Husbandry of some of the states like Madhya Pradesh, Gujarat, Rajasthan, Andhra Pradesh, and Maharashtra as these are the states where the demand of high yielding buffaloes was comparatively more.

In Haryana Murrah Buffalo Association is engaged in farmer to farmer extension as it organizes milk competitions, buffalo melas in some of the villages of Haryana annually. The progressive farmers of association mentioned that during this crisis they could not organize some of the events like buffalo melas, breed competition, milk competition etc. as the mass congregation of the farmers was not allowed by the administration at village, district and state levels. Farmers of other states also participate in these events and lot of buying and selling of buffaloes takes place on these occasions. During the 2020 it could not happen due to the pandemic.

Supply of inputs for milk production:

The main inputs for milk production are feed and fodder in buffaloes. Feed and fodder significantly affects the maintenance cost of buffaloes. During this crisis, it was observed by atleast 64 per cent farmers opined that the supply of inputs like feed and fodder and other

ingredients for milk production was affected severely, due to disruption in transportation services. Progressive farmers viewed that during this period preparation of mineral mixture and concentrate mixture at home became difficult due to problem in procurement of ingredients. This also led to cost escalation with regard to feed and supplements. In buffalo husbandry the share of feed and fodder cost is about 65-70 per cent. It was found that during the crisis about 65 per cent of the respondents felt that there was increase in maintenance cost of the buffaloes to the tune of about 22 per cent. To address this problem Murrah Buffalo Association felt that the vehicles available in the villages are mainly engaged in transportation of animals may be identified to arrange supply of required inputs from local market to farmers door step. Also village youths may be engaged in identification of buffaloes for sale and their transportation.

Buffalo milk production and consumption:

During lockdown situation there was no significant change in the milk production. However, some of the respondents observed that there was slight increase in the milk production due to extra care and management during the crisis. With regard to consumption it was felt that milk consumption increased as supply of other dietary sources such as the vegetables, eggs and meat were affected. About 25 per cent of the farmers also opined that they were not able to market their milk fully which lead to increase in milk consumption at home.

Marketing of milk:

The milk available after family consumption is called as marketed surplus of milk. The marketed surplus of the milk during the crisis was affected significantly due to lack of sale/procurement at the door step. In Haryana there are two milk marketing channels i.e. organized and un-organized. Among these, organized milk marketing channels - dairy co-operatives, private societies and government agencies are doing the job, whereas milk vendors and sweet makers/halwies come under unorganized milk marketing channels. In the state milk procurement is mainly dominated by the unorganized channels. During the lockdown, unorganized milk channels were affected most and even some of the farmers could not sell small quantity of milk due to disruption in unorganized milk supply chain. During the crisis milk procurement by dairy co-operatives in Haryana was decreased in first few days of lock down but subsequently picked up due to the reason that unorganized sector could not procure same quantity of milk which it was procuring before lockdown situation. Some of the farmers also switched over from unorganized milk channels like vendors, halwais to dairy co-operatives as they became members of the society. During this period co-operatives collected milk daily from the farmers and it became assured source of income for the farmers. The managing Director of

Haryana Dairy Development Co-operative Federation mentioned that Haryana Dairy purchased eight lakh litres of milk per day, which is 40 per cent higher than the pre-lockdown situation.. It is attributed to the fact that milk vendors, halwai shops, restaurants etc. could not procure the pre-lockdown quantity of milk daily during this period. Therefore there was overall reduction in the milk procurement/sale and ultimately this led the decrease in price of milk.

Veterinary services:

During the lockdown situation the accessibility to the veterinary services became erratic due to fear of spread of covid infection. This was reported by a majority of the respondents (76%). In the villages farmers were reluctant to call outsiders for the treatment of their animals. However, in some villages during this situation panchayats allowed treatment of animals and the veterinary services were available during emergency only.

Impact:

The dairy farmers felt that the covid-19 impacted them socially, economically and psychologically. With regard to economic impact majority of the farmers felt that it did not affect them initially but after a prolonged lock down there was decrease in their income. This may be due to the reason that there was erratic procurement and instability in milk marketing particularly by the unorganized sector. During this period maintenance cost of buffalo increased while demand of milk decreased. Therefore, this led to considerable decrease in the income of the farmers. During pandemic majority of the farmers mentioned that they did not move out their houses very frequently especially beginning of the lockdown due to fear of spread of pandemic people avoided to attend marriages, funerals etc. thus they felt isolated in the initial phases of lock down. ROY ET AL. (2020) in their study revealed that high levels of anxiety with more than 80 per cent of the farmers preoccupied with thoughts of covid-19 experienced sleep difficulties, distress and paranoia about acquiring covid-19 infection. This caused deterioration in social relations and also economic wellbeing of the farmers in general and dairy farmers in particular as they had to contact more to the outsiders for the sale of their produce.

Some of the experts in the field felt that due to adverse effects of covid pandemic on buffalo production following problems need to be addressed by the extension personnel in Haryana. Role of extension advisory services during the crisis became most important to tackle the problems faced by the dairy farmers. Following steps may be undertaken by different extension agencies to control the adverse effects of the pandemic on buffalo production.

- Extension personnel and state line department should facilitate the farmers in sale and purchase of buffaloes to sustain their income during such a crisis.

- Enlist the challenges faced by the farmers in milk production during the crisis through online advisories and sensitize them how to overcome the problem.
- Organize awareness programs for farmers regarding the effects of pandemic at village level to improve their livelihood.
- Strengthen digital advisory services and provide information on availability of inputs, price of inputs, output price, etc.
- Organize groups of young people to maintain supply chains of inputs and outputs.
- Educate and sensitize farmers about bio-security measures such as hand washing, wearing masks, staying home if sick and maintaining social distancing.

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DIFFERENTLY ABLED WOMEN (DAW): EXPLORING THE RIGHTS, ISSUES AND CHALLENGES IN THE COVID ERA - A REVIEW STUDY

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Abstract:

Differently Abled Women (DAW) are among the most marginalized sections of the Indian society, often facing segregation and abuse, which can be physical, mental, or emotional in nature. Time and again, they are deprived of their basic political, social, economic, and personal rights. They also find it extremely difficult to gain appropriate health service and educational opportunities due to various attitudinal and physical barriers. Social stigma, incidences of abuse, double discrimination and rising poverty are prevalent issues for Girls and Women with Disabilities (GWDs) on a regular basis in the COVID era. Such individuals face extreme deprivation, and complex issues due to the presence of extensive physical, and cognitive deficits. The review of relevant secondary literature for the present study clearly shows that Differently Abled Women are often subjected to abuse and exploitation due to their inherent vulnerabilities owing to their disability. The study found that restrictions in mobility, lack of healthcare facilities, rising tensions within families and institutions, prevalence of double discrimination, increased dependency on care givers and lack of appropriate health services have led to rising burden of disabled mothers, continued deprivation and extreme segregation of differently abled women from the general population. Further, the issues also include mental health deterioration, pandemic related absence of social security, and increased cost of living aggravated the condition faced by such individuals. The study recommends the need for active participation of DAW in decision making process, access to improved healthcare services, formulation of better policies and stronger implementation of the same can have a positive impact on their lives.

Keywords: Differently Abled Women (DAW), Dependency, Deprivation, Girls and Women with Disabilities (GWDs), Mental health deterioration, Segregation, Women with Disabilities (WWDs)

Introduction:

From time immemorial, the needs and rights of women especially Women with Disabilities (WWDs) have often been neglected and violated. Ganle et al. (2016) performed a qualitative study which examined 72 purposively selected women participants from 27 rural and urban communities in selected districts of Ghana. Due to presence of disability, they lacked access to quality healthcare services. It is also seen that the Differently Abled Women (DAW) are not a homogenous group rather they have highly diverse needs. Some may be intellectually disabled, some may be visually handicapped, some may have auditory deficits, some may have restricted mobility, while others may have learning Disability, autism, or multiple handicaps. Women With Disabilities (WWDs) face significantly higher level of challenges in both public and private spheres. Due to the disparities in gender perspectives on disability, women and girls with disabilities often lack access to equal opportunities in education, employment, housing, and healthcare. Hence, they are viewed as having twin disability and face more risks for maltreatment, abuse, and neglect. DAW are highly vulnerable individuals who face numerous challenges and issues in daily lives. The presence of physical or mental impairment makes it extremely difficult for such women to meet and fulfil their legal inheritance rights. Such vulnerable individuals find it extremely difficult to access and assert their rights towards property inheritance and other possessions. Such women face stigma, prejudice, and social isolation, and often lack the education, social support networks, and legal right to appeal against the injustice occurring at the family, community, or national level (Department for International Development 2000; World Health Organization (WHO)/World Bank 2011). Women with Disabilities were often viewed as asexual, non-human beings who were viewed discriminatively as compared to able bodied humans (Hughes, 2009).

The past few decades have witnessed a paradigm shift from segregation to inclusion of persons with special abilities. The Rights of Persons with Disabilities Act (GoI, 2016) focus on promotion of greater acceptance and protection of equal rights of Persons with Disabilities (PwDs) through inclusion and full participation. It focuses on aspects such as non-discrimination, respect for human diversity, gender equality and equalization of opportunities, accessibility, and respect for the evolving capacities of individuals with disabilities. Despite rapid advancements in laws and policies focusing on Rights and Equal opportunities, DAW continue to face numerous challenges and restrictions. It is seen that Women with Disabilities face dual challenge due to the feminist nature of the disability which is why they are termed as twin disabled (Blackwell-Stratton, et al., 1988). More Girls and Women with Disabilities (GWDs) suffer abuse and

exploitation compared to non-disabled girls and women; hence this adversely impacts their independence and functioning. Some of the common issues faced by Differently Abled Women are:

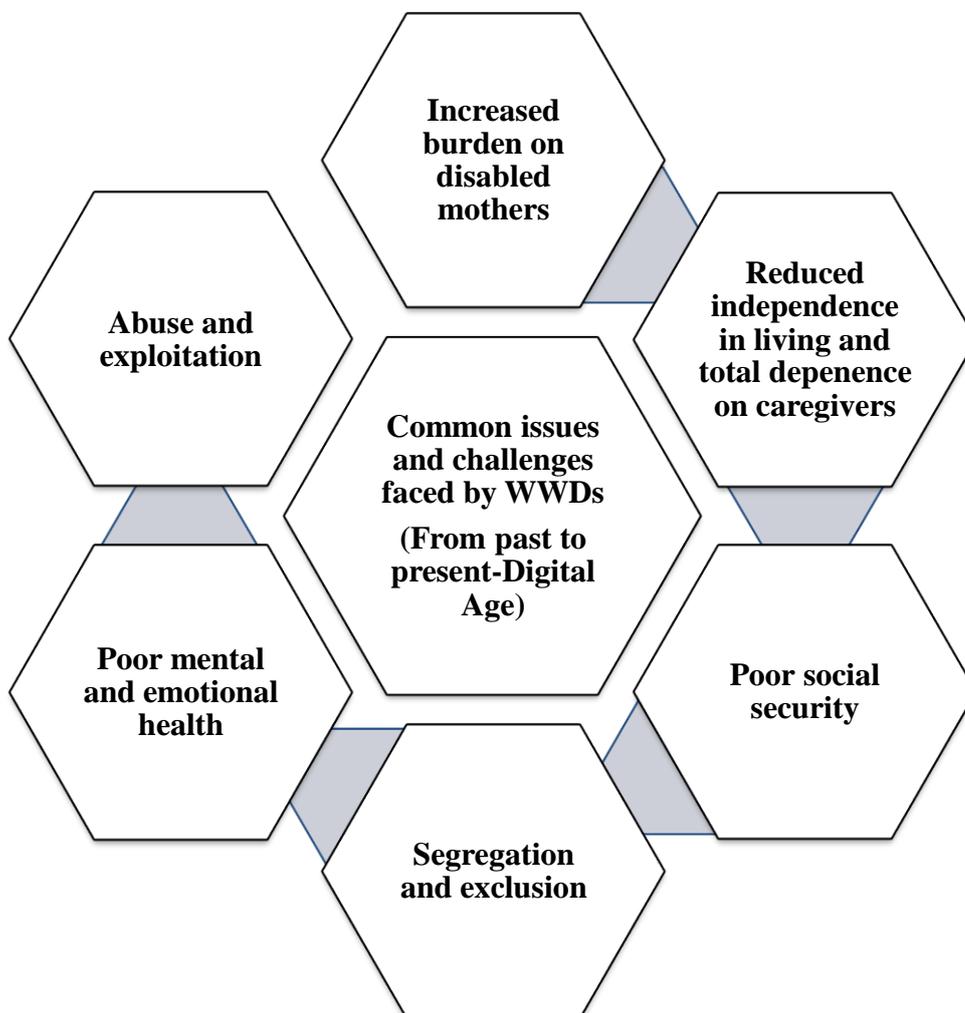


Figure 1: Issues faced by Differently Abled Women (DAW)

From the figure 1 it can be clearly seen that DAW face numerous issues such as high drop-out rate, segregation and exclusion, poor self-image and self-concept, abuse and exploitation which can occur in various forms (physical, mental, social, emotional), reduced independence in living and poor social security being the most prominent, as seen from reviewed literature. The present study tries to highlight the issues and challenges faced Women with Disabilities. The community comprising of parents, family members, care givers and trainers are also seen to be ignorant of benefits support services and available provisions. This study provides an overview of the need for promoting empowerment of DAW through advocacy for a more inclusive culture and society. The study also recommends certain measures which are

crucial towards the need for supporting differently-abled women in realizing their true potential.. This will increase their participation in the society, raising their self-esteem and helping them to achieve success in life. There is an intense need to create and spread awareness regarding promotion of gender equality and empowerment of Women and Girls with Disabilities (WGDs) which will be instrumental towards attaining the Sustainable Developmental Goals (SDGs) and international norms of gender equality supported by organizations like the United Nations (UN).

Objectives of the study:

The present study deals with the following objectives:

1. To reflect on the issues faced by Differently Abled Women (DAW).
2. To explore the challenges faced by Differently Abled Women (DAW) in the COVID-era.

Methodology:

The present study utilized a literature survey of data sources comprising of secondary sources to identify and explore, issues and challenges faced by DAW especially in the COVID-era. The entire study was divided into several phases which are listed as below:

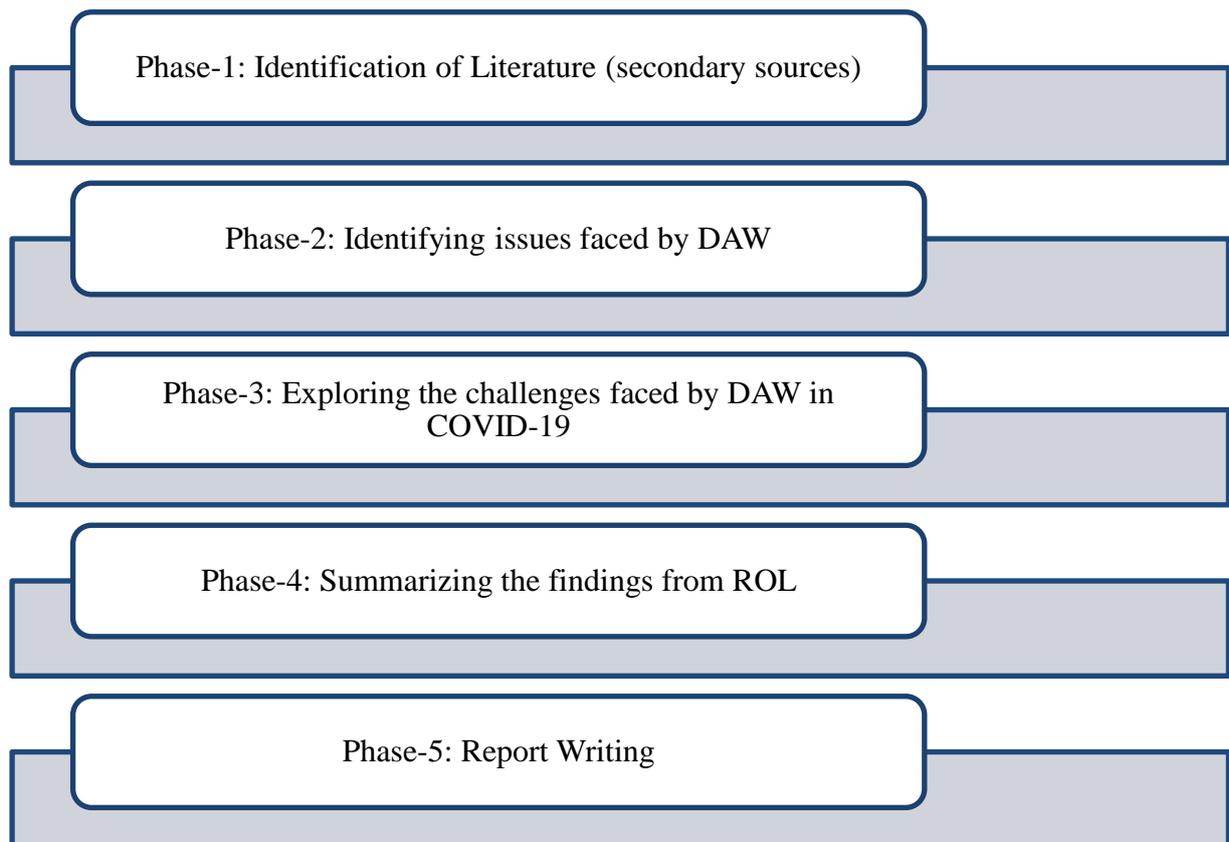


Figure 2: Phases of Research Methodology

Specific keywords like Women with Disabilities, Differently Abled Women, Issues, Challenges, Rights, Abuse, Skills were used to identify previously published research studies.

Findings:

Findings for Objective 1: To reflect on the issues faced by Differently Abled Women (DAW)

The review of literature conducted as part of the study reveals that there are several challenges and issues faced by DAW. The major challenges identified from the review of literature are highlighted in the word cloud below:



Figure 3: Word cloud showing the challenges and issues faced by women with disabilities

The word cloud reveals some of the major challenges and issues faced by Women with Disabilities namely gender bias, exclusion from society, extreme forms of violence against Women with Disabilities such as physical, mental, and emotional, forms of disparities which range from unequal or poor access to legislative measures, healthcare, education etc. This finding finds resonance with the findings mentioned in previous studies (Raha & Sengupta, 2019). From the reviewed literature it is seen that despite several differences in culture, language and religion, the violence and challenges faced by women with disabilities remain common, across the global landscape. Such women and girls face increased risk of violence at all stages including early childhood, adolescence, adulthood, and even old age. A guide published by the World Bank in collaboration with other agencies (Brief on Violence against Women and Girls with Disabilities (2019) classifies the multiple types of violence faced by women with disabilities as following:



Figure 4: Issues faced by DAW (from reviewed literature)

The review as shown in figure 4 indicates the heightened vulnerability towards abuse among DAW stem from their inability to report or understand cases of sexual abuse, inability to say ‘No’ and inaccurate perception of consent due to inherent disabilities. It is also noticed that total dependence on care givers, family members and others lead to reduced independence. Also, it is seen that the perpetrators of violence may include family members, members of extended family and care givers due to total dependence or limited opportunities to seek and get help. These lead to poor mental health, increased stress, lower self-esteem and resulting trauma.

Finding for Objective 2: Challenges faced by Differently Abled Women (DAW) in COVID-19

It is seen that the COVID-19 had given rise to a public health crisis, in which Girls and DAW faced numerous challenges. The Country Support Policy Brief-1 states that:

- DAW faced restrictions in mobility which was aggravated due to enforced physical isolation during the crises.

