

## PRE-PANDEMIC AND POST PANDEMIC IMPACT OF COVID 19 ON THE PHARMACEUTICAL INDUSTRY

\*Soumik Maity and Dr. Beduin Mahanti

School of Pharmacy, Tchno India University, Sector-v, Saltlake, Kolkata -700091, West Bengal, India.

Corresponding Author: Soumik Maity

School of Pharmacy, Tchno India University, Sector-v, Saltlake, Kolkata -700091, West Bengal, India.

Article Received on 21/03/2022

Article Revised on 11/04/2022

Article Accepted on 01/05/2022

### ABSTRACT

As countries and industries continue to face the insurmountable challenges posed by the novel coronavirus (COVID-19), a particular concern has been the uncertainty surrounding the impact of the global COVID-19 epidemic and the chains provided to the Indian pharmaceutical business as well as to the whole world's pharmaceutical industries. The COVID-19 crisis has the undeniable importance of developing a risk management plan that focuses on assessing future risks caused by the loss of a range of products between countries. This review focuses on the role of the Indian and global medical industries in the epidemic. This review examines the economic impact of COVID-19 on all segments and its implications for the Indian economy. The nineteenth-century outbreak of COVID should first open the door for Indian pharmaceutical organizations to re-operate in a supportive pharmaceutical and medium-sized trading center. The large pharmaceutical business in the Asian country has formally become the basis of affordable human services, and this pattern will now be the basis of affordable human resources. Ready to be required to raise more. Activities from COVID-19 that need to change the general perception of Indian pharmaceutical organizations and even more so, have reduced the dependence of private drug companies' organizations on sole providers such as China.

**KEYWORDS:** Pandemic, Pharmaceutical industry, Covid-19, Supply chain.

### 1. INTRODUCTION

In December 2019, the newly diagnosed coronavirus (COVID-19) was diagnosed in Wuhan, China. On March 11, the outbreak of COVID-19 was identified as a global epidemic by the World Health Organization (WHO). In the months that followed, COVID-19 spread rapidly around the world and infected an estimated 2.5 million people on April 23, 2020. The COVID-19 epidemic affected the global economy, including the health sector. Although there is currently no cure for this infectious disease, the healthcare industry is helping governments address the unmet needs of COVID-19, ranging from research and development to treatment strategies that may limit the supply of medication during a crisis<sup>[1]</sup> In line with this, the pharmaceutical sectors are struggling to maintain the natural market movement; as the recent epidemic affects access to essential medicines at affordable prices, which is a key goal of all drug programs. In line with exploring the challenges of the global pharmaceutical system, an analysis of the industry's situation in developing countries with a pharmaceutical market, due to diversity, could highlight additional impacts.

### 2. WHAT IS COVID-19?

Coronaviruses (CoV) are a large family of viruses that cause colds and other serious infections. The novel coronavirus (nCoV) may be a new species that has never been known to humans before. COVID-19 affects completely different people in many ways. Most infected people develop a mild to moderate illness and recover without being hospitalized. Coronavirus nineteen (COVID-19) may be an infectious and contagious disease caused by coronavirus two (SARS-CoV-2), which has caused a global epidemic that has caused significant human losses worldwide. Genomic analysis reveals that SARS-CoV-2 is phylogenetically associated with a SARS-like bat virus (similar to SARS), and therefore nutty is a pool of water.<sup>[2,6,8]</sup> The structural structure of the four types of coronaviruses: long polypeptides 2 of the 16 unregulated proteins from Pp1a and pp1b have been shown. S, E, M, and N are represented by four structural proteins: spike, envelope, membrane, and nucleocapsid. COVID-19; CoVs, coronavirus; HE, hemagglutinin-esterase. Virus names:

HKU, coronaviruses known by the University of Hong Kong; HCoV, human coronavirus; IBV, Participate in

Nursing Infectious Respiratory Virus; MHV, a viral infection of the liver; TGEV, Associate with Nursing Infectious stomach flu virus.<sup>[4,2,9]</sup> A typical CoV contains at least six ORFs respectively. Excluding Gamma coronavirus that pools (Please check) nsp1, first ORFs (ORF1a / b), about a simple fraction of the total order length, cipher ten sixteen nsps (nsp1-16). ORF1a and ORF1b contain intermediate frameshifts that produce 2 polypeptides: pp1a and pp1ab.<sup>[2,6,1]</sup> These polypeptides are processed by chymotrypsin-like proteinase (3CLpro) or main proteinase (Mpro) and papain-like proteinase one or 2 into sixteen nsps. All structural and auxiliary proteins are translated from sgRNAs for CoVs. The four essential structural proteins include spike proteins (S), membranes (M), envelopes (E), and nucleocapsid (N)