- Lack of healthcare facilities and support services for DAW including girls and ignorance of older women further increased the challenges.
- The measures enforced for the pandemic led to rise in tensions among families and within institutions which further caused increased incidences of domestic and sexual violence among DAW.
- The economic impact of the pandemic was also greatly felt by this vulnerable group.
- The policy further recommends need for: access to better health services in sexual and reproductive health, need for creating greater awareness and provision of legal capacity building.

Powell (2021) in the Women's Policy Group report discusses few challenges in their report such as:

- During the Public Health Crises emerging due to COVID-19 there was an increase in cost of living for WWDs with a subsequent decrease in income.
- Increased and total dependence on partners, friends, and care givers of DAW for physical, social, and financial needs led to heightened workload for disabled mothers.
- Reduced access to basic amenities such as food, medicines, groceries, personal hygiene, and household products especially for DAW led to increased challenges during COVID-19.
- Emotional and mental health needs of WWDs underwent deterioration and neglect due to social isolation, lack of timely care and support, disrupted intervention services.
- The disabled persons underwent redundancy due to medical crises.
- Social security of DAW was hit and largely affected due to COVID-19.

Discussion and Recommendations:

The findings clearly suggest that it's vital to protect DAW against abuse, seclusion, and victimization by creating awareness about their rights and provisions available. DAW may have highly limited and fragmented access to rehabilitative health care, protection from abuse, and support services. Such situations lead to an increase in the vulnerability and thereby creating a need to provide extra care to reduce the risk of abuse and violence. Public Health Emergencies (PHE) like the Covid era has helped us to see that the needs of Women with Disabilities (WWDs) may often get neglected due to their unique dual nature, thereby creating the strong urge to have powerful mechanism and measures at hand.

Overall, it has been noticed that gender-based, social stereotypes and lack of timely medical support and occurrence of violence continue to plague the girls and women with disabilities in the present era.

Recommendations emerging from the study:

The following recommendations are proposed in the chapter:

- Need for provision of information on barriers and accessibility issues to DAW.
- Need for development of effective communication strategies such as use of plain language and accessible formats.
- The need for delivering direct consultations with organizations regarding the situation faced by DAW.
- Support must be provided to local community-based organizations through joint and collaborative programs for helping DAW to promote sensitization, information dissemination and advocacy regarding prevention strategies.
- There is increased need to strengthen and enhance social security for DAW.

Conclusion:

Targeted and focused efforts towards Protection of Rights of DAW is the urgent need of the hour. Women with disabilities are highly marginalized and excluded within our patriarchal society, dealing regularly with stigma, abuse, and denial of equal opportunities. Promoting, maintaining, and understanding their present state and need for protection of rights is essential towards maintenance of gender equality and the advancement of girls and women with diverse needs. The non-inclusion of women with disabilities in the decision-making processes has impoverished our societies. Lack of awareness of rights and inability to seek help becomes the root cause of the discrimination faced by DAW thereby allowing the perpetuation of harmful stereotypes, both concerning gender and disability, and leading to innumerable human rights violations. The present study highlights these core issues and challenges through a detailed review of secondary sources.

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ARTIFICIAL INTELLIGENCE AND COVID-19 MANAGEMENT

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Abstract:

The World Health Organization warned that artificial intelligence (AI) might be a crucial tool to handle the problem brought on by the virus not long after the covid-19 pandemic was proclaimed. The fourth industrial revolution's key technology, artificial intelligence (AI), is a crucial non-medical intervention to address the present global health crisis, prepare for the next generation of epidemics, and advance toward robust recovery. Even while AI has a lot of potential, it also creates important issues with regard to justice, dependability, responsibility, privacy, transparency, and safety. This collection aims to provide answers to these issues and envisions an intelligent healthcare future based on best practices and lessons learned by applying artificial intelligence for the COVID-19.

Keywords: Artificial Intelligence; COVID-19

Introduction:

An outbreak of a novel Coronavirus emerged in Wuhan city in the Hubei province of China in December 2019. Most of the initially identified patients were traced back to the 'wet market'. The virus spread to other parts of China and subsequently to 213 countries and territories in a very short time. On February 11, 2020, the WHO gave this illness the moniker "COVID-19," which stands for Coronavirus Disease 2019. 21.2 million Confirmed cases and 761,000 fatalities had been recorded globally as of August 17th, 2020 [1]. The worst COVID-19 outbreaks have been documented in the USA, India, Brazil, and Russia, where there are now more cases than there are confirmed cases in China. On January 30, 2020, and March 11, 2020, respectively, the WHO classified the current COVID-19 outbreak a "Public Health Emergency of International Concern" and a "Pandemic." Although SARS-(2.9%) CoV-2's mortality rate is substantially lower than that of SARS-CoV (9.6%) and MERS-CoV (34.4%), SARS-(high CoV-2's infectivity rate) relative to other coronaviruses has become a growing concern. Males were shown to have greater rates of mortality and COVID-19 susceptibility than females, which may

be related to other gender-specific behaviours like smoking [2]. In addition to being affected by underlying co-morbidity, which includes disorders including diabetes, hypertension, cancer, cardiovascular disease, and chronic respiratory disease, the mortality rate of COVID-19 changed with age. No evidence of vertical COVID-19 infection transmission from the mother to the foetus has been found. Children can contract COVID-19, although they often only exhibit minor symptoms.

SARS-CoV-2 and its Transmission

SARS-CoV-2 is a zoonotic beta coronavirus that is spread to people through spillover events. The animal reservoir is expected to be bats, but the other plausible intermediate animal host is still unknown. The virus is a spherical particle that is 70–90 nm in size. Glycoprotein spikes that protrude from its surface attach to the cell's angiotensin-converting enzyme 2 receptor. A furin polybasic cleavage site (PRRARS|V), which is catalysed during biogenesis, may be found in the SARS-CoV-2 glycoprotein between residues 682 and 685 at the border between the two subunits S1/S2. This cleavage site is unique to SARS-CoV-2 and has an effect on the virus's entrance, tropism, dissemination, and toxicity . It is not present in closely related viruses like SARS-CoV and SARSr-CoVs. The host's respiratory tract, brain, pancreas, liver, gastrointestinal tract, and reproductive organs all express furin proteases, which let the virus infect various organs and aid in its spread into the environment in a variety of ways. Currently, the public domain contains 255 whole-genome sequences and 249 protein structures from the SARS-CoV-2 virus.

SARS-CoV-2 has developed into two separate lineages, the more widespread, aggressive, and virulent L type descended from the S type and the primordial S type. L type was more prevalent in the early phases of the pandemic, but as time went on, its frequency declined and S type grew, which can be linked to differential selection pressure and epidemiological characteristics. Its genome size is around 30 kilobats, and it is phylogenetically more related to bat-SL-CoVBZC45 and bat-slvzC45 than to bat-Slvzc45 or sluvvyc [4].

In addition to direct contact caused by respiratory droplets from sneezing or coughing, COVID-19 can also transmit from person to person indirectly through fomites and frequently handled surfaces [5]. For several hours to days, SARS-CoV-2 may survive on different surfaces . Processes that produce aerosols in a medical or hospital setting can lead to airborne transmission. Although it has not been shown to yet, fecal-oral transmission of COVID-19 is still a possibility. SARS-CoV-2 Clinical symptoms, Prevention and control

The majority of patients have moderate flu-like symptoms such as fever, coughing, malaise, exhaustion, production of sputum, and respiratory issues. There were also less frequent symptoms including headache, hemoptysis, and gastrointestinal issues with diarrhea, as well as more severe symptoms like pneumonia and bronchitis. Some individuals have been found to have complications such as Acute Respiratory Distress Syndrome, RNAemia, acute cardiac damage, acute renal injury, and secondary infections [1]. Low white blood cell and lymphocyte counts, an increase in erythrocyte sedimentation rate, C-reactive protein, infiltrates, and bilateral ground-glass opacity in lung CT scans were additional laboratory findings linked to COVID-19. To prevent human-to-human COVID-19 transmission, control methods such as case isolation, contact tracking, and quarantine are essential. Personal hygiene practices including routine hand washing, respiratory hygiene, social isolation, wearing face masks or shields, and disinfecting surfaces can all assist in lessening the spread of the disease.

SARS-CoV-2 diagnosis

CT scans are routinely used for COVID-19 diagnosis in outbreak settings, but can be misleading due to indistinguishable images with other viral pneumonia. Discriminant clinical features like hyposmia and hypogeusia can be explored for preliminary diagnosis in telemedicine and mass screening.

Molecular test reverse transcriptase-PCR is recommended by WHO as the method of choice for detecting the SARS-CoV-2 nucleic acid for diagnosis of COVID-19. As the false-negative rate of RT-PCRs is high, it is imperative to use CT scan of the chest to confirm the diagnosis. It has been covered elsewhere [1] how useful these serological techniques are for contact tracing and assessing the effectiveness of non-pharmaceutical therapies in public health settings. The US FDA has officially granted emergency use authorization for these serological techniques. Future point-of-care testing methods might be CRISPR-Cas12-based and offer quick results [5].

On January 16, 2021, India rolled out the world's largest COVID-19 vaccination drive. Initial phase of the program aims to vaccinate 300 million people by August 2021. Includes 10 million healthcare workers, 20 million frontline workers and 270 million people aged over 50 years. AstraZeneca-Oxford University's Covishield and Bharat Biotech's Covaxin, which are produced by Serum Institute of India Ltd. and Bharat Biotech International Ltd., respectively, are the two vaccines used to start the COVID-19 immunisation campaign in India. [2] More recently, on April 12 and June 29, 2021, respectively, two more vaccines—the Russian COVID-19 vaccine, Sputnik-V, and the COVID-19 vaccine manufactured by the US pharmaceutical

company Moderna—were given the go-ahead for use in India. Both vaccinations are not available at any one immunisation facility; only one is. e also qualified for immunization in the following round [3].

ChemoTherapeutic agents of SARS-CoV-2

Remdesivir (GS-5734), baricitinib, a medicine combination known as ritonavir/lopinavir, Ribavirin®, umifenovir, and IFN-, as well as other broad spectrum antiviral therapies are a few of the prospective COVID-19 medications being researched and tested. In a randomised, placebo-controlled study, remdesivir was not proven to be useful in treating COVID-19 patients. Remdesivir has just received FDA approval for treatment in confirmed and probable COVID-19 patients. Approximately 1235 clinical studies for different treatment medicines against COVID-19 are being carried out throughout the world as of June 25, 2020 [4, 5].

Application of artificial intelligence in COVID-19 disease management

The replication of human intellectual functions by machines, particularly computer systems, is known as artificial intelligence. Expert systems, natural language processing, speech recognition, and machine vision are some examples of specific AI applications. Despite initiatives to do so, there has been little progress in integrating studies from many branches of biology. We postulate that reintegrating biology will be made possible by next generations of Artificial Intelligence (AI) technology tailored for biological sciences. We will be able to collect, link, and analyse data at previously unheard-of scales thanks to AI technology, and we will also be able to create thorough prediction models that cut across several fields of study. They will enable both targeted discoveries (testing certain hypotheses) and untargeted ones. The interdisciplinary technology that will improve our capacity to do biological research at all scales is artificial intelligence for biology. In the same way that statistics revolutionized biology in the 20th century, we anticipate that AI will do the same for biology in the 21st.

Big data and artificial intelligence are being used to solve the COVID-19 pandemic issue at an unprecedented rate (AI). Earlier disease outbreaks have exploited a variety of AI-related offshoots. In the struggle against COVID-19, AI has a significant impact.

AI is effectively employed in the diagnosis of COVID-19, the identification of illness clusters, the monitoring of cases, the forecasting of future outbreaks, mortality risk, the facilitation of training, the preservation of records, and pattern recognition for analyzing disease trends. The following are a few AI apps that are attracting a lot of attention and offering promise in the fight against COVID-19:

AI for tracking and prediction

Utilizing AI, early warning systems may be created and the spread of viruses predicted. BlueDot located a cluster of pneumonia patients and foresaw the COVID-19 epidemic as well as its global distribution. To enable the efficient tracking of COVID-19's propagation, HealthMap compiles and makes accessible the publicly available data about this virus [6].

Contact tracing using AI

By utilizing AI, early warning systems may be created and the spread of viruses predicted. BlueDot located a cluster of pneumonia patients and foresaw the COVID-19 epidemic as well as its global distribution. To enable the efficient tracking of COVID-19's propagation, HealthMap compiles and makes accessible the publicly available data about this virus.

For diagnosis, contact tracing, and effective monitoring of COVID-19, smart technologies including watches, mobile phones, cameras, and a variety of wearable gadgets can be used [7]. Telemedicine can make use of tools like AI for COVID-19, which analyse audio recordings of coughs lasting two seconds [8].

AI used to track COVID-19 patients

In healthcare settings, such as the critical care unit, artificial intelligence (AI) may be utilized to supply key information for resource allocation and decision-making. AI may aid managers in making better judgments regarding the amount of equipment needed for critical care patients by prioritizing the need for ventilators and respiratory support in the ICU based on data from vital statistics and clinical markers [9].

Early diagnosis with AI

AI was used for the detection and quantification of COVID-19 cases from chest x-ray and CT scan images. Researchers have developed a deep learning model for diagnosis based on visual 2D and 3D features extracted from volumetric chest CT scan. This may find application in reducing the number of RT-PCR tests in resource-poor settings. Another study used AI-based classifiers for predicting the outcome of RT PCR test using 16 simple parameters derived from complete blood profile. When it came to diagnosing COVID-19, COVID-ResNet, which was created utilising automated and discriminative learning rate and progressive picture resizing, outperformed COVID-Net. By utilising enhanced Inception Recurrent Residual Neural Network and NABLA-3 network models for the identification and localization of areas of interest from x-ray images and chest CT scans, Alom et al. created a system known as COVID MTNet [10-15].
AI in relieving medical professionals' and healthcare workers' workloads

AI can be used for classification of patients based on the severity of symptoms, genetic disposition and clinical reports in different categories like mild, moderate and severe. It can also be used to eliminate the need of frequent and unnecessary hospital visits by distant monitoring of cases and recording of patient's data. Chatbots like Clara from the Centre for Disease Control and Zini are providing much needed support to patients in remote settings. A prognostic prediction algorithm predicted the mortality risk of patients by machine learning methods using extracted features derived from other patients as training dataset [16-23].

AI for predicting protein structure

AI may assist in predicting the structure of significant proteins that are essential for viral entrance and replication and offer insightful data that can quickly open the door for medication development. In order to predict the protein structures of membrane protein, protein 3a, nsp2, nsp4, and nsp6, as well as the papain-like C-terminal domain of SARS-CoV-2, the AlphaFold algorithm of Google Deep Mind used deep residual networks (DRN) known as ResNets [24]. High-resolution cryoelectron microscopy density maps and the amino acid sequence were utilised to generate the protein complex structure of SARS-CoV-2 using DeepTracer, a tool built on a customised deep convolutional neural network [25].

AI in the creation of pharmaceuticals

The lead finding, virtual screening, and validation procedures may all be significantly accelerated by artificial intelligence (AI). By obtaining pertinent data for medication repositioning or repurposing, it can help quicken the pace. Additionally, technologies based on deep learning and machine learning are being utilised to speed up the drug development process. There are other AI-based projects, notably Project IDentif. Candidate identification for COVID-19 has been made possible by AI (identifying infectious disease combination treatment) [26-36].

AI in vaccine development

Never before in human history has there been such a hurry to create a disease vaccine. By utilising the power of AI, the velocity of discovery may be greatly enhanced. Using the Vaxign reverse vaccinology-machine learning platform, which was based on supervised classification models, Ong et al. projected potential vaccination candidates for COVID-19 [37, 38].

AI for reducing the spread of false information

Twitter, Facebook, and other social media sites can assist in developing a plan to gather and distribute accurate information in a timely manner to lessen the impact of COVID-19. Machine learning algorithms may be used to spot trends, do sentiment analysis, reveal where erroneous information comes from, and assist put a stop to rumors and disinformation. In this

extremely dynamic environment, AI can deliver the most recent information on new findings in diagnosis, therapy, the range of symptoms, and therapeutic results [39-44].

Genomics using AI

Machine learning may be used to quickly and accurately classify SARS-CoV-2 genomes using known genomic characteristics. Wang et al. evaluated the adverse effects of Traditional Chinese Medicines for the treatment of SARS-cov-2 using an ontology-based side effect prediction framework and Artificial Neural Network [45, 46].

Conclusion and future perspective:

To tackle COVID-19, a three-pronged strategy centered on testing, isolation, and contact tracking is necessary. Understanding the molecular basis of SARS-CoV-2 and other coronaviruses is crucial for improving our capacity to stop future epidemics. Because of the urgent need for answers in the current situation, the reaction to this epidemic was greatly aided by numerous digital technologies and AI.

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THE ROLE OF VIRTUE ETHICS DURING PANDEMIC

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Introduction:

In the moral philosophy there are three branches called 1) Utilitarianism, 2) Deontology and 3) Virtue ethics.

In the modern period utilitarianism and deontology these two normative ethics was dominating the world of moral philosophy. These two moral philosophies are rule based that is they impose some rules to determine an action to be right or wrong. They have nothing to do with the character of a person. But virtue ethics is not rule based, rather it is character based. Thus, virtue ethics gives importance to person or nature of the person i.e., human nature. It focuses on moral character of a person and stresses on the question – How should I (we) live? This living is not just simply to live but to flourish properly and get the ultimate end of human life i.e., happiness.

Pandemic is always unwanted and unfortunate for every life and human civilization. Pandemic is like a curse on the earth. It mostly comes due to the imbalance in our environment such as urbanization, climate change, consumption of various animals etc. These are created specifically by human deeds. Here I (we) can say ‘specifically’ human deeds because it is human beings who are greedy to enjoy the resources of the nature in any manner. It is okay to use the resources when it is necessary for our better survival giving importance to sustainable development too. When human crosses the limit, nature shows its supremacy over human civilization. When man forgets his responsibility as care-taker and becomes only ‘taker’, serious issues arise and a question mark comes to his existence.

Man as a rational and the supreme animal has the responsibility to take care of the world, its living and non-living entities or resources. Power always goes hand-in-hand with responsibility. When the power (of a person) increases, his responsibility increases. Power is directly proportional to responsibility. So, the most powerful person has the most responsibilities. And consequently, the supreme animal (man) has the supreme (or most) responsibilities.

Being ignorant of our responsibilities is the sign of lacking in character or virtue. So, there is the importance of 'ethics of character' or 'ethics of virtue' i.e., virtue ethics. It teaches us how to act. Act for a better life, act for a happy life. You cannot be happy when your neighbor is unhappy. So, man to be happy must also look for the happiness of others and their wellbeing.

Pandemic is such unfortunate situation or period where the whole human civilization is in trouble. In such a complex situation human relation loses its strength, their connection or bonding breaks. Sometimes they lose morals also. But humans in such a situation needs to be together with each other, help each other and go together for the solution and to get out of the dreadful situation.

Two conflicting approaches during pandemic:

Two approaches of human life can be taken into consideration in pandemic situation. The first one is utilitarian approach which stresses on the greatest happiness for the greatest number. Following this approach govt. generally make policies or impose some restrictions such as Lockdown during Covid-19 pandemic. This approach is beneficial for the society as a whole. The interests of the individuals are generalized and are taken to be one grand interest.

But this approach causes conflict with the Freedom of the individuals. Freedom is generally taken as the absence of constraints. Individuals seek their personal freedom which is overlooked in case of utilitarian approach. If government looks into individual freedom or interest, general happiness and wellbeing of the whole will not be reached. There is weaker group of people in our society such as old aged people, sick people or babies who need special care during pandemic. So, in such a case we should be patient and should think for the other's wellbeing also.

Role of virtue ethics during pandemic:

During pandemic people are in dilemma about which approach is to be taken. They do not know what actually to do. Utilitarianism and deontology tell us what we should do or what action is a right action. But Virtue ethics, advocated by Aristotle and revived by Anscombe, Williams, MacIntyre, deals how to act virtuously or perform right action. It does not focus on rule for determining rightness of an action. Rather, it shows us 'the way to act' in which a virtuous person act.

Virtue ethics can be a better solution and can play a very crucial role during pandemic. During pandemic or to avoid it we need to have patience, respect for the others (it can be a person, any animal, plant or any resource from our environment). "A virtuous moral agent exercises the relevant virtue when appropriate to the circumstances. To remain far from any

pandemic, we need a holistic and integrated health approach. And this approach is obtained by maintaining coexistence among man, animal and environment. Imbalance always causes trouble and therefore we need to care for maintaining the balance. Man, animal and environment is interdependent on each other and cannot exist properly without the other. Whenever one tries to break this interdependent relationship, it faces the harmful consequences. “Both the animals and environment have a significant role in the emergence of infections with zoonotic origin in human population. Several factors like climate crises, increased travelling, population explosion, urbanization, deforestation, animal trade and rapidly evolving pathogens have further amplified the threat of emerging zoonosis” (Tanveer *et al.*, 2020).

To avoid pandemics or to avoid its consequences we need some virtues to be cultivated such as virtue of generosity. “The virtue of generosity concerns giving and sharing one’s possessions for the good of others” (Bellazzi & Boyneburgk, 2020). When we decide our will to be directed towards an action, we exercise the freedom of our will and act in a virtuous way. When we act virtuously no constraint we need to face as there is no rule for the rightness and wrongness of an action. So, though there may have constraint upon us imposed by government but our freedom is no more threatened by any kind of restrictions, rather, the virtuous person has the freedom of will to act virtuously in such a situation and it is the specialty of a virtuous person to act in a virtuous manner in any situation.

Again, benevolence and justice (distributive justice) have very crucial role during pandemic. As the developed countries have more money-power, they can easily avail the vaccines or other health protection measures. And, consequently, the developing or undeveloped countries are undermined for the basic protection of public health, they cannot avail these. “Making available for developing countries might then not just be an issue of benevolence, or even of distributive justice, but of correcting previous wrongs, such as, current or historical government policies in the developed countries that have harmful effects on other populations” (Verweij, 2009). Again, Marcel Verweij says, “If our primary obligation is to protect health capabilities, arguably pandemic vaccination is much more important in countries that have little or no vaccine supplies, than in countries that could afford to purchase sufficient vaccine for their whole population” (Verweij, 2009). During Covid-19 pandemic India provided large number of vaccines to the other needy countries as a good example of benevolence and distributive justice. Thus, virtues like benevolence and distributive justice have significant role during pandemic.

Conclusion:

Ethics is very important for an individual and also for the society as a whole. It determines what is moral to do and what is not. Ethics works for maintaining peace and harmony in the society. And its role during the time of pandemic becomes more crucial. We have seen that among all the moral theories it is virtue ethics which is more fruitful or effective during pandemic. So, we need to cultivate virtues so that we can flourish properly and find it easy to choose the right way to act for the wellbeing of the self as well as the others. This is a moral responsibility of everyone to make the world peaceful and its inhabitants to live or survive with proper dignity. Lastly, we have to keep this in mind that like influenza, COVID-19 there may other new pandemics arise in future. So, at that time we have to show and practice virtues towards the needy. Only virtue ethics can help a person to act in a just way. Ethics of virtue intrinsically make the person flourish and live a life of happiness whatever the situation he is in. It makes the person having higher standards and helps him to remove all the ethical dilemmas.

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MANAGEMENT OF THE PRODUCT LIFECYCLE IN A CREATIVE AND COMPETITIVE BUSINESS ENVIRONMENT

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Abstract:

Management of a product's entire life cycle, from its conception to its successful market entry, is called Product Lifecycle Management (PLM). The process begins with the description of a concept, followed by business analyses, product design, solution architecture, and implementation of the technical aspects. Customers, regulators, shareholders, and public bodies are among the many groups currently exerting pressure on businesses to improve the quality and sustainability of product management throughout the entire life cycle. While it is possible for an organisation to innovate its project management procedures, it will face significant challenges in dealing with the various rules, instruments, and approaches currently in place to address the issue. This chapter's goal is to review the literature on PLM from an operational perspective in order to assist businesses in meeting their key market needs.

Keywords: product lifecycle management, business operations, and competition

Introduction:

Humans have been refining the practises of product development, production, maintenance, and recycling pretty much since the beginning of history as we know it. Complex, knowledge-based procedures are required now. Even though there have been significant advancements in the tools and techniques used in product development and support, the fundamental concept of determining a set of needs (which are actually derived from customers) and developing a product to meet those needs has not changed.

The information about the product is disseminated by a number of different parties; these parties represent a diverse array of expertise and, frequently, opinion on the effectiveness of the product. It can be challenging to ensure that all parties involved are "on the same page" in terms of their goals and objectives when working in an environment that is as diverse and dispersed as this one. On the other hand, in the context of the current global economy, success requires that companies effectively manage their value chains in order to shorten the amount of time needed

for product development, bring down costs, and increase quality. When referring to this problem, the phrase "extended enterprise" is frequently used in both the business world and the academic literature.

It is common practise for employees of large corporations to collaborate on projects as members of geographically dispersed, interdisciplinary groups. In today's environment of knowledge-intensive product development, it is therefore essential to develop a computational framework that enables the capture, representation, and reuse of product and process knowledge. This can be accomplished through reusing existing data. During the entirety of the manufacturing process, each of these pieces of information regarding the product need to be communicated to each other and kept up to date with any upcoming modifications. During the use and maintenance stages of the product's lifecycle, the information concerning the product must also be made accessible to the service supply chain. It is possible to collect user feedback on the performance of the product while it is being used, which can help improve the design of the product. Recycling and termination are two examples of processes that can have an impact not only on the demand for, but also the supply of, data on resources such as parts and materials. The foundation of product lifecycle management is the process of sharing and managing information, knowledge, and data pertaining to a product (PLM).

The reintegration of people, processes, resources, and information is an essential component of product life cycle management, and it is equally as important as the focus on the value chain. Successful companies are now aware that the significance of maintaining a consistent focus on products and the development of a language that is product-centric extends far beyond any one particular philosophical position. Product lifecycle management, also known as PLM, is a business strategy that centres on the creation and upkeep of a knowledge base centered on the company's products. This strategy was developed to address the challenge described above. In addition to systems that assist with things like product repairs and replacements, it depends on design software and data warehouses. Throughout the entirety of a product's lifecycle, a PLM environment makes it easier for all parties involved in the creation, production, and maintenance of that product to communicate with one another and share data. On the market for information and communication technologies, PLM has already established a strong reputation (ICT). PLM, or product lifecycle management, is a process that helps streamline the flow of information throughout the various phases of the product lifecycle by making use of an integrated set of tools and technologies. PLM is not a ready-made tool nor is it a solution that can operate independently, in contrast to other technologies. Instead, it is based on

the concept of connecting disparate bodies of knowledge and it strives to deliver pertinent information at precisely the right moment. In a nutshell, product lifecycle management (PLM) makes it possible to develop a long-term, product-focused corporate strategy that is also competitive. PLM's "holistic" role in the modern world encompasses many different aspects, including but not limited to: products, services, activities, processes, people, skills, information and communication technology (ICT) systems, data, knowledge, techniques, practises, procedures, and standards.

A business process is a set of interrelated activities carried out by different people or parts of an organisation to create value for the business as a whole. The tangible value of a company's offerings can be seen in both the goods and the services that it provides.

The components of product lifecycle management (PLM) can be divided up into two distinct groups: digital product definition and delivery. The fact that these efforts have been completed digitally indicates that they made use of computer modeling and were carried out with the assistance of computers. The majority of these resources are going to be put to their best use during the design phase, which is when the vast majority of product data is going to be generated. The definition of digital products serves as the structural cornerstone of product lifecycle management. The development of the product definition procedure called for the elimination of engineering drawings in favour of computer-aided drafting software. This change was necessary because of the evolution of the process. Following the introduction of computer control of machine tools, a demand emerged for computerized shape models that could directly drive manufacturing, which resulted in the development of surface and solid modeling systems (3D CAD). In later years, advancements in feature technology made it possible for designers to create parametric shapes. In addition, the designer was able to define intent thanks to the constraints that were provided by the features. The most recent iterations of CAD software not only make it possible for product designers to define product structure in terms of an assembly and a variety of different types of parts, but they also make it easier to associate the 3D model with the 2D drawings. This category of software is frequently referred to as "authoring tools," which is also a term that can be used to describe the category itself.

To thrive in today's competitive global market, a company must be able to roll out innovative new products frequently, with a focus on high levels of functionality that customers will appreciate and a price at which needs are met at a level acceptable to buyers. Meeting buyers' requirements is crucial to the success of any product. To rephrase, it is imperative that the products be able to fulfill the customer's requirements in terms of when they need them, what

they need them to accomplish, how effective they are, how attractive they are, how much they cost, etc. These factors will shift throughout a product's life cycle, so innovation strategies will need to be flexible. Today's successful product developers know that making a perfect product isn't enough. The best-in-class organisations use initiatives like lean manufacturing and design for manufacturing to enhance their product lifecycle processes (Pol et al., 2008; Saaksvuori & Immonen, 2008; Grieves, 2009). Collaborating between manufacturing and product development teams at the earliest possible stage of the product lifecycle can help reduce production costs, improve product quality, deliver more reliable products, provide products that are easier to service, and promote "green" initiatives that aid in the long-term sustainability of our planet.

Enterprise Resource Planning and Customer Relationship Management have converged in the past because of Product Lifecycle Management (PLM) (PLM). In the early 1990s, ERP brought together the systems for manufacturing, human resources, financial management, and storage. In the decade since the introduction of CRM, call centres and sales force automation have been merged. PLM is now enabling the convergence of CAD, CAM, PDM, and manufacturing processes, as well as product data management (PDM). PLM stands out from other enterprise software programmes because of its focus on generating revenue from repeatable processes. Product lifecycle management (PLM) provides a path to innovation, industry leadership, and increased revenue (Saaksvuori & Immonen, 2008; Grieves, 2009; Bernard & Tichkiewitch, 2008; Stark, 2004).

Product lifecycle management approach:

"Product Lifecycle Management" (PLM) is a strategy that helps companies manage their intellectual capital in an efficient manner. They have to deal with issues like globalization and outsourcing, mass customization and rapid innovation in addition to product traceability in the product development process today. These Product lifecycle challenges increase the need for knowledge management and collaborative environments. More and more companies are implementing PLM systems to keep track of all product-related data throughout the entire lifecycle of their products, from conception to operation and disposal. A wide range of engineering and business activities are supported by PLM systems and philosophy (Stark, 2004; Pol et al., 2008).

PLM integrates people, processes, business systems, and information to support the creation, management, dissemination, and use of product definition information across the extended enterprise from the time of product conception until the end of the product's useful life. PLM is also known as product lifecycle management (PLM). Product lifecycle management, also

known as PLM, is an all-in-one strategy for increasing productivity in the product development process by consolidating data into a centralised hub. PLM was developed by Siemens AG. The invention, concept description, business analysis, product design, and solution architecture stages of the product life cycle management (PLM) process are just the beginning of the process that ultimately leads to the introduction of a product to the market and the product's continued success through service/maintenance and product enhancement. PLM allowed for the collection of data and information as well as its subsequent availability during each stage of the process. Businesses are able to manage the lifecycle of their products as if they were created, developed, and supported in a single location if they use product lifecycle management software (PLM) (Bernard & Tichkiewitch, 2008; Pol *et al.*, 2008; Saaksvuori & Immonen, 2008; Grieves, 2009). In order to create a repository of valuable intellectual capital that can be reused in a methodical and reproducible manner in the future, best practises and lessons learned are recorded. This allows for the creation of a repository. PLM's standardised data storage makes it simpler to implement an IT strategy that promotes real-time communication and collaboration among members of different teams located in different parts of the world. This is because PLM makes it possible to store data in a standardised format. Companies are able to make the most of their previous investments in a variety of application systems by utilising PLM. PLM software that adheres to industry standards lessens the likelihood of encountering issues with data translation while simultaneously granting users access to data and enhancing the visibility of processes throughout the entirety of a product's lifecycle.

Using PLM systems, you can keep track of a wide range of different products, services, and processes all the way from conception to final disposal (Figure 1). (Siemens PLM) managing projects, goods and services

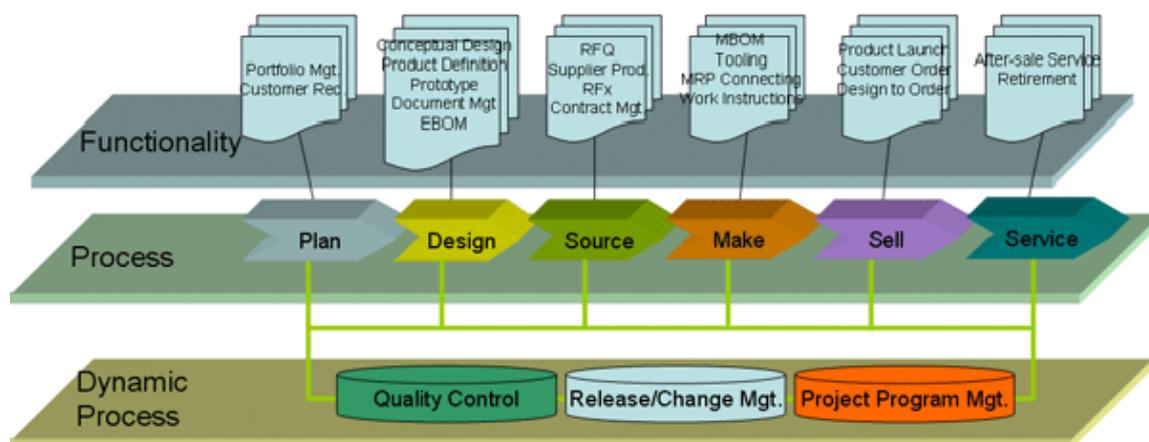


Figure 1: Structure of PLM System (Source: Siemens PLM, 2009)

When a new product is introduced, production, service, and retirement all take place at the same time, information must be exchanged between the various stakeholders. Figure 1 shows the "Structure of PLM System" from Siemens PLM in 2009.

As part of the product lifecycle management (PLM) concept, the following methods for Organising and managing product information can be used:

- It is important to keep all of these departments up to date on the latest product information.
- Iterate new designs by working with external users, vendors, and clients as a team.
- Conserve resources by creating a database of product information that can be re-used in future designs.
- Evaluate the needs of customers or markets in a systematic manner
- Create a list of preferred vendors for the purchase of both custom and standard parts to streamline the sourcing process;
- Simplify the allocation of resources to specific projects by evaluating the costs and benefits of doing so.
- Manages and distributes enterprise data at a variety of levels, such as Technology of the information and communication.
- Obsession with the current system of record the integration of PLM with ERP and CAD systems
- Procedures One that cannot be fixed or improved upon
- Modeling, regulation and enhancement of a collection of information and objects.
- Data in a variety of formats; a standard way of representing data (IGES, STEP...)
- Maintaining the integrity and evolution of data over time.

Putting PLM into action:

PLM process support software is offered by a variety of companies. If the users to whom PLM is supposed to contribute do not first define and understand the PLM process, the software itself is nothing more than a tool and cannot make many contributions. The company's PLM implementation is in and of itself a process and project (Kecojevic et al., 2010). Specific business operations, such as the following, need to be managed as part of PLM across the company's entire enterprise:

- Customer relationship management (CRM) is a system for keeping track of customer information (CRM),
- Enterprise resource planning (ERP) is a system for managing financial records (ERP)
- Supplier support is handled by a system called supply chain management (SCM).
- A method for keeping track of personnel files is referred to as "human resource management" (HRM),
- Requirement management is a system for managing the requirements (RM),
- A project's execution is fueled by the ability to track and manage resources and processes through PM systems, which also provide tools for scheduling and tracking work in progress (WIP).
- Product Data Management, a system for managing product data and workflows (PDM).

The first step in implementing PLM is to understand and analyse the company's organisational structure, job roles, and responsibilities. Each PLM operational system must be defined, including who is contributing to the system, how information is shared, and who has been designated as the system's responsible person. Small and medium-sized businesses don't typically require the integration of all of these operating systems into a single software tool. Large businesses, on the other hand, may need to customize the software and tools that are already available.

In the case of collaborative software development projects, SCM systems can be used by IT companies to store reusable implementation blocks (Kecojevic et al., 2010). All developers in the company must have access to information about the assess ability of these building blocks, and a successful process must be established for collaborative creation and updating. Such a scenario can be applied to an ERP system, where some existing project management tools may provide a solution.

Applications of PLM:

Large and medium-sized companies

In the current economic climate, most medium and large businesses have prioritized addressing global business challenges as their top priority. Whether they want to expand their customer base in new markets or use more cost-effective resources, doing business internationally is critical for them (Pol et al., 2008). If they are to maintain an advantage, they must overcome the difficulties of a distributed organisation while still allowing each team member the freedom to succeed. The PLM concept offers comprehensive solutions to help

companies overcome challenges and gain an advantage in the market. In order for medium and large businesses to be successful, they should have achieved the following:

- Manage the launch of new products for a successful product portfolio management.
- Engineering concurrently around the world for faster market entry.
- Cutting costs and speeding up product customization can be achieved by developing reusable platforms.
- Managing the complexity of manufacturing and product development.
- Assuring that currently available products can be used with the least expenditure possible.

Small and medium-sized businesses (SMEs)

Small and medium-sized businesses (SMEs) face particular challenges because of the scarcity of resources they have to work with. They can better serve their customers with PLM's comprehensive solutions, which are designed just for them.

Companies that are just starting out need a product lifecycle management system that was built from the ground up with industry best practises in mind. For small and medium-sized businesses, fully integrated PLM solutions provide everything they need to maximise their innovation strategy and easily scale to meet future needs. There are a number of PLM software providers, and Siemens PLM software is one of them (Siemens PLM, 2009). For mid-sized manufacturing companies, applying preconfigured best practises to routine engineering tasks and processes can help them transform their innovation process. The following are some of the advantages that PLM software provides to businesses:

- Safeguarding corporate design data, but still allowing authorised users to access it.
- A smoother transition between 2D and 3D
- Their ability to reuse their designs will be boosted by the addition of a flexible and powerful search feature.
- Efficient change management and design review workflows to streamline the company's engineering process
- Decrease in the number of errors in manufacturing by eliminating manual error handoffs and improving departmental communication
- The ability to quickly and fully implement a PDM (product data management) solution.
- Low overall ownership costs.

PLM Metrics development process:

Businesses often wonder how well they know what they're doing and how they can tell if they're doing it right. Measurement of significance and importance necessitates an understanding of the metrics process (Grieves, 2009). The only way to get the answers to these questions is to measure the processes and results of these processes. As PLM transforms the way companies do business, they must know how well they're doing. In order to evaluate the success of PLM implementation in any context, PLM processes and results must be measured. PLM measurement necessitates the development of relevant and useful metrics. It is imperative that the metric chosen is relevant, appropriate, and significant, given that what is measured is likely to be implemented. Measures that can be used by companies implementing PLM to gauge the success of their efforts are what the metrics development process is all about.

The ideation, design, construction, service, disposal, and recycling processes of PLM have an effect on the key performance indicators of success, but they also have an impact on the implementation of strategies and initiatives. The key performance indicators are directly influenced by the organization's strategies and initiatives. As a result, the organization's goals and objectives should serve as the basis for determining key performance indicators. The key metrics are derived from the performance indicators. In order to keep track of what matters most to the company, the organisation uses a set of key metrics. The findings of the assessment and analysis using the key metrics have an impact on the organization's strategic plan. Company expansion, income, and profitability are linked to these metrics.

Different levels of complexity can benefit from PLM metrics:

- The first level is referred to as level 1. We use the most basic level of measurement for input metrics. At this point, the main concern is whether or not the company is allocating adequate resources to the PLM process.
- To determine if the proper PLM processes, such as requirements management, sourcing and procurement, and distribution quote/order generation, have been implemented, metrics are used at Level 2.
- Level 3 is all about building relationships with customers.
- A number of metrics are used to determine whether outputs meet customer needs and if desired outcomes have been achieved.
- Level 4 and 5 metrics look at efficiency measures such as requirements traceability; visualization; concepts; design capture and accessibility; change control; change capacity; configuration management; commercial cost of risk; and product quality (e.g.,

generation of new business, software integration, cost performance, market share, cost reduction, design reuse) metrics are used to assess the impact of implementing a PLM system by evaluating the degree in which processes and controls are integrated and the return on investment,

- Level 6 metrics are the most complex and difficult to measure. Environmentally friendly manufacturing and waste management are just a few of the many responsibilities that come with running a business.

PLM benefits for business:

The PLM concept can help an organisation advance strategically while achieving short-term results, and it can lay the groundwork for future innovation when implemented. An immediate and long-term innovation benefit for the enterprise will be realized through the PLM platform as it addresses specific business issues and sets the groundwork for future success.

To get their products to market, companies used labor-intensive serial processes, which put off downstream contributors like suppliers, manufacturing experts and service/maintenance providers.. By allowing as many lifecycle tasks as possible to be completed simultaneously, PLM can help the enterprise streamline and reduce the number of critical stages in the product lifecycle. When it comes to product lifecycle management (PLM), PLM is an essential part of the process. The costs and scheduling issues caused by downstream players' last-minute recommendations and unanticipated issues A competitive advantage can be gained by launching new products early with PLM, as well as increasing the sales of existing products.

Increase profitable growth

Using PLM, an organisation can develop, collect, and share the product-related needs, expectations, and preferences of its target markets and customers. Consumers' needs are then matched with the type of cutting-edge content they want at a price they can afford. In order to keep up with the ever-increasing demands of the market, PLM develops new products that are both innovative and cost-effective to produce. When working on new concepts, global cross-functional teams pool their resources and expertise in real time. In a never-ending cycle of innovation, knowledge and "lessons learned" are archived for future reference. PLM facilitates mass customization by making it possible to quickly and cheaply deliver customised product offerings that are tailored to specific customers and specific market segments. Options and variants management are combined with configuration management in PLM. Because of these cutting-edge capabilities, the company can carry out portfolio planning in the most adaptable and continuous manner possible.

Reduced build costs

Product lifecycle management (PLM) enables businesses to reduce costs at every stage of the product lifecycle, resulting in lower product prices. For example, by using PLM to assess the time and resource implications of proposed design changes and requirements changes, the company's team can decide to reduce lifecycle and product costs. Early detection of design flaws using product lifecycle management (PLM) can save time and money in the manufacturing stage of the product lifecycle. Reduce warranty costs and incorporate maintenance and service groups' concerns into product designs by using PLM in the enterprise's team. By digitally creating and reusing manufacturing plans, plant information, and manufacturing processes, the company can reduce overall operational costs. With the help of PLM, the company can also implement virtual prototyping to save money on physical prototyping testing.

An organisation can benefit from cost-effective delivery of product derivatives, niche offerings and additions by implementing PLM. Products can be launched more quickly with PLM, which reduces the cost of taking a product to market as well as the amount of money that can be made from its first release. Best practices, intellectual capital, human resources, product plans, production plans, production facilities and value chains can be reused across an ongoing set of take to market programmes and a comprehensive set of product and production management capabilities through PLM.

Conclusion:

Even though PLM is a relatively new method with a short history, it has proven useful to all levels of management in both vertical and horizontal organisations. It is used by both those in the field and those in the decision-making process because it organizes and makes available relevant historical data. Adapting to the rapid changes in the business environment. Small and medium-sized enterprises (SMEs) can improve their design coordination by implementing product lifecycle management (PLM) systems. The foundation of this business strategy is an analysis method for informal collaboration and a modeling technique for detailed design processes. PLM technologies are used to put this all into action. Project management and document lifecycle management can be monitored using workflows that have varying levels of detail.

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THE NEW NORMAL IN ENTERTAINMENT: AN INDIA BASED DESCRIPTIVE STUDY ON THE RISE OF OTT

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Abstract:

Pandemic or Covid -19 may have hit a lot of sectors but was also the reason behind the acceptance of OTT platforms in India. Undoubtedly boosted by the increase in mobile usage with cheap data, especially in smaller cities and towns amid the pandemic, several reports suggest that the OTT entertainment industry is expected to grow into a \$15 billion market in India by 2030 (source: Zee business). With a growing number of filmmakers opting to stream movies on this medium since the outbreak of the Covid-19 pandemic last year, it may not be wrong to call OTT the new normal in entertainment. Confined to their homes with no means to watch movies at theatres people shifted towards different OTT platforms for entertainment. Not only this led to the entry and growth of several international players but also became the reason behind the birth of regional OTT in India. Another reason for attraction to OTT platforms is accessibility and availability. One can watch their favourite shows, cricket matches, movies anywhere and at any suitable time.

The proposed chapter is aimed to theorise the rise and usage of OTT platforms during and post-Covid -19 pandemic. The growth in subscription will be an important criterion for assessment. When production houses closed during the Pandemic people shifted to OTT platforms for entertainment. In most cases, it was paid subscription as very few OTT platforms would screen popular shows for free. The research data shows that during pandemic newer versions like mobile were offered at a very basic price to cultivate the habit of OTT entertainment.

Even though, after the second phase of Covid -19, while the TV industry has started producing new shows and theatres have opened, people are still consuming OTT space as the new form of entertainment. The lack of clarity on the effectiveness of vaccines has forced the Indian audience to avoid multi-screen theatres. Also, the cost for a family to watch a new film works to less than ₹150 making it more Value for money. Now, it would not be wrong to say that

OTT space has not only changed the way people look at entertainment but has also provided an opportunity to content creators to explore their creativity.

The proposed chapter tries to connect these dots and frame a descriptive study by studying different factors behind the rise of the OTT space. It also tries to study the evolving and maturing regional OTT market and the entrance of new genres in the OTT space to keep it growing post-pandemic.

Keywords: New Normal, Entertainment, OTT platform, Pandemic, Regional OTT, Subscription, Covid -19

OTT and Entertainment - An Introduction

Entertainment is an abstract term which can be defined differently for different people. This chapter tries to talk about a new forum for entertainment which is OTT. Entertainment which in earlier days would mean cinema and theatre gradually shifted to other forms like Cable, DTH and have now gradually shifted to OTT (Sundaravel *et al.*, 2020). Internet search defines OTT as any online content provider that offers streaming media as an individual product. The term is commonly applied to video-on-demand platforms, but also refers to audio streaming, messaging services, or internet-based voice calling solutions. (<https://www.tapjoy.com/resources/what-is-ott/>)As long as you have access to an internet connection — either locally or through a mobile network — you can access the complete service at your leisure. OTT services are usually making money via paid subscriptions, but there are a few exceptions which stream content for free. These OTT platforms may possibly be making money via in-app purchases or advertising.

Why do people choose OTT?

The most important reason behind people using OTT is the availability of variety of content at a reasonable price. Big OTT giants like Netflix and Amazon prime start their mobile packages for Rs. 199 a month for Indian audience which is quite cost effective even if one chooses to watch only a fraction of the content offered. Also, in terms of content, viewers claim to find them more original and updated and variety of choices in terms of genre is extensive. Apart from this, another important factor behind the rise of OTT is the compatibility with multiple devices. These platforms can be viewed on a Smart TV or phone or a tablet. The platforms also allow users to create separate profiles for different members of the family based on their choices.

Growth of OTT- global and regional

OTT or Over-the-top has widened its definition from just a direct reference to Netflix. The rise of the OTT platform as a source of entertainment shows signs of displacing the ecosystem comprising of the traditional players such as DTH services (Kim *et al.*, 2016). This evolution has seen greater shape, impact, and accessibility at the backdrop of the global pandemic.

Fitzgerald (2019) examines the growth, development, and acceptance of OTT video services to rise in digital infrastructure, smartphones, state regulation and policies among other things. Subscription format and personalized content has also led to the shift of the platform from “luxury to commodity” (Sundaravel *et al.*, 2020). Market that was earlier dominated by global players such as Amazon Prime, Netflix is now seeing a stiff competition from Indian streaming services, Hotstar, Jio Cinemas, Sony Liv, Voot Originals, Alt Balaji to name of few. This shift has not only impacted the market but also brought about a paradigm shift in our culture. This shift is not only visible in urban population but also amongst the rural population (Saha, 2021). Some of the key catalysts to this increase in consumption of OTT as a form of entertainment has been credited to streaming of live sports, regional content and content dubbing in regional language and ever advancing cellular networks (Sundaravel *et al.*, 2020). With nearly all the big over the top (OTT) platforms concentrating mainly on Hindi content, a new set of OTT platforms are rising in the regional markets that offer local flavors and preferences. Unlike the big players, who are targeting almost everyone, the regional OTT players are strongly aimed on meeting the content needs of native audiences. (<https://www.exchange4media.com/digital-news/regional-platformsdriving-the-second-ott-wave-in-india>)The Pandemic year especially 2020 has seen regional OTT platforms flourishing in markets like Maharashtra, Gujarat, Kerala, Karnataka, Andhra Pradesh-Telangana and Tamil Nadu. Some of the well-known platforms in this space are aha (Telugu), hoichoi (Bengali), Planet Marathi, Koode (Malayalam), and City Short TV (Gujarati), among others. This tendency is related to one that has been spotted in TV broadcasting space more than a decade back. Sensing an opportunity, Star India and ZEE had launched regional channels to expand their business outside the Hindi-speaking markets. OTT is tracing the footsteps of TV broadcasting. However, the regional OTT platforms have their own set of challenges like restricted investment capacity, rivalry from bigger OTT players and lack of clarity on business model. According to a FICCI-PwC report, the share of regional language consumption on OTT platforms will cross 50% of total time spent by 2025, easing past Hindi at 45%.

Moochhala (2018) observes that India has been in comparison to other countries slower in adapting streaming services. However, with India rebranding itself as Digital India has led to greater internet penetration making embracing of OTT even more seamless. This has had its effect on more staple forms of entertainment such as television and cinemas. Scholarly work on the landscape of Indian entertainment business has credited the acceptability of OTT to reasons such as comfort, content engagement, penetration of smart phones, cost efficiency and internet facilities (Ghalawat *et al.*, 2021, Sadana *et al.*, 2021). It is also the discourse surrounding shows in OTT platform and its popularity that have been contributory factors to steady replacement of consumption of television and cinema as sources of entertainment (Kumari, 2020).

OTT- the new normal in entertainment

Amidst the global pandemic while most industries had taken a hit, OTT not only survived but flourished. As the Prime Minister declared a nation-wide lockdown in March 2020, small to big film production houses had to halt their shooting. It forced mainstream films such as *Gulabo Sitabo*, *Shakuntala Dev*, *Raadhe* to rely on OTT platform for release. A considerable increase in the subscription was seen due to the lockdown (Raghuvanshi, 2021). A report by FICCI (Federation of Indian Chambers of Commerce and Industry) on the economy of the Indian digital media industry for the year of 2020 was seen to have risen by 6.5 % (Raghuvanshi *et al.*, 2021).

As the world continues to debate if OTT can replace and not just be a competition to theatres, Kannada films *Daali* has had both OTT and theatre release. While movies such as *Krishna and his Leela*, *47 days*, *V* opted for OTT releases. This changing viewer preferences can also be observed as India prepares 52nd International Film Festival and for the first time five digital platforms Netflix, Amazon Prime, Zee5, Voot and SonyLIV will also be showcasing films (“OTT platforms to...”2021).

Ormax Media, a media consulting firm conducted research for the timespan of just two months with a demographic sample of both urban and rural population to find that one in every four Indian have watch OTT content. Its study further shows that in India there are 353 million users of which 96 million are also active paid subscribers (afaqs.com). RBSA Advisors, a leading Valuation and Transaction Advisory firm has estimated that the Indian OTT market which is worth 1.5 billion in 2021 is expected to grow exponentially to 12.5 billion by the year 2030 (bestmediainfo.com). According to a report in trak.in (2021) Amazon Prime will be increasing their annual subscription by 50% for its Indian consumers. However, no such tariff changes have been indicated by Netflix, even though the global market leader has increased its rate in South Africa (Bose, 2021).

The intensification of the convenience of the OTT platform is though credited to the ‘new normal’, it continues to entice consumers with wider varied choices of tailored narratives to growing regional market. It is not only welcoming independent filmmakers to innovate but successfully also dissolving geographical boundaries, *Squid Game* which continues to dominate top viewed show in India (as of October 2021) being a rising example of which. The OTT creative space is an expansive market for digital consumers/subscribers, marketer, multi- screen video screening providers along with filmmakers and producers.

Another reason for rise of OTT in India is the absence of a censorship board for web content which in turn has been fuelling creativity and, hence, viewership on OTT platforms. Although the government plans to come up with censorship, but no such regulation has taken a shape. This freedom attracts younger population and hence forth making it the ultimate choice for entertainment. Although content will continue to remain the biggest draw for audiences, technology also has a very big role to play here. The coming times in this space will probably belong to not only those with the best original content, but also the most advanced technology, analytics, and user-friendly features. (tech.hindustantimes.com/tv/news/the-future-of-entertainment-here-s-what-is-going-to-drive-growth-in-the-ott-space). Eventually, the streaming wars will encourage viewers and revolutionise how they consume content. It is not that people have stopped consuming traditional media, but one cannot deny the fact that a gradual shift has taken place due to the streaming platforms which gives a tough competition to the older forms of entertainment. Nonetheless, it would not be wrong to say that OTT is the new form of entertainment now and is going to remain there in the market for a very long period.

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IMPACT OF COVID-19 ON EDUCATION

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Abstract:

A novel Covid named COVID-19 by the World Health Organization (WHO) is in charge of the on-going flare-up of pneumonia that started toward the start of December 2019 close to in Wuhan city Hubei Province, China. Coronavirus - 19 is a pathogenic infection. This pandemic has impacted a huge number of people groups, who are either debilitated or are being killed due to the spread of this infection. The most well-known side effects of this viral contamination are fever, cold, hack, bone agony and breathing issues and eventually leadings to pneumonia. The effect of pandemic COVID-19 is seen in each area all over the planet. The training areas of India as well as world are gravely impacted. . The unexpected flare-up of a lethal infection called COVID-19 brought about by Corona Virus shook the whole world. The COVID- 19 seriously affects schooling system. It has changed the conventional instruction framework to the instructive advances model in which educating and appraisals are led on the web. Both the positive and adverse consequences of COVID-19 on schooling system are noticed.

Introduction:

Many changes came to our reality because of COVID-19. After seeing this present circumstance, Indian government encouraged to keep up with social removal as the anticipation and began lockdown to isolate the polluted individuals. The training area includes Colleges, Colleges and schools are shut with no sureness as to when they will open. All instructive exercises like assessment, school affirmation, entrance trials of different colleges, and cutthroat assessments were delayed endlessly. Consequently, the lockdown annihilated the entire school system.

However schools are shut, and students are going to their classes through different training drives like internet-based homerooms, and radio projects. The two educators and understudies are confronting many obstacles during web training. At home, an absence of essential offices, outside interruption, and family interference during instructing were significant issues. There are heaps of understudies who didn't claim the assets to go to internet-based classes and endure a great deal. Instructors likewise confronted specialized hardships. The challenges

were gathered in the absence of specialized help. Educators who are specialists in Blackboard, Chalk, Books, and study hall education are truly new to this advanced instructing, yet they are taking on the new techniques. Instructed guardians are supporting their kids all through the pandemic, however, there are ignorant guardians and their sensation of weakness to help their youngsters in their instruction. Numerous students were experiencing not having sufficient nourishment for their endurance. A large portion of the understudies is engaged with kid work to help their families. This pandemic has impacted the understudies as well as the low-financial plan organizations and schools.

The episode of COVID-19 has made positive as well as adverse consequences on education, the educational foundations of India has acknowledged the demands and attempted their best to offer help administrations to the students during a pandemic.

Positive effect on the education system:

A few positive effects on instruction are given beneath:

- The quality of education in India has improved according to the future perspective.
- Instructors are additionally upgrading their e-learning modules.
- Understudies can deal with their time all the more effectively in web-based schooling.
- There is a new open door where cooperative instruction and learning can take a new structure.
- The pandemic has made a gigantic ascent in remotely coordinating, virtual gatherings, online classes, and e-conferencing potential open doors.
- Students couldn't gather the printed versions of study materials during lockdown also, thus they utilized delicate duplicate materials.
- The pandemic circumstance actuated individuals to learn and utilize advanced innovations and brought about expanding computerized education.
- Learning materials are shared effectively and the connected questions are tackled through e-mail, calls, SMS, and WhatsApps

Adverse consequences on the school system:

The outbreak of COVID-19 adversely affects training and some of them are given beneath:

- Schools are shut. Various sheets have deferred the yearly assessment and entrance test across India.
- Instructors and understudies are caught off guard by online training, they were not prepared for this unexpected change from one face to another figuring out how to internet learning.

- Compelling appraisal can't be taken on the Online stage
- Understudies are now and then diverted by games, social media, etc.
- In provincial regions, understudies have no appropriate assets.
- The web-based instructing learning strategies make a major hole between rich versus poor and metropolitan versus rustic understudies.
- Numerous understudies will be unable to manage the cost of PC, PC, or support versatile telephones in their homes, web-based education learning might make a computerized split among the understudies.
- Because of COVID-19, the vast majority of the enrollment got delayed. Position for students may likewise be impacted. The joblessness rate is expanded because of this pandemic.
- Mid Day meals is a school feast program that is intended to give better wholesome food to young kids. The closure of school has serious ramifications on the day-to-day nourishment of understudies as the late morning dinner plans have for a brief time been closed.

Conclusion:

Coronavirus - 19 has influenced enormously the schooling area of India, It has made many difficulties, and different open doors are likewise advanced. India isn't completely prepared to make schooling arrive at all sides of the country through advanced stages. The understudies endure because of advanced stages. It is need of great importance for the instructive foundations to reinforce their insight and data innovation foundation to be prepared for confronting COVID-19-like circumstances. There is a need to take endeavours on greatest use of online stages. India ought to foster imaginative methodologies to guarantee that all kids should have economical admittance to get the hang of COVID-19-like circumstances. As the online practice is helping the students gigantically, it ought to be continued

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COVID 19: VACCINES AND HERBAL TREATMENT

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Introduction:

Coronavirus disease (COVID-19) is an infectious illness brought on by the recently identified coronavirus (SARS-CoV-2) and has been spreading quickly around the globe. The World Health Organization (WHO) classified the COVID-19 outbreak as a pandemic in March 2020¹. Global health systems, as well as social and economic advancement, have been badly damaged by the pandemic. As of December 4th, 2020², there were 96,06,810 verified COVID-19 cases in India and more over 1,39,700 fatalities. The most typical symptoms of COVID-19 are fever, dry cough, fatigue, and shortness of breath. Approximately 20% of people may get more serious illnesses, although the majority (around 80%) just experience minor illness and recover without hospitalisation. Better diagnoses and treatment have been implemented by several nations, including India, to stop the spread of COVID-19, but vaccines will offer a long-lasting cure through intra muscular route³.

Covid 19 vaccines:

Vaccine development strategies and platforms

Since May 14th of 1796, when Edward Jenner performed the emblematic experimental inoculation of an 8-year-old boy with pus obtained from a milkmaid infected with cowpox that resulted in his immunization against smallpox, vaccination has been proven to be a successful story in Medicine. Traditional vaccine development strategies, though proven to be efficient for a number of pathogens, are slowly giving space to more sophisticated techniques involving recombinant DNA technology, adding new options in vaccine design strategies. However, there are two main goals that any vaccine strategy needs to achieve: the safety of the vaccine and the production of robust adaptive immune responses that lead to long term protection against several strains of the pathogen with -ideally- one dose of the vaccine. The vast majority of approved vaccines were traditionally focused on the induction of strong protective neutralizing antibodies

against the target pathogen, thus aiming to confer sterilizing immunity in vaccinated individuals. Sterilizing immunity describes the immune status whereby virus infection of the host is totally inhibited and, therefore, disease and further transmission of the virus prevented. It differs from innate trained or T-cell mediated immunity that allows for infection, but efficiently controls and subsequently eradicates the pathogen. Sterilizing immunity is quite rare especially against viruses that infect the lower mucosa of the respiratory tract, such as the influenza virus or different coronaviruses. Yet, a growing body of evidence suggests that T-cell mediated responses against SARS-CoV-2 are extremely important and more long-lasting than B-cell immunity. Therefore, vaccine strategies and herbal drugs (immunomodulators) that induce strong cellular responses apart from humoral immunity present a significant advantage in the present pandemic [4].

Attenuated pathogen vaccines

Attenuated live pathogen vaccine strategies consist in administering a debilitated form of live pathogen. Lengthy cell culture passaging in non-human cell lines or animals decreases the virulence of the pathogen. This type of vaccines usually elicits robust and long-term memory immune responses after a single dose. B Inactivated pathogen vaccines contain whole pathogen that has been submitted to heat or chemical treatment inactivation. C Subunit vaccines are prepared either from antigen purification of pathogens replicated in cell cultures or from recombinantly expressed antigens. These vaccines commonly require adjuvant addition in order to deliver danger signals to antigen-presenting cells and provoke robust immune responses. D Virus-like particles can be self-assembled in and released from recombinant yeast cells or other expression systems such as the vaccinia virus expression system or even tobacco plants transfected with tobacco mosaic virus. E Viral vector vaccines use a genetically manipulated measles or adenoviral platform to express a foreign antigen commonly resulting in robust cellular and humoral response. F, G lastly, nucleic acid (DNA and mRNA) vaccines are very quick to produce, yet were untested as successful human vaccine strategies. The nucleic acid codifying for an immunogenic protein of the pathogen once administered is captured by antigen-presenting cells that use it to express and present the antigen. These vaccines are predicted to have minor safety issues as nucleic acid is swiftly degraded within the human body [3].

Inactivated pathogen vaccines

A few years after the attenuated cholera vaccine produced by Pasteur, Salmon and Smith were introducing the method of heat, gamma radiation or chemical treatments (i.e., formalin, β -

propiolactone) to inactivate pathogen vaccines aiming to tackle these rare events of severe adverse effects after live-attenuated pathogen administration. Inactivated pathogen vaccines use a dead form of the pathogen, thus ensuring a better safety profile than live attenuated vaccines. However, chemically, irradiated or heat-inactivated pathogens sometimes lose their immunogenicity rendering this strategy less efficacious than live attenuated pathogen immunization. Accordingly, inactivated pathogen vaccines often fail to induce cellular adaptive responses unless and thus require the addition of adjuvants, specific compounds that act as stimulants of immune cells and amplifiers of immune responses, is required [3].

Subunit vaccines

The principle underlying the development of subunit vaccines was based upon the observation that does not need to administer the entire pathogen to elicit strong immune responses, but merely an immunogenic fragment. Protein subunit vaccines, polysaccharide and conjugated vaccines and virus-like particle vaccines are all considered to be different forms of subunit administration strategies that differ in the chemical nature of the antigen administered, the platform used to administer the antigen and the necessity to use an adjuvant to potentially activate the immune system [3].

Protein subunit vaccines

The first forms of developed subunit vaccines aimed to harness early on the ability of protein antigens to elicit germinal centre reactions and lead to high affinity, isotype-switched immunoglobulins. Protein subunit vaccines are generated through recombinant synthesis of protein antigens or protein isolation and purification methods after cultivating large amounts of the pathogen. This strategy eliminates the possibility of severe adverse effects, but frequently raises the necessity to increase booster doses and optimize the adjuvant added to achieve stronger and more durable immunization. The administered antigen is up taken by adjuvant activated antigen-presenting cells (APCs) and presented to adaptive immune cells [3].

Virus-like particle vaccines

‘Virus-like particle’ (VLP) vaccines explore the immunogenicity and safety of empty virus particles presenting several copies of the same antigen on their surface. These are designed to mimic the virus structure, thereby triggering strong immune responses against the antigen(s) presented on their surface; they have good safety profiles because they lack the pathogen’s genetic material. This characteristic, however, represents a complexity in their development because their assembly can be technically challenging. In the mid-1990s, the work of two

independent groups led to the self-assembly of L1 human papilloma virus (HPV) protein into VLPs provided the platform for the GlaxoSmithKline and MERCK vaccine design for HPV [3].

Viral-vectored vaccines

Viral vectors represent one of the latest strategies for vaccine development. Different viruses are modified to reduce their virulence and—usually—their replication potential but maintain their capacity to infect human cells. These are designed to deliver the pathogen's genetic information to immune cells in order to express and present antigenic proteins to lymphocytes. Adenovirus, measles, and vesicular stomatitis virus (VSV) vectors are commonly used for such designs which have been shown to provoke robust immune responses with a single administration. There are two broad viral vector groups used for vaccine production, namely replication-competent and replication-defective viral vectored vaccines. Replication-competent vectors need lower dose to elicit strong responses as the multiplying vector can result in enhanced antigen presentation. Conversely, replication-defective vectors should be administered in higher dosages since they are devoid of a self-propagation capacity. However, this last characteristic allows translating into safer platforms [3].

Nucleid acid vaccines

Nucleic acid vaccines are potent inducers of both humoral and cellular adaptive immune responses and are very fast to deploy since the only ingredient required for their production is the genetic sequence that encodes for a viral antigen and a delivery platform. Their fast-track design and production allowed them to emerge as spearhead candidates against the new coronavirus SARS-CoV-2. Since the DNA and mRNA molecules have different stability and, also include different steps that lead to antigen production these two platforms present different challenges that are analyzed in the following sections [3].

DNA vaccines

DNA vaccines can have different routes of application. They can be delivered intradermally whereby a short electric pulse (electroporation) optimizes their uptake by cutaneous antigen-presenting cells (APCs) such as macrophages, monocytes, and dendritic cells that will process and present them to naïve T cells in secondary lymph organs, thus raising cellular adaptive immune responses. Newly synthesized antigen will also arrive in these organs and initiate naïve B cell activation that will result in antibody production. Subcutaneous administration of DNA will lead to fibroblast and keratinocyte uptake. These cells will subsequently synthesize and release the antigen that can be recognized and phagocytosed by APCs. Transdermal administration of DNA will primarily engage by tissue-resident Langerhans

cells that will express, process, and present the transgene. On the other hand, DNA administered via intravenous injection will systematically reach secondary lymphatic organs, whereas intramuscular application of a DNA vaccine enhanced by electroporation can principally lead to myocyte delivery [3].

mRNA vaccines

The delivery of mRNA vaccines follows the same concept as DNA vaccines with the difference that mRNA only needs to reach cytoplasmic or endoplasmic reticulum ribosomes in order to be translated into protein. mRNA molecules can therefore be administered encapsulated in lipid nanoparticle (LNP) vectors that can encapsulate efficiently nucleic acid and potentially enable tissue penetration to facilitate genetic information delivery in host cells so that foreign antigen protein synthesis can initiate. The subsequent induction of immune responses is similar to the induction of DNA vaccines [3].

COVID-19's effects on the Indian healthcare system

The extremely ambitious COVID - 19 vaccination plans, the routine immunization aim, and ensuring that other public health initiatives, such as those against tuberculosis, poor nutrition, etc., do not suffer are India's three most significant healthcare concerns in 2021.

- Evidence reveals that since India entered a strict state of lockdown in 2020, the populace has had a very difficult time receiving basic healthcare treatments. Inpatient admissions for a variety of illnesses, including TB, dengue fever, and malaria, decreased nationwide.
- Many hospitals were designated as "COVID-19 only," and a sizable portion of the medical workforce was dedicated to COVID-19; other hospitals provided only limited regular services. Traveling to medical facilities was also challenging due to the entire closure of both public and most private transportation.
- Due to the lack of mobility, the lockout, and the overburdened healthcare system, diagnostic testing, medication refills, and medical consultations were significantly disrupted.
- More than 260,000 fewer kids received the BCG vaccine in March 2020 than they did in January 2020. When compared to January 2020, the decline was even more pronounced, and there were just half as many kids receiving the BCG vaccine in April 2020.
- Between January and August 2020, India's malaria cases decreased by 39% while tests for the disease fell by 32% as compared to year 2019.

- TB cases that were reported in August 2020 decreased by over 50% compared to the same month in 2019. (Tuberculosis and COVID-19 pandemic in India; BMJ Global Health).
- Just half as many TB patients were registered as being receiving treatment in April 2020 as compared to February 2020 levels. Compared to January 2020, there were roughly 23,000 fewer patients who had successfully completed TB treatment by June 2020.
- When compared to March 2019, there were at least 350,000 fewer people receiving outpatient diabetes care, 150,000 fewer people receiving outpatient mental health therapy, and around 100,000 fewer people receiving outpatient cancer treatment. [4]

The majority of COVID-19 immunizations are designed to be given in two doses

The two vaccinations (prime-boost) imitate natural immunity in order to be effective. Immunological memory is primed by the first dosage, and it is solidified by the second dose. The immune system requires time to respond to the initial dosage of the vaccine and to develop memory cells that will detect the virus if it is met again. In comparison to a short gap, a longer period between the first and second dosage may trigger a higher immunological response. A 12-week prime-boost interval may increase vaccine efficacy, according to preliminary data from Astra Zeneca's COVID-19 vaccine trials^{1, 2} [4].

COVID-19 vaccinations and SARS-CoV-2 variations

Several COVID-19 vaccines have reported decreased efficacy to protect against mild to moderate disease in individuals infected with SARS-CoV-2 variants, but the vaccines are still anticipated to protect against severe disease and death. Current SARS-CoV-2 variants involve mutations to the gene for the spike protein that is targeted by COVID-19 vaccines. Studies are still being conducted to determine whether some vaccines may be more vulnerable to the effects of variants than others. For example, vaccines that use smaller epitopes (the receptor binding domain on the spike protein) may be more vulnerable than vaccines that use a larger portion of the virus, such as the spike protein or the entire inactivated virus. Other studies are exploring the development of COVID-19 vaccines that make it difficult for the virus variants to evade immunity, for example: multivalent vaccines that include both new (derived from variants) and old forms of the spike protein in a single dose vaccines that target multiple sites on several viral proteins in contrast to vaccines that target only the SARS-CoV-2 spike protein [5].

Allocation of COVID-19 vaccines worldwide:

- Objectives for public health serve as a direction for the distribution of COVID-19 vaccinations. These goals are for the first phase: Lower mortality Safeguard health systems.
- The global vaccines allocation system aims to achieve the following goals to maximise the public health effect of a limited supply of COVID-19 vaccines: reducing severe disease and death in high-risk populations (those over 65, those with cardiovascular diseases, cancer, diabetes, chronic respiratory disorders, or obesity).

Health professionals to safeguard the healthcare system These groups make up 20% of the world's population. As a result, up to 20% of a country's population will receive COVID-19 vaccinations in the first phase 17 G [5]

Ayurveda and Immunity:

Plant extracts may do a lot to strengthen the body, according to traditional medical research. According to Ayurveda, only when all seven layers of our body's tissues—Rasa, Mamsa, Rakta, Medha, Majja, Asthi, and Shukra—are strong can our body survive diseases. Our immunity will be improved when all seven levels are functioning properly. According to Ayurveda, some plants and plant products might boost our immunity by building ojas [6-20]

Table 1: List of some plants having immunomodulator activities

Sr. No.	Plant Name	Biological source/Family/ Part used	Chemical constituents	Uses
1	Moringa	<i>Moringa oleifera</i> Lam./ Moringaceae/Whole plant	Niazinin A, Niazinin B and Niazimicin A, niaziminin B	Antioxident, anti-inflammatory, Anti-diabetic, Antiviral and antifungal
2	Neem	<i>Azadirachta indica</i> J. Juss/ Meliaceae/Whole Plant	Nimbin, 6-desacetylnimbinene, Nimbinene, Nimbandiol, nimbolide, Quercetin	Antiviral, antifungal, Rheumatism, skin disease, jaundice
3	Tulsi	<i>Ocimum sanctum</i> Linn./ (Labiatae)/ Entire plant	Essential oils such as eugenol, cavacrol, derivatives of ursolic acid, apigenin	Carminative, stomachic, antispasmodic, antiasthmatic, hepatoprotective

4	Aswagandha	<i>Withania somnifera</i> fam./ Solanaceae/Root and leaves	withanolides, withaferins, saponins, sitoindosides VII-X, Withaferin-A,	adaptogenic properties, immunomodulation, Anti-inflammatory, hypolipidemic, antibacterial,
5	Guduchi	<i>Tinospora Cordifolia</i> (Willd.) Hook. f. / Menispermaceae/ Stem and leaves	alkaloids, diterpenoid lactones, glycosides, steroids, sesquiterpenoid, phenolics,	Immunomodulators, Anti-inflammatory, treatment of chronic coughs, Antiallergic, Antioxidant
6	Kalamegha	<i>Andrographis paniculata</i> (Burm.f.) Nees/Acanthaceae/ Entire plant	Andrographolide is 3 α , 14, 15, 18-tetrahydroxy-5 β , 9 β H, 10 α -labda-8, 12-dien-16-oic acid γ -lactone	immunity building, antimalarial properties, antibiotic properties, anti-inflammatory activity
7	Adrak	<i>Zingiber officinale</i> Roscoe/ Zingiberaceae/ Rhizome	zingiberene, bisabolene, farnesene, sesquiphellandrene, limonene, cineole, linalool, borneol, geranial and curcumene.	Anti-inflammatory and anti-oxidative, antiviral, antibacterial, antidiabetic, antihyperalgesic, gastroprotective
8	Haldi	<i>Curcuma longa</i> Linn./Zingiberaceae/ Rhizome	Curcuminoids, essential oil, curcumin I, curcumin III, curcumin II, dihydrocurcumin, zingiberene	Antiinflammatory, stomachic, uretic, stimulant, tonic, carminative, blood purifier, antiperiodic,
9	Amla	<i>Emblica officinalis</i> Gaertn/Euphorbiaceae/fruits and leaves	Vitamin C, 7-ketositosterol, Epigallocatechin, Phyllaemblic acid-C	Immunomodulatory, anti-inflammatory, antioxidant, anticancer, antiviral, anti-diabetic, antimicrobial
10	Karripatta	<i>Murraya koenigii</i> / Rutaceae/ Leaves	D-Sabinene, D- α -Terpinol, di- α -phellendrene, D- α -pinene, caryophyllene and dipentene	Antiviral, antifungal, anti-inflammatory, antioxidant

Immunomodulators' and Rasayanas' mode of action

The "Rasayanas" are said to be rejuvenators, nutritional supplements, and have potent antioxidant properties. Additionally, they have an antagonistic effect on oxidative stressors, which results in the production of various free radicals. The consequences of ageing, atherosclerosis, cancer, diabetes, rheumatoid arthritis, autoimmune illness, and Parkinson's disease are mostly treated with them. The Rasayana plants appear to work by influencing the effector arm of the immune response or by acting as immunostimulants, immunoadjuvants, or immunosuppressants. The primary mechanisms of immunomodulation activity include stimulation of phagocytosis, activation of macrophages, immunostimulatory effect on peritoneal macrophages, stimulation of lymphocytes, enhancement of cellular immune function and nonspecific cellular immune system effects, increased production of antigen-specific immunoglobulins, increased numbers of nonspecific immunity mediators and natural killer cells, reduction of chemotherapy-induced leukopenia [21]

Conclusion:

Drugs known as immunomodulatory agents have the potential to change an organism's immune system. If they stimulate or depress the immune system, respectively, they are known as immunostimulants or immunosuppressants. The most typical conditions for which these medications are prescribed are autoimmune disorders, allergic responses, AIDS, cancer, and a few viral infections. Due to financial limitations, providing modern medical services in underdeveloped nations like India still remains a distant objective. Only a small number of plants have been examined for immunomodulatory properties. It is clear from the analysis above that a number of medicinal plants and marine products have immunomodulatory action, but insufficient data prevents their application in clinical settings. As a result, immunomodulatory substances will be given more consideration in future studies on herbal therapy.

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THE COVID 19 VACCINE DEVELOPMENT AND ITS PROSPECTS: A REVIEW STUDY

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Introduction:

In 2019 the coronavirus was identified as the cause of the disease outbreak that originated in Wuhan, china. Corona virus disease (covid 19) is an infectious disease caused by the SARS-COV-2 virus. The virus is also known as severe accute respiratory syndrome coronavirus 2. Corona virus is a family of virus that cause illness such as the common cold. In march 2020, the world health organisation declared the covid 19 outbreak a pandemic. ([www.world health organization.int](http://www.worldhealthorganization.int))

How it spreads:

The virus can spread from an infected person's mouth or nose in small liquid particles when they cough, sneeze, speak, sing or breath. These particles range from respiratory droplets to smaller aerosols. You can be infected by breathing in thr virus if you are near someone who has COVID 19, or by touching a contaminated surface and then your eyes, nose or mouth. The virus spreads more easily indoors and in crowded settings. ([www.world health organization. Int](http://www.worldhealthorganization.int))

Symptoms:

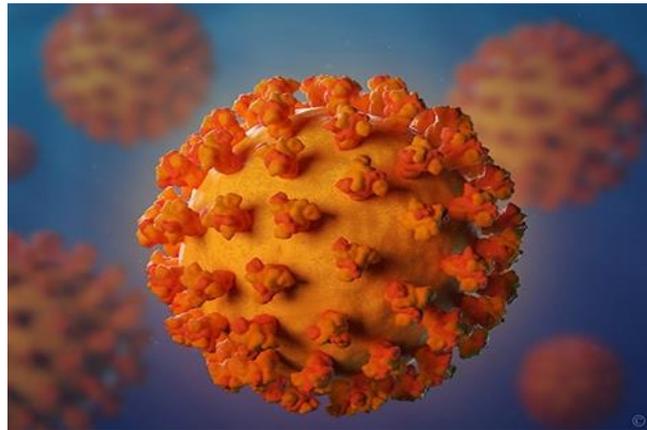
Signs and symptoms of coronavirus disease 2019 (covid 19) may appear 2 to 4 days after exposure. This time after exposure and before having symptoms is called the incubation period. You can still spread covid 19 before you have symptoms common signs and symptoms can include

- Fever
- Cough
- Tiredness

Early symptoms can include a loss of taste or smell. Other symptoms can include

- Shortness of breath or difficulty breathing
- Muscle aches
- Chills

- Sore throat
- Runny nose
- Headache
- Chest pain
- Pink eye
- Nausea
- Vomiting
- Diarrhea



This list isn't complete. Children have similar symptoms to adults and generally have mild illness. The severity of COVID-19 symptoms can range from very mild to severe. Some people may have only a few symptoms. Some people may have no symptoms at all, but can still spread it (asymptomatic transmission). Some people may experience worsened symptoms, such as worsened shortness of breath and pneumonia, about a week after symptoms start.

Some people experience COVID-19 symptoms for more than four weeks after they're diagnosed. These health issues are sometimes called post-COVID-19 conditions. Some children experience multisystem inflammatory syndrome, a syndrome that can affect some organs and tissues, several weeks after having COVID-19. Rarely, some adults experience the syndrome too. People who are older have a higher risk of serious illness from COVID-19, and the risk increases with age. People who have existing medical conditions also may have a higher risk of serious illness. Certain medical conditions that may increase the risk of serious illness from COVID-19 include:

- Serious heart diseases, such as heart failure, coronary artery disease or cardiomyopathy
- Cancer
- Chronic obstructive pulmonary disease (COPD)

- Type 1 or type 2 diabetes
- Overweight, obesity or severe obesity
- High blood pressure
- Smoking
- Chronic kidney disease
- Sickle cell disease or thalassaemia
- Weakened immune system from solid organ transplants or bone marrow transplants
- Pregnancy
- Asthma
- Chronic lung diseases such as cystic fibrosis or pulmonary hypertension
- Liver disease
- Dementia
- Down syndrome
- Weakened immune system from bone marrow transplant, HIV or some medications
- Brain and nervous system conditions, such as strokes
- Substance use disorders

This list is not complete. Other medical conditions may increase your risk of serious illness from COVID-19. (www.mayoclinic.org)

Causes:

Infection with severe acute respiratory syndrome coronavirus 2, or SARS-CoV-2, causes coronavirus disease 2019 (COVID-19). The virus that causes COVID-19 spreads easily among people. Data has shown that the COVID-19 virus spreads mainly from person to person among those in close contact (within about 6 feet, or 2 meters). The virus spreads by respiratory droplets released when someone with the virus coughs, sneezes, breathes, sings or talks. These droplets can be inhaled or land in the mouth, nose or eyes of a person nearby.

Sometimes the COVID-19 virus can spread when a person is exposed to very small droplets or aerosols that stay in the air for several minutes or hours — called airborne transmission. The virus can also spread if you touch a surface with the virus on it and then touch your mouth, nose or eyes. But the risk is low. The COVID-19 virus can spread from someone who is infected but has no symptoms. This is called asymptomatic transmission. The COVID-19 virus can also spread from someone who is infected but hasn't developed symptoms yet. This is called pre symptomatic transmission. It's possible to get COVID-19 twice or more, but this is uncommon.

When a virus has one or more new mutations it's called a variant of the original virus. The omicron (B.1.1.529) variant spreads more easily than the original virus that causes COVID-19 and the delta variant. However, omicron appears to cause less severe disease. People who are fully vaccinated can get breakthrough infections and spread the virus to others. But the COVID-19 vaccines are effective at preventing severe illness. This variant also reduces the effectiveness of some monoclonal antibody treatments. Omicron has a few major offshoots (sublineages), including BA.5 and BA.2.12.1. BA.5 made up about 54% of COVID-19 infections that had genetic sequencing in the U.S. during the last week in June, according to the CDC.

In April, the CDC downgraded the delta variant from a variant of concern to a variant being monitored. This means that the delta variant isn't currently considered a major public health threat in the U.S. (www.mayoclinic.org)

Risk factors:

Risk factors for COVID-19 appear to include:

- Close contact (within 6 feet, or 2 meters) with someone who has COVID-19
- Being coughed or sneezed on by an infected person (www.mayoclinic.org)

Complications:

Although most people with COVID-19 have mild to moderate symptoms, the disease can cause severe medical complications and lead to death in some people. Older adults or people with existing medical conditions are at greater risk of becoming seriously ill with COVID-19.

Complications can include:

- Pneumonia and trouble breathing
- Organ failure in several organs
- Heart problems
- A severe lung condition that causes a low amount of oxygen to go through your bloodstream to your organs (acute respiratory distress syndrome)
- Blood clots
- Acute kidney injury
- Additional viral and bacterial infections (www.mayoclinic.org)

Covid vaccine 19 development:

How does a vaccine work?

Traditionally, vaccines are dead or weakened virus molecules—known as antigens—that trigger defensive white blood cells in the immune system to create antibodies that bind to the virus and neutralize it. Sinopharm's COVID-19 vaccine, which contains inactivated

coronaviruses, is one example. Another well-established method uses isolated proteins from a virus, or fragments of them, to stimulate an immune response; U.S.-based Novavax's COVID-19 vaccine is protein-based.

There are also several types of vaccines that use the virus's genetic material—DNA or RNA—to prompt the body to create antibodies. The vaccines by U.S. pharmaceutical giant Pfizer and partnering German firm Bio N Tech and by U.S.-based Moderna use mRNA, or messenger RNA. No vaccine of this kind had ever been approved for commercial use in humans before the COVID-19 pandemic. Additionally, some COVID-19 vaccines rely on viral vectors, or modified versions of a different virus, to prompt an immune response. Several approved COVID-19 vaccines use viral vectors, such as that by the University of Oxford and British-Swedish company AstraZeneca.

When most of a population has been vaccinated and is immune to a particular disease, even those who are not immune are considered protected because the likelihood of an outbreak is small. This is known as herd immunity. Chicken pox, measles, mumps, and polio are all examples of diseases for which the United States has achieved herd immunity due to vaccines. Scientists are divided about how much of a population must have COVID-19 antibodies to prevent new outbreaks, with estimates ranging from less than half to over 80 percent. Yet, many experts believe that herd immunity for this coronavirus is unreliable in part due to uneven vaccination rates. (www.council on foreign relation organisation)

How is a vaccine developed?

There are many stages involved in the development and production of a vaccine, from initial academic research to distribution to hospitals and doctor's offices.

Clinical trials are crucial indicators of whether a vaccine is effective. Potential vaccines, as with other drugs, are commonly tested in animals first. Human trials are broken up into three phases, progressively increasing the number of volunteers. If a vaccine candidate appears to be ineffective, has harmful side effects, or is too similar to existing vaccines, it won't move on. Trials are often carried out "blind," by which some groups are administered the vaccine and some receive a placebo.

If a vaccine candidate is considered successful in human trials, the developers can seek approval by a national or regional regulatory agency, such as the FDA or the European Medicines Agency. In the United States, less than 10 percent of all drugs that go into clinical trials make it past this part of the process. Prior to approval, a vaccine maker can ask the FDA for an emergency use authorization (EUA), which allows the sale of unapproved medical

products. Finally, the vaccine must be approved by national regulators in other countries to be distributed abroad. Following approval, the vaccine can be manufactured for broad use. In August 2021, the FDA granted approval to the Pfizer-BioNTech vaccine, the first to receive a license in the United States. Modern's vaccine was approved the following January.

Additionally, while the WHO does not approve drugs, the vaccine maker can request prequalification by the WHO—a process to determine quality assurance. Many low- and middle-income countries rely on WHO prequalification when buying medicines. The WHO similarly maintains an emergency use listing (EUL) for unlicensed vaccines and other medical products during a health crisis; eleven COVID-19 vaccines have been issued an EUL (www.council on foreign relation organisation).

How are COVID-19 treatments helping?

Dozens of treatments—which would not prevent someone from being infected with COVID-19 but could help reduce the severity and duration of illness—have been developed or repurposed. Among them is the antiviral drug remdesivir, which was developed by U.S.-based Gilead Sciences and approved by the FDA; studies of the drug have shown faster rates of recovery from COVID-19 and lower risk of hospitalization. Additionally, dexamethasone, a common steroid, has been found to reduce the risk of death in severely ill COVID-19 patients. The FDA has authorized emergency use of convalescent plasma, or blood plasma of previously infected people who have created COVID-19 antibodies. Though plasma donations have already been used in hundreds of thousands of patients, research is ongoing to determine the treatment's effectiveness. Doctors are also optimistic about oral antiviral treatments that can be administered at home. Paxlovid and molnupiravir, pills developed by Pfizer and Merck, respectively, were the first such treatments to be authorized for emergency use by the FDA, in late 2021. (www.cfr.org)

India's first covid vaccine:

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. Bharat Biotech has brought to market 16 original vaccines, including for rotavirus, hepatitis B, Zika virus, and chikungunya.¹ The company reportedly spent \$60-\$70m (£43-£50m; €50-€58m) developing Covaxin.

How does Covaxin work?

The vaccine is similar to CoronaVac (the Chinese vaccine developed by Sinovac)³ 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.⁴ Covaxin comes as a two-dose regime, recommended to be taken 28 days apart. (Kamala Thiagarajan, freelance journalist. 2021)

Side effects of Covaxine:

Injection site pain, Injection site swelling, Injection site redness, Injection site itching, Stiffness in the upper arm, Weakness in the injection arm, Body ache, Headache, Fever, Malaise, Dizziness and weakness, Rashes, Nausea, Vomiting, Allergic reactions, Swelling of face and throat, A fast heartbeat. (Soumendra Darbar at all,2021)

Covishield booster dose:

India is all set to administer Covid-19 booster shots to all adults from April 10 after the Union Ministry of Health gave its nod on Friday amid the drop in new virus cases. While the Centre has laid out certain rules that who will be eligible for the third shot and details regarding appointment booking, but netizens have expressed confusion about which vaccine will be the booster shot. As a result, the Union Health Ministry has cleared the confusion saying the precaution dose will be the same vaccine that was used for the first and second doses. There will not be a cocktail of vaccines.

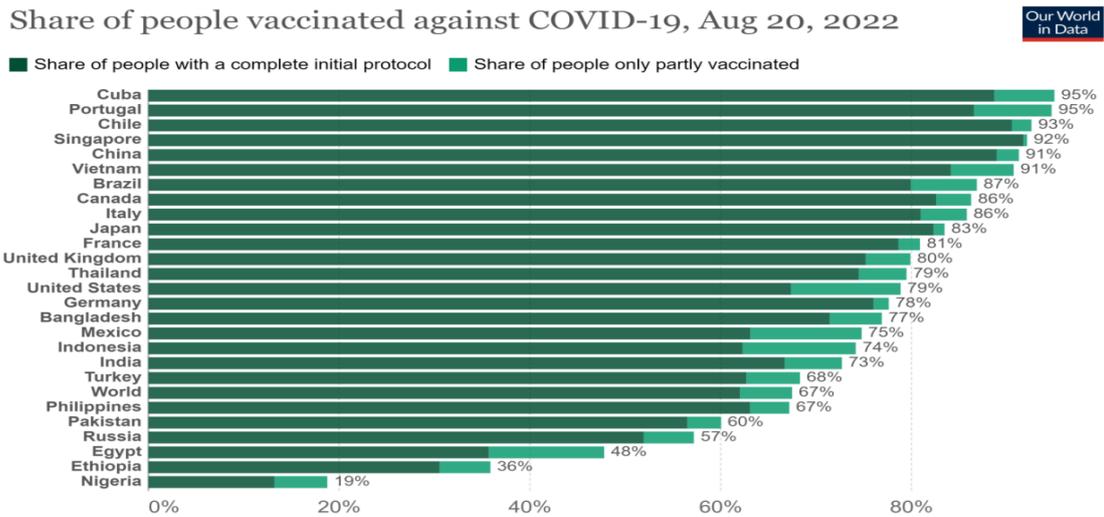
"Precaution dose will be of the same vaccine which has been used for administration of first and second dose. No fresh registrations would be required for precaution dose as all due beneficiaries are already registered on CoWIN," Union Health Secretary wrote on Twitter. Further, the Health Secretary allowed the vaccination centre to impose a service charge on vaccination up to ₹150.

"Private vaccination centres can charge only up to a maximum of ₹150 as service charge for vaccination over & above the cost of the vaccine," the Central government said on Saturday. Meanwhile, Covishield manufacturing company Serum Institute of India has already announced the cost of its vaccine on Friday.

In a notification, the company informed, the end-users will have to pay ₹600 for a Covishield booster dose and the hospitals will get it at a discounted price. The government in January launched a state-funded booster programme for health workers and people older than 60, which has since administered 24 million shots.

India launched its Covid vaccination campaign in January last year, banking on homemade vaccines Covishield and Covaxin. India remains the world's third-worst affected nation by the virus after the United States and Brazil. More than 521,000 people have died and over 40 million have been infected across the country since the pandemic began in January 2020, according to official figures. (www.livemint.com)

Share of people vaccinated against COVID-19 (Aug 20, 2022):



Source: Official data collated by Our World in Data
 Note: Alternative definitions of a full vaccination, e.g. having been infected with SARS-CoV-2 and having 1 dose of a 2-dose protocol, are ignored to maximize comparability between countries. CC BY

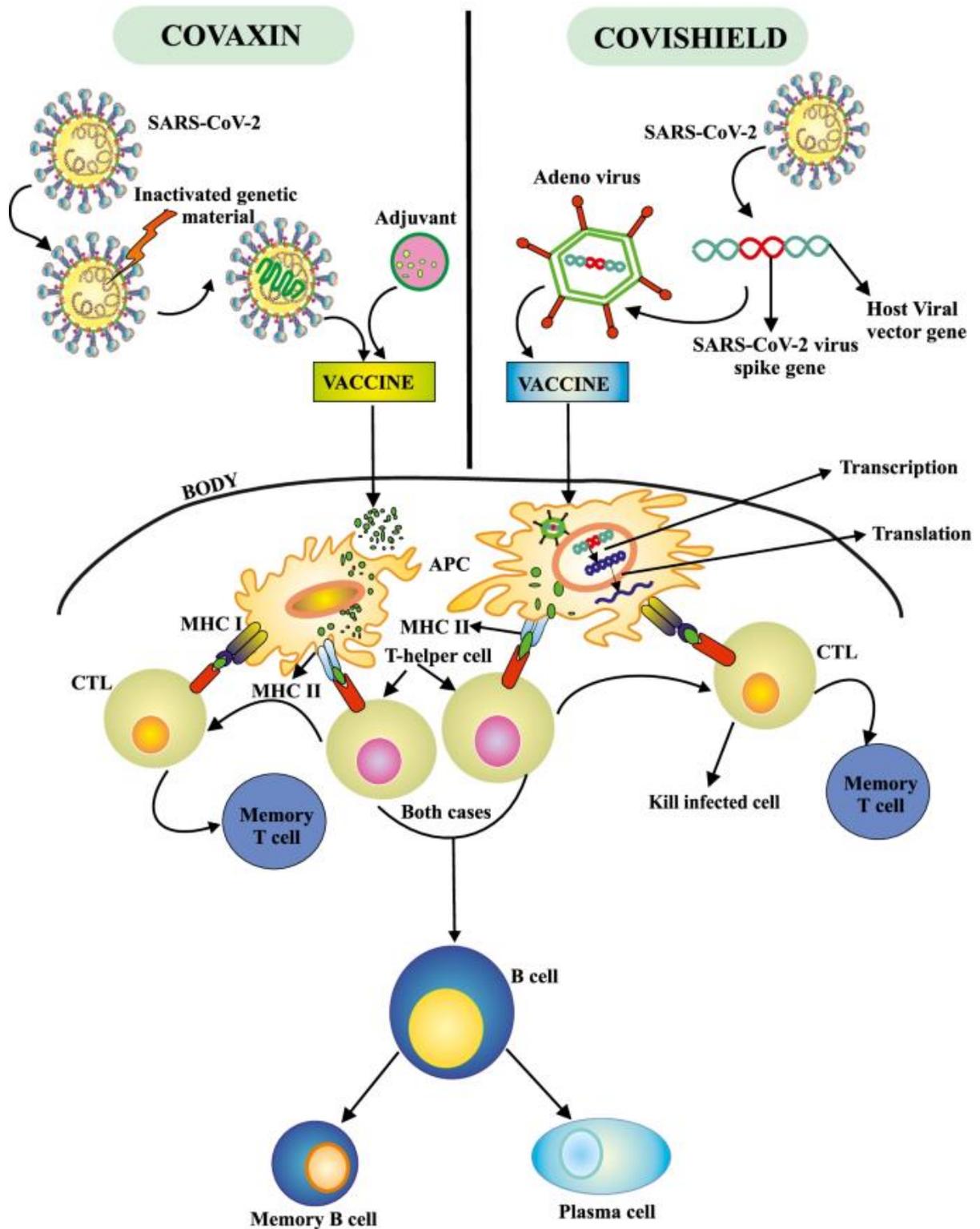
Mechanism of covaxine:

Covaxin works by teaching the immune system to make antibodies against the SARS-CoV-2 coronavirus. The antibodies attach to viral proteins, such as the so-called spike proteins that stud its surface. To create Covaxin, Bharat Biotech used a sample of the coronavirus isolated by India’s National Institute of Virology. Once the researchers produced large stocks of the coronaviruses, they doused them with a chemical called beta-propiolactone. The compound disabled the coronaviruses by bonding to their genes. The inactivated coronaviruses could no longer replicate. But their proteins, including spike, remained intact. The researchers then drew off the inactivated viruses and mixed them with a tiny amount of an aluminum-based compound called an adjuvant. Adjuvants stimulate the immune system to boost its response to a vaccine. Inactivated viruses have been used for over a century. Jonas Salk used them to create his polio vaccine in the 1950s, and they’re the bases for vaccines against other diseases including rabies and hepatitis A. (www.nytimes.com/bharath-biotech-covid-19-vaccine)

Prompting an immune response:

Because the coronaviruses in Covaxin are dead, they can be injected into the arm without causing Covid-19. Once inside the body, some of the inactivated viruses are swallowed up by a type of immune cell called an antigen-presenting cell. The antigen-presenting cell tears the coronavirus apart and displays some of its fragments on its surface. A so-called helper T cell may detect the fragment. If the fragment fits into one of its surface proteins, the T cell becomes

activated and can help recruit other immune cells to respond to the vaccine. .
(www.nytimes.com/bharathbiotech/covid19vaccine)



(Source: immunogenic and rectorgenic efficacy of covaxine and covishield comparative review link.springer.com)

Making antibodies:

Another type of immune cell, called a B cell, may also encounter the inactivated coronavirus. B cells have surface proteins in a huge variety of shapes, and a few might have the right shape to latch onto the coronavirus. When a B cell locks on, it can pull part or all of the virus inside and present coronavirus fragments on its surface. A helper T cell activated against the coronavirus can latch onto the same fragment. When that happens, the B cell gets activated, too. It proliferates and pours out antibodies that have the same shape as their surface proteins ([www.nytimes.com/bharath biotech covid 19 vaccine](http://www.nytimes.com/bharath-biotech-covid-19-vaccine)).

Stopping the virus:

Once vaccinated with Covaxin, the immune system can respond to an infection of live coronaviruses. B cells produce antibodies that stick to the invaders. Antibodies that target the spike protein can prevent the virus from entering cells. Other kinds of antibodies may block the virus by other means ([www.nytimes.com/bharath biotech covid 19 vaccine](http://www.nytimes.com/bharath-biotech-covid-19-vaccine)).

Conclusion of vaccine development:

The sudden emergence of a previously unknown, highly contagious respiratory pathogen as the cause of a global pandemic necessitated the rapid development and testing of vaccines. This effort benefited from more than a decade of advances in vaccine antigen design and new vaccine platform technologies. The rapid development and high protective efficacy of these initial COVID-19 vaccines was not based on chance. This success was driven both by strategic investments in new vaccine technologies and by advances in immunogen design, such as the stabilizing of class I viral fusion proteins in their prefusion conformation. For COVID-19, this structure-based vaccine design resulted in levels of neutralizing antibodies that can surpass levels generated by natural COVID-19 infection. In retrospect, the road to success highlights the importance of investing in basic virology and vaccinology research and leveraging the prototype pathogen approach, having access to nimble manufacturing platforms ready for mass-scale use, and being able to rapidly design and launch pivotal efficacy studies with experienced trialists. The United States and international public-health experts now need to analyze lessons learned and insist on global agreements and commitment to pandemic preparedness, thereby increasing capacity for pandemic response, including the transfer of technology and manufacturing capability to LMICs, and intensifying surveillance efforts to identify potential pathogens and prevent or control future zoonotic spillover (Karin Bok *et al.*, 2021).

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IMPACT OF CORONAVIRUS 2019 ON AQUACULTURE

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Abstract:

Covid-19 pandemic and subsequent lockdown affected not only public health but it also resulted in disaster for aquaculture. Steps have been taken to keep the public informed about the ongoing impact on fisheries and aquaculture food systems, as well as responses by aquatic food producers and governments to mitigate the negative effects on aquatic food value chains. New challenges have arisen, as well as government and industry innovations along the aquatic food value chain. Working with sectoral and regional groups to establish a variety of strategies to manage aquaculture and related industries during the pandemic is critical. Some lessons on how to rebuild better are already emerging, ensuring that the resilience of aquatic food value chains is strengthened to withstand future crises, ensuring that sustainability; livelihoods and food security are not compromised. Food loss along with waste of high-value and perishable food is reduced to meet the Sustainable Development Goal targets. The opportunity to reform the food system to be more inclusive, greener and resilient to future shocks is a good side of the epidemic.

Keywords: agriculture, food security, fisheries, pandemic

Introduction:

Global fisheries and aquaculture production (excluding aquatic plants) hit a new high of over 179 million tonnes of live weight equivalent in 2018. Overall, capture fisheries accounted for 54% of the total, with 96.4 million tonnes, while aquaculture accounted for 46% with 82.1 million tonnes. Aquaculture has been the primary engine of increased fish output over the past three decades, but the catch fisheries industry remains dominant for a number of species and critical for local and international food security. Indonesia, China, India, Peru and Vietnam are

the leading producers in 2018, with China, India, Indonesia, Vietnam, and Peru leading the way. The fisheries and aquaculture industries are becoming increasingly globalised (WHO, 2018).

Since 2013, salmonids (salmon, trout, etc.) have become the most valuable commodity traded, accounting for nearly 18% of the overall value of internationally traded fish products. Shrimp and prawns account for roughly 17 percent of all exported species, followed by groundfish (9 percent) (e.g. hake, haddock, cod, and Alaska pollock) and tuna (9 percent). Preliminary results for 2018 show that fish and fish products commerce increased even more in 2018, reaching a new high of USD 163 billion (Ramsden and Harkell, 2020).

Why is aquaculture being at COVID-19 pandemic danger?

Fishing, aquaculture production, processing, input transit, distribution, wholesale, and retail marketing are all important aspects of a fisheries or aquaculture supply chain. Each of these operations is equally important to the supply chain's performance. Impacts from COVID-19 and similar actions have the potential to disrupt or stop each stage of the chain. If the disease or containment measures break one of these buyer–seller linkages, the result will be a cascade chain of disturbances that will harm livelihoods and food security. Households in financial trouble may have to cut back on their spending. Reduced household demand, which is also influenced by cost-cutting measures (e.g., closure of food services, tourism sites, etc.), has an impact on production, processing, and distribution, as well as on foreign and domestic trade. The idea that live, fresh, or chilled fish – which account for 45 percent of all fish ingested – is highly perishable adds to the supply chain's logistical issues.

Furthermore, a country's imports and foreign revenue are both affected by reduced domestic demand and broad containment measures, with severe ramifications for a sector that is heavily reliant on international commerce. Finally, financial difficulties in a corporation might result in wage cuts, reduced working hours, or even layoffs. Because the financial sector is in trouble, it has fewer resources to withstand economic losses. Furthermore, many insurers do not cover business interruptions caused by occurrences like COVID-19.

Pandemic's impact on the aquaculture food system

COVID-19 (Corona Virus Disease, 2019) began as a locally circulating infection. The WHO declared the COVID-19 outbreak a pandemic on March 11, 2020, citing an increasing number of cases recorded outside of China, from Eastern Asia to Europe and North America (WHO, 2020). The pandemic spread around the world in the first half of 2020, with certain places faring worse than others, including many key fish-producing and/or fish-consuming countries, as well as worldwide fish feed providers. Fig. 1 shows the effect of pandemic on

different sectors. While most countries regard fishing and aquaculture, as well as the delivery of their goods, the steps taken to restrict the spread of illness posed substantial direct and indirect obstacles to the sector.

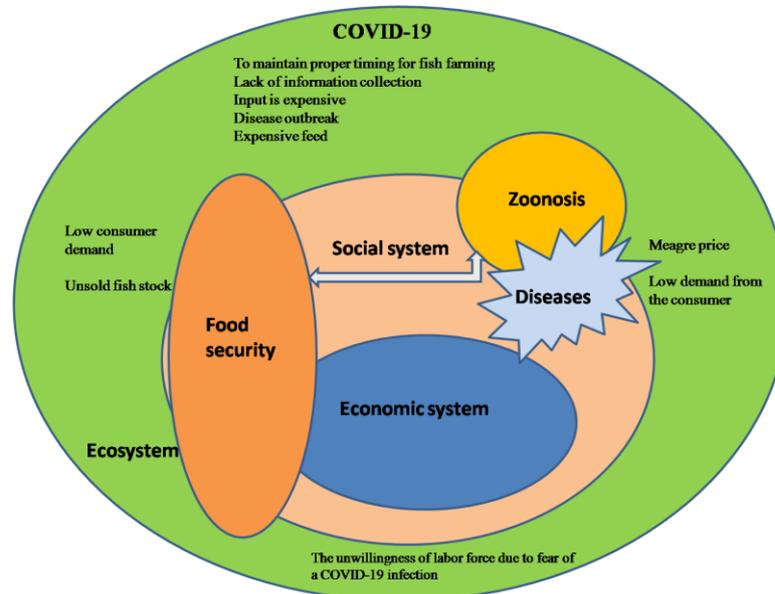


Figure 1: Impacts of COVID-19 pandemic

Effect on the output of capture fisheries

Many fishing fleets have ceased or reduced operations as a result of the drop in demand, which has resulted in lower prices for fish and fish products. Due to low demand and a lack of storage for a perishable product, quotas have not always been filled. Export-oriented fleets are more likely to be affected than fleets serving domestic markets. Sanitary measures (physical distance between crew members at sea, facial masks, etc.) and a lack of appropriate equipment (e.g. masks and gloves) make fishing difficult (and in some circumstances dangerous) and may result in the suspension of activities (Blank, 2020).

Another restraint on the fishing business is a lack of input supplies (such as ice, gear, and bait) due to suppliers closing or being unable to offer inputs on a credit basis. The effects on catches have varied around the world, with many nations experiencing dramatic declines in productivity in the early weeks of the crisis, followed by improvements as the sector reacted. Furthermore, movement limitations for professional seafarers and marine employees have prohibited crew changes and repatriation by preventing them from disembarking in ports and transiting across national boundaries (i.e. to an airport).

As a result, fishing crews have been stranded at sea on vessels (Santos, 2020) or in foreign nations for months without pay, resulting in a human rights issue, particularly for

migratory and transient workers. This is an area that has to be improved in order to ensure that these vulnerable workers have social protection in the future.

Production of aquaculture

The aquaculture production industry, which includes both freshwater and marine aquaculture, is incredibly varied, yet it still relies significantly on labour, inputs, funding, and markets, all of which have been and will continue to be impacted by the COVID-19 pandemic.

The aquaculture production and market economic environment remains very variable and uncertain, which has a direct impact on the activities. Because fish production is seen as an important source of revenue, household resilience, trade, and food security in many countries, farmers are expected to continue to care for their fish and not give them away as gifts or sell them (Le Télégramme, 2020).

However, due to the present lockdown and economic downturn, the industry may struggle to maintain its activity or maintain its scheduled production cycles, as markets, supplies of production inputs (e.g. seeds, feeds), as well as access to finance, may be disrupted or drastically restricted. In the short term, labour layoffs may increase due to confinement measures, but in the medium to long term, they may grow due to financial or cash flow challenges faced by farms, or travel barriers for seasonal or migratory workers. During the COVID-19 epidemic, some nations have exempted the aquaculture sector from lockdown measures or developed guidelines to control the free movement of personnel (Ramsden and Harkell, 2020).

One recent global adaption has been the development of direct retail sales, whether through online ordering and home delivery or aquaculture drive-ins. Another adaptation has been to prepare and freeze commercial-sized fish in order to store them in cold storage (EFE: AGRO, 2020). Small-scale aquaculture and fish farming operators in locations where fish imports are significant, on the other hand, may benefit from less competition, particularly if they can obtain retail markets.

Trade, market, and after-harvest

Along with the majority of industries, the wild and farmed aquatic food sector is dealing with an uncertain demand outlook and there have been plenty of supply issues. Food service demand has decreased significantly as a result of the effective shutdown of the restaurant business in several areas, while retail sales have been distinguished by great instability. Fresh fish sales, for example, have decreased by 30% in France, Italy and Spain. Furthermore, several seafood trade events around the world have been cancelled, resulting in missed opportunities for large buyers and sellers who rely on these regional events.

Table 1: Effect of COVID-19 on supply chain

Major Supply Chain Domains	COVID-19 Impacts	References
Aquaculture production	<ol style="list-style-type: none"> 1. Access to catch fisheries is restricted. 2. Increased labour cost 3. Reduced time spent capturing 4. Restrictions on travel 	<ol style="list-style-type: none"> 1. Fiorella <i>et al.</i>, 2021 2. Campbell <i>et al.</i>, 2021 3. Paradis <i>et al.</i>, 2021 4. Ruiz-Salmón <i>et al.</i>, 2021
Fishing	<ol style="list-style-type: none"> 1. Maintaining unsold stock has become more difficult. 2. Demand and price are both down. 3. Non desired seed stock 4. Input and transportation costs have risen. 	<ol style="list-style-type: none"> 1. Islam <i>et al.</i>, 2021 2. Sarà <i>et al.</i>, 2021 3. Manlosa <i>et al.</i>, 2021 4. Cooke <i>et al.</i>, 2021
Cold storage facilities	<ol style="list-style-type: none"> 1. Access to cold storage facilities is limited. 2. Due to the perishable nature of the commodity, there was an unexpected loss. 	<ol style="list-style-type: none"> 1. Fahlevi <i>et al.</i>, 2021 2. Kumaran <i>et al.</i>, 2021
Processors	<ol style="list-style-type: none"> 1. The expense of transportation has risen. 2. Rates of sale and prices are declining. 3. Inputs that are costly 4. Due to constraints, transportation is limited. 	<ol style="list-style-type: none"> 1. Ramsden and Harkell, 2020 2. Bennett <i>et al.</i>, 2020 3. Fiorella <i>et al.</i>, 2021 4. Kumaran <i>et al.</i>, 2021

Worker health is affecting fresh fish processing, as are staff shortages as a result of COVID-19 disease and mandatory quarantine. COVID-19 positive workers have forced the closure of fish processing plants in a number of nations (Xuemin, 2020). Workers' demands for better health and safety conditions may also cause processing activities to be disrupted. As a result, processing capacity and output are reduced. Furthermore, low demand for fish causes production disruptions and necessitates an expansion in storage capacity by processors to cope with incoming raw materials and completed goods. Processors who are proactive have reacted by

implementing strict safeguards, such as physical separation of workers and temperature checks. Table 1 shows how COVID-19 had disrupted the food supply chain domains.

Overall, demand has dropped significantly, and prices have dropped for many species, notably those marketed to the food service industry. Changes in demand are influencing the storage of fish and shellfish, a perishable food commodity with a high value, resulting in increasing food loss and waste. Fig 2 demonstrates the changing strategies taken to cope with the pandemic.

Various factors like blocked roads and flight cancellations have resulted in higher transportation costs. Despite the fact that global demand for air travel is declining, the cost of air freight has increased significantly (Lennane, 2020). Many wholesale and retail fish markets, especially in developing nations, are congested and packed, posing an infection risk to both dealers and consumers. Retail marketplaces in some nations have become highly regulated to ensure physical separation and other hygienic standards, preventing consumers from accessing the market and reducing income for fish sellers and fishermen.

To combat infection threats, shops in more developed countries have implemented home delivery and online services (Anthonysamy, 2020). The wide-ranging ramifications of the COVID-19 epidemic, as well as the new market landscape, continue to dominate the global fisheries and aquaculture sectors' outlook.

Due to the impact of containment limits on demand, logistics, prices, labour, and business planning, fish supply, consumption, and trade income are all predicted to drop this year. For the first time in several years, global aquaculture production is predicted to decline by 1.3 percent (FAO, 2020a). Longer production cycles, such as salmon, make it difficult to respond swiftly to market swings, though shrimp and pangasius producers have been able to considerably lower their output. Global catches from wild fisheries are likely to fall marginally as a result of COVID-19-related restrictions on fishing vessel workers and low market circumstances, which are expected to diminish overall fishing activity. The pandemic's market consequences have resulted in a number of far-reaching changes, many of which are expected to last in the long run. Most traded species' aggregate prices for 2020, as determined by the FAO's Fish Price Index (FAO, 2020b), were lower than last year. The picture for the fourth quarter of 2020 was uncertain, with firms and consumers alike showing a significant trend toward risk aversion. In many nations, a second wave of the pandemic has emerged, highlighting the ongoing threat to market stability. Product developments, new distribution channels, e-commerce and home

delivery, and the shortening of supply chains, all of which have coincided with this upheaval, are expected to benefit the fish industry for many years to come.

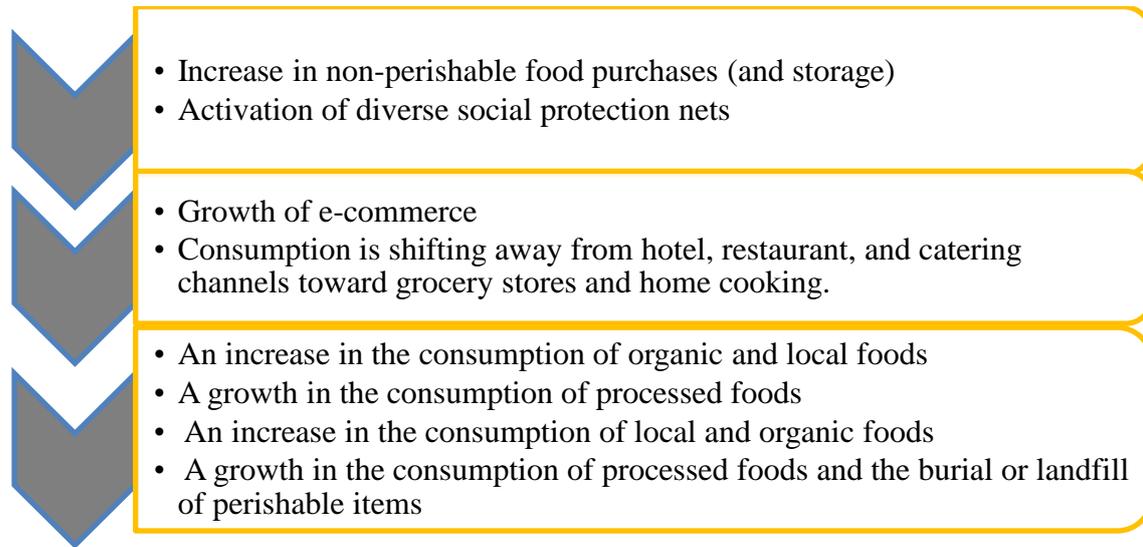


Figure 2: Adaptive strategies taken by people under agri-food systems after COVID-19

Security of food

Although early reports associated with the emergence of COVID-19 centred on fish and conventional markets, subsequent studies have shown that COVID-19 is spread primarily through human-to-human transmission of the virus, known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) – either through droplets or direct contact with an infected person. Because the receptor proteins for corona viruses on the cell membrane of humans and fish have very little genetic resemblance, fish are exceedingly unlikely to be infected by SARS-CoV-2 (Chen *et al.*, 2020). It's vital to note that there's no proof that any virus that causes fish sickness is also pathogenic to people. Fig. 3 shows the steps to be taken after COVID-19 pandemic.

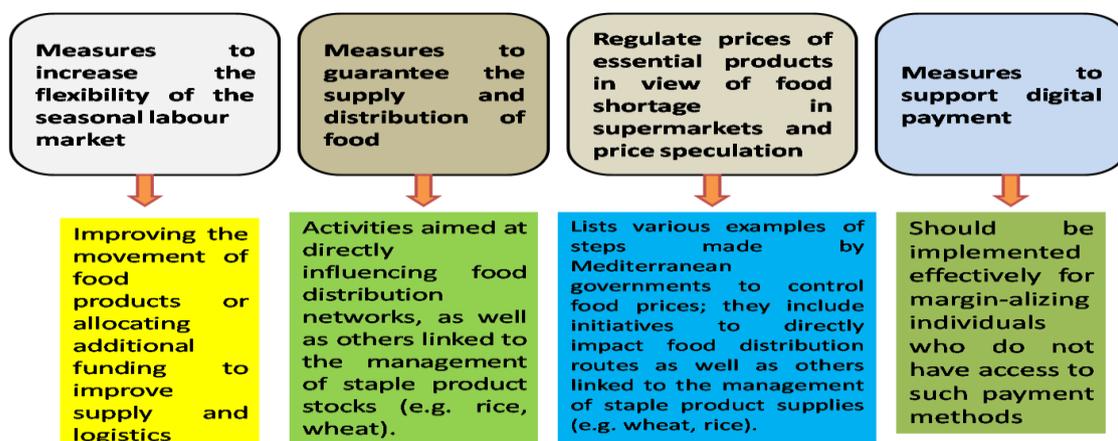


Figure 3: Measures to be taken after COVID-19 pandemic

Safety of food

COVID-19 cannot be transferred by fishery or aquaculture products, according to current evidence (WHO, 2020a). However, any food can be contaminated with viruses by contact with infected equipment, surfaces, or environments, including people's hands, gloves, or aprons, just as it could before the current pandemic. Cleaning, disinfection, and crosscontamination prevention are crucial in the prevention of foodborne infections. COVID-19 is typically spread from person to person, and food workers infected with COVID-19 could contaminate food with SARS-CoV-2. It is crucial to note, however, that food has not yet been identified as the source of the disease's transmission to humans. The use of basic sanitation principles, personal cleanliness, and well-established food safety protocols are all key strategies to limit the risk of cross-contamination. Food safety hazards can also be reduced by thoroughly boiling fishery and aquaculture products before consumption.

Conclusion and Future Perspectives:

Stakeholders and communities in the fisheries and aquaculture sectors have suffered as a result of the ongoing, restrictive measures imposed on transportation and travel. Fishermen and other supply chain actors have faced a number of challenges as a result of COVID-19, including limited input supply, a lack of technical support, an inability to market their products, a lack of transportation to the market, export restrictions on fish and fishery products, and low fish prices. This chapter reveals effects of COVID-19 dilemma on aquaculture and the fish food chain, recommending in particular the availability of interest-free loans for stakeholders in the fisheries sector, which could aid in their resilience. In addition, future lines of research should be there to analyze and purpose solutions for the impacts of COVID-19 on stakeholder in the fish and aquaculture business.

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COVID-19: IMPACTS ON MENTAL HEALTH

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Abstract:

Covid -19 pandemic shook the whole world, it affected individual and society and caused disruption, anxiety, stress, depression, phobias and obsessive compulsive disorder. Isolation, social distancing and closure of work place and educational institution and entertainment venues consigned people to stay in their homes, it was helpful in breaking the chain of infection. These preventive measures had affected the mental health of individual from across the world.

Introduction:

The world had faced an anomalously crisis due to the novel coronavirus. First it was detected in Wuhan, China in December 2019. The World Health Organization defined coronavirus as a family of viruses that range from the common cold to middle respiratory syndrome and severe acute respiratory syndrome coronavirus. Coronaviruses circulate in some wild animals and have the capabilities to transmit from animals to humans. These viruses cause respiratory symptoms in humans, along with other symptoms of the common cold and fever. There were no specific treatment to fight with coronavirus, Infection could have been avoided by maintaining physical distancing from infected person and basic personal hygiene.

The WHO declared coronavirus disease (Covid-19) as a global pandemic on March 11, 2020. The disease had spread across 212 countries and territories around the world, with a total of more than 3 million confirmed cases, In India the disease was first detected on January 30, 2020 in Kerala in a student who returned from Wuhan. After the 3 cases from January 30 to February 3, 2020, there were no confirmed cases for about a month. The Covid-19 cases appeared again from March 2, 2020 onwards. These cases are related to people who had been evacuated or had arrived from Covid-19 affected countries. From March 2, 2020 onwards there was an exponential growth in the daily number of Covid-19 cases at the pan India level.

Most people infected with the virus will experience mild to moderate respiratory illness and recover without requiring special treatment. However some will become seriously ill and require medical attention. Older people and these with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease or cancer are more likely to develop

serious illness. Anyone can get sick with Covid-19 and become seriously ill or die at any age. The Covid-19 pandemic caused an untold fear and suffering for older people across the world. Fatality of over rate over 80 years of age was five times the global average.

The virus can spread from infected person's mouth and nose in small droplets when they cough, sneeze, speak and breathe. These particles/ droplets range from larger respiratory droplets to smaller aerosols. It was required to practice respiratory etiquettes like by coughing into a flexed elbow, and to stay home and self- isolation until recovery if someone feel unwell. The Covid-19 has had terrible impacts on the daily lives of individuals in the first half of 2020 across the globe. Widespread lockdown and preventive measures have isolated individuals, affected the world economy and limited access to physical and mental healthcare. While these measures were necessary to minimize the spread of the virus but it had reduced the income and threatens the food security of people. One fourth population of India is below poverty line and approximately half a billion population is working in the informal sector, living on daily wages. March 2020, due to the Covid-19 national lockdown imposed in the country it has affected millions of lives, leaving them hungry, penniless and with no money and means to earn, these people depend on others for food and help. The people not only feared for their lives but also the stigma attached to the infection the lockdown fanned their fears further as they faced isolation, uncertainty and income loss. The second wave of epidemic showed a very formidable form in which countless people had lost their family members, relatives and dear ones whose effects can still be seen on their lives and they are still struggling to return to normal life. People are facing lots of emotional and mental challenges like obsessive compulsive disorder, Anxiety, Depression, stress, fear and phobias. The lockdown badly affected every aspect of life.

Effect of pandemic on mental health:

Pandemic had aggravated mental health problems in people of all ages across the globe. "Mental illness is still poorly understood, inadequately addressed and needs a whole of community approach to address the spectrum from mental health to severe mental health." According to WHO, the pandemic had taken a dire toll on mental health, indicating that cases of anxiety and depression had swelled by over 25% globally. Mental health is one such issue whose implication has still not been completely assessed. Some may not be aware of it, others may be aware but won't want to acknowledge it and not willing to talk about it. The stigma attached to mental health issues makes mental health situation more alarming in India. Due to the situation of lockdown twice, people had to face challenges of mental health problems. The lockdown was helpful in controlling the spread of virus but badly affected the mental health of the people. The

impact of prolonged lockdown on people can be seen in form of depression, OCD, stress and different kind of phobias. People had faced many kind of insecurities like of losing of loved ones, fear of losing job, fear of infection, fear to face someone.

Conclusion:

Whatever the situation was by the Covid-19 but the global response of society was very helpful and admirable it bridged the gap between poor and rich. Everyone had stretched his hand for help for needy who were fighting with covid-19. Helping each other with financial help, medical help, transportation help, e-employment, grossary delivery help, tele consultation help, and telemedicine help by doctors and mental and emotional support by telephonic conversation and many more relief provided by community and many non- governmental organization. Ultimately tis pandemic gave us a lesson of one world family. By helping each other we can come out of any traumatic situation.

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COVID -19 AND GLUCOSE METABOLISM

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Abstract:

COVID-19 is caused by the SARS-CoV-2, a highly infectious disease. Some individuals are more prone to develop the severe form of COVID-19. For severe symptoms of COVID -19, age, cardiovascular diseases, and diabetes are the main risk factors. Diabetes has been very common in the past few years and now more than 400 million people living with diabetes in the world and about half of them do not know they have diabetes. People with diabetes develop severe COVID disease. This pandemic has shown that people with diabetes are at higher risk than people without diabetes and also dying of COVID. When people with diabetes develop a viral infection, it can be difficult to treat due to fluctuations in blood glucose levels and presence of diabetes complications. The two main types of diabetes are type 1 and type 2. Type 2 is more common. In people with diabetes there is more inflammation in the body with COVID that inflammatory state gets worse much more quickly.

Keywords: SARS-CoV-2, COVID-19 Diabetes, pandemic, inflammation

Introduction:

The 2019 novel coronavirus disease (COVID-19), caused by severe acute respiratory syndrome coronavirus -2 (SARS-CoV-2), is seriously troubled the health sector. This pandemic has badly affected humans and caused considerable morbidity and mortality worldwide. Diabetes is one of the most frequent comorbidities associated with COVID-19 [1]. Diabetic people with uncontrolled blood glucose levels are prone to develop the severe form of COVID-19. An American study reported that 122 patients admitted in hospital for COVID-19, the rate of mortality during hospital stays of those suffering from diabetes or hyperglycaemia was four-fold higher (28.8%) than that of patients with normal glucose level (6.2%). When the diabetic people caught infection of virus, the progression of the disease is fast and becomes much more severe.

Both type 2 and type 1 diabetics, are more prone to severe disease, but Type 1 patients do better because they're younger. Type 1 seems to have a higher risk than type 2 of a severe COVID illness and death because in Type 1 most of the insulin producing cells in the body are destroyed by an immune process, their immune system is compromised, found difficult to fight the virus and required longer recovery period. Secondly, elevated blood glucose is favourable for virus to replicate. In diabetes immune system becomes weak which may be the primary cause of mortality in COVID-19 patients (Fig-1). Virus clearance is decrease when blood glucose level increase as it affects neutrophil chemotaxis and phagocytosis which improve the viral binding affinity and entry. In addition, it has significant effects on the proteins by inducing glycosylation and altering the composition of complements, and glycosylation renders cells susceptible to viral inflammation and damage. In severe COVID-19 patients, dysfunction of adaptive immune response and epithelial cell death is associated with the cytokine storm. Reports from the Centres for Disease Control and Prevention (CDC) and other national health centres demonstrated that the risk of a fatal outcome from COVID19 could be up to 50% higher in diabetes patients than people without diabetes. DM patients present a higher COVID-19 risk, and diabetic individuals infected with the disease have impaired virus clearance [2,3]. Diabetes is one of the most frequent comorbidities associated with COVID-19. Number of studies showed that the incidence of diabetes was twofold greater in severe patients compared to their non-severe counterparts. In the patients with diabetes, there is a risk of severe complications like Adult Respiratory Distress Syndrome and multiorgan failure [3,4,5]. COVID-19 patients with diabetes had an increased risk of mortality [6]. SARS-CoV-2 infection is accompanied by the release of many pro-inflammatory cytokines [tumour necrosis factor (TNF), interleukin-6 (IL-6), and IL-1 β] described as “cytokine storm”, which correlates with vascular hyperpermeability, lung injury, multiorgan failure, and severity of COVID-19 (Fig- 2) [7,8,9]. In severe condition, inflammation and cytokine production is greatly increased which generate insulin resistance and affects the function of beta cells involving a further reduction of insulin secretion [10]. This reduction in insulin secretion may induce hyperglycaemia, which can elevate the virulence of SARS-CoV-2 and reduces the phagocytic activity and polymorphonuclear leukocytes [11]. SARS-CoV-2 causes changes in glucose metabolism, which would result in the complication of the pathophysiology of pre-existing diabetes or the creation of new mechanisms of disease [12]. Zhu et al. [13] found that improvement in glycaemic control results in better outcomes in COVID-19 patients and pre-existing T2D, so that covid patients with well-controlled blood glucose (upper limit ≤ 10 mmol/L) had markedly lower mortality in comparison to those with

poorly controlled blood glucose (upper limit > 10 mmol/L) during hospitalization. It has also been suggested that COVID-19 may trigger diabetes onset in predisposed subjects. Thus, it is evident that Severe SARS-CoV-2 infection and its associated hyperinflammation contribute to hyperglycemia through an indirect negative effect on insulin target tissues and a potential direct negative effect on pancreatic b-cells (14). The resulting hyperglycemia can worsen the prognosis of COVID-19 (15–18).

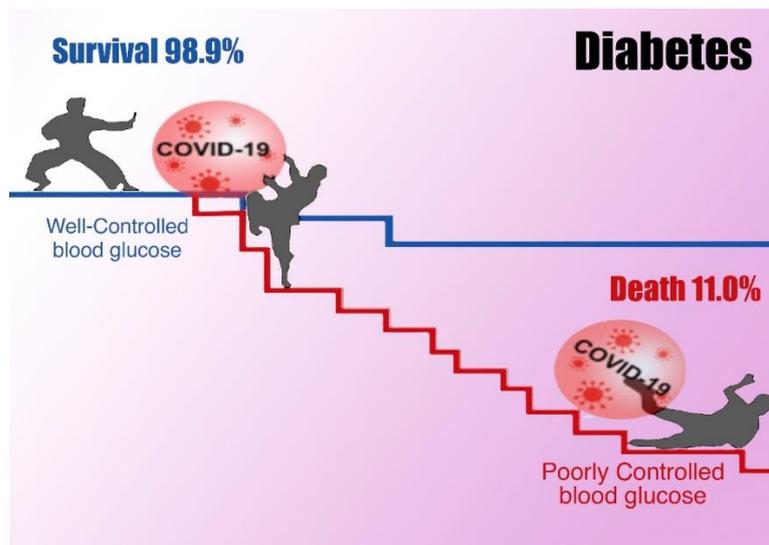


Figure 1: Relation showing between COVID –19 and blood glucose

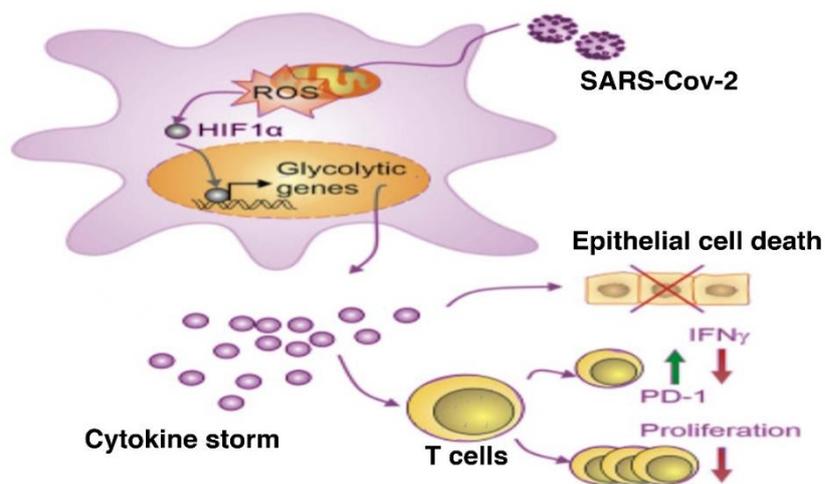


Figure 2: Production of excessive inflammatory “cytokine storm” in severe COVID-19

COVID-19 and glucose metabolism

Diabetic patients are prone to severe SARS-CoV-2 infection (13) they essentially need medication and hospitalization as they have poor glycaemic control (8,15). Hyperglycaemia and

sustained aerobic glycolysis in monocytes directly promote replication of virus, cytokine production, subsequent T cell dysfunction and lung epithelial cell death. Therefore, elevated blood glucose level might support viral proliferation. In patients with diabetes mellitus glycaemic deterioration is a typical complication of COVID-19. For example, in patients requiring insulin, SARS-CoV infection was associated with a rapidly increasing need for high doses of insulin (often approaching or exceeding 100 IU per day) (16). Changes in insulin needs are associated with the levels of inflammatory cytokines can changes the dose of insulin (16,17). For the rapid and efficient replication, viruses alter the metabolism of the host cell and spread. They increase the uptake of glucose to support metabolic signalling, i.e., aerobic glycolysis, a primary pathway of glucose metabolism. In Type 2 diabetes, impaired insulin secretion causes abnormal glucose metabolism which affects several tissues important for the regulation of whole-body metabolism, such as liver, adipocytes, muscle, pancreatic islets, and immune cells. In hyperglycaemia, Glucose metabolism is increased which may enhance the entry of SARS-CoV-2 and their replication that worsened immune response in individuals with diabetes. Thus, a disrupted glucose metabolism may be an intrinsic cellular strategy that favours SARS-CoV-2 pathogenesis. In this reference, Codo *et al.* studied the molecular response of SARS-CoV-2 infected human monocytes under diabetic condition.

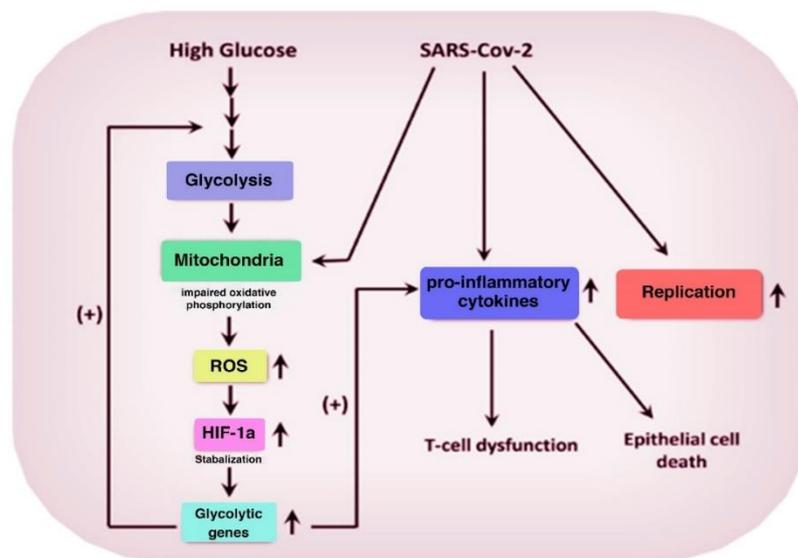


Figure 3: Monocytes metabolism causes the T- cell dysfunction and Epithelial cell death in Covid -19

They found peripheral blood monocytes infected by SARS-CoV-2 efficiently, virus then upregulates angiotensin-converting enzyme 2 (ACE2), a key SARS-CoV-2's receptor and highly

induced proinflammatory cytokines such as TNF- α , IL-1 β , and IL-6. This is consistent with the altered innate immune response and excessive inflammatory cytokine production, the so-called “cytokine storm” observed in severe COVID-19 (19).

Thus, it is evident that in diabetic patients when concentration of glucose increases, replication of SARS-CoV-2 increase with upregulation of ACE2 and production of cytokine in monocytes indicating elevated glucose is a principal promoter of virus replication and inflammatory response (Fig 3). Enrichment of glycolytic genes occur as SARS-CoV-2 directly causes glycolysis in monocytes. In lung monocyte of COVID-19 patient metabolic remodelling by single cell RNA sequencing is observed (20).

To understand the biochemical mechanism required for SARSCoV-2' replication and its impact in monocytes, Codo et al.1 provided conclusive evidences that glycolytic flux is indispensable for SARS-CoV-2's impact (20). The metabolic transcription factor hypoxia-inducible factor-1 α (HIF-1 α) is a master regulator of glycolysis and HIF-1 α levels and activity as well as target genes are strongly induced in SARS-CoV-2 infected monocytes consistent with elevated HIF-1 α in blood monocytes isolated from critical COVID-19 patients. Codo et al. further identified that HIF-1 α inhibition or stabilization blocks or exacerbates HIF-1 α target genes, viral replication and ACE2 and cytokine expression, indicating that HIF-1 α is essential for elevated glycolysis and subsequent inflammatory responses (20).

Through a series of biochemical experiments, it has been observed, that for the stabilization of HIF-1 α and the proinflammatory state in SARS-CoV-2 infected monocytes, increased mitochondrial oxidative stress is responsible. The relationship between COVID-19 and diabetes is complicated and bidirectional. In diabetes, the associated comorbidities and diabetes-related complications and certain demographic features can contribute to this higher risk of a severe course of COVID-19. Glycemic control is a key factor. On the one hand, hyperglycemia is a strong risk factor for a more severe course of COVID-19. On the other hand, the hyperinflammation associated with severe COVID-19 as well as its treatment with steroids can cause or worsen hyperglycemia through an effect on insulin target tissues (predominantly liver, muscle and fat cells) reducing insulin sensitivity (insulin resistance), as well as on pancreatic b-cells causing insufficient insulin secretion. SARS-CoV-2 directly affect the b-cell through the ACE-2 receptor, but this is controversial. Hyperglycemia decreasing insulin sensitivity and insulin secretory function thus causes glucose toxicity. Hereby, the risk of severe COVID-19 in patients with diabetes is increased even further (20).

Conclusion:

Uncontrolled blood glucose levels observed in diabetic patients are a major risk factor for the severity of COVID-19 (13). Patients with both type 1 and type 2 diabetes are at greater risk for a severe course of COVID-19 and mortality. The poorer prognosis is linked to the comorbidities and other risk factors that are often concomitantly present with diabetes mellitus, but also to glycaemic control. In monocytes, elevated glucose levels enhance the replication of COVID-19 and expression of cytokine. Once the virus enters in the airway, it infects host cells and starts to replicate. Accumulation of immune cells like macrophages and monocytes occur in the lungs after the infection (21). These monocytes are likely recruited by chemokines produced by infected epithelial cells (22, 23). It has been observed that in peripheral blood monocytes infected virus and enhances the expression of ACE2. Infected Monocytes expressed higher levels of IFN and proinflammatory cytokines which are associated with the COVID-19 “cytokine storm” (Figure 2). Thus, glucose availability may affect viral replication capacity. The interrelation between diabetes and COVID-19 is complicated and bidirectional, with COVID-19 causing hyperglycaemia, but hyperglycaemia causing worse outcome of COVID-19

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