and are coded ten ORF, eleven in the same portion of the order close to three -terminus. in addition to those four main building proteins, various CoVs include specific structural and auxiliary proteins, such as the HE macromolecule, 3a/b macromolecule, and 4a / b macromolecule (bottom panel).<sup>[14,7,6]</sup> These mature proteins are responsible for many of the functions required for the maintenance and reproduction of microorganisms There are 3 or 4 microorganisms proteins within the coronavirus membrane. the main macromolecule structure is membrane (M) glycoprotein; it incorporates a membrane bilayer 3 times, from a short NH<sub>2</sub>-terminal base released from the virus and a long COOH terminus (cytoplasmic base) within the particles.<sup>[5,2,6]</sup>

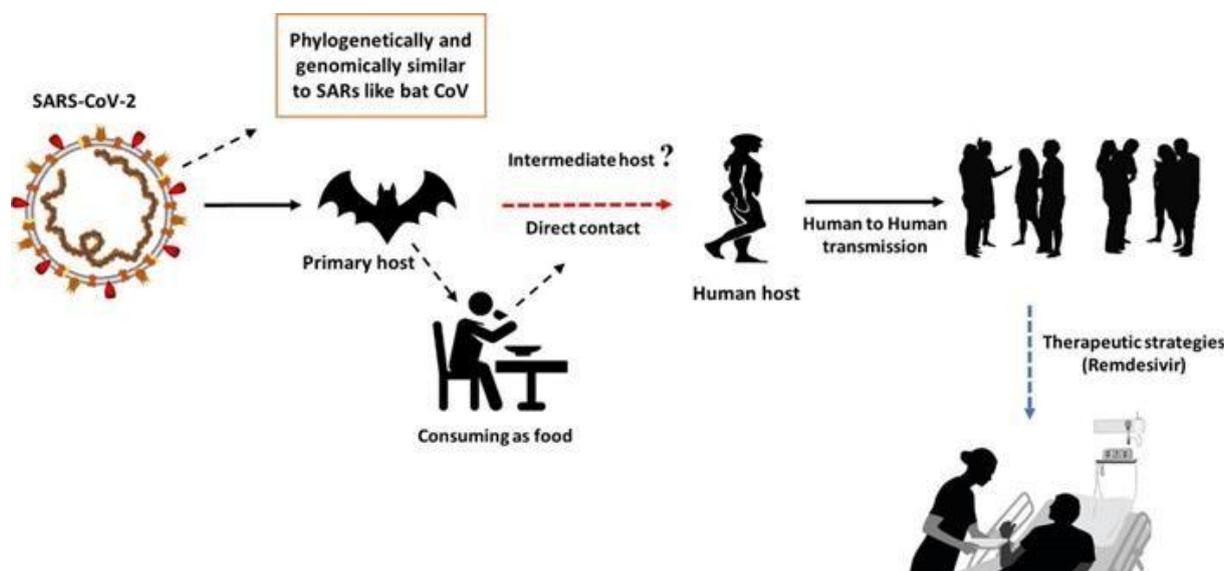


Fig. 1: Transmission of Covid-19.

### 3. THE WORLD EFFECT OF COVID-19

In addition, the Yank Society of Health-System Pharmacists (ASHP) has announced a list of 11 deficiency drugs; At the global level, the impact of drug shortages varies according to the amount of access to drugs, stores, and hospitals only, and type.<sup>[7,1]</sup> The use of currently-tested drug trials but not fully approved by a government agency or questionable therapeutic agents - as well as anti-inflammatory, lopinavir + Norvir, tocilizumab, and sarilumab - are used twice in the past month, 8 times. widespread use in hospitals. Medicines used in COVID-19 hospitals - as well as metabolic, analgesic, and pain medications - have increased by 100 percent to 700%, from the beginning of 2020.<sup>[12,17,26]</sup> The evaluation of the Asian nation as a developing country severely affected by the COVID-19 epidemic can be a reliable example of its demonstration. To our knowledge, it has been a key country to see these challenges within the context of a developing country with a retail market. Iran, as a developing middle-income country, has a generic-based retail market regulated under the National Drug Policy (NDP), last updated in 2014. Key elements of Iran's

NDP policy on generic drugs, traditional promotion, production, rate management as well as the nation-based housing industry. Iran | Iran | the Islamic Republic of Asian nation | Persian country | Asian nation | Asian nation The Department of Health (MOH) has supported indigenous production aimed at increasing access and access to medicines; leading to improved access to quality medicines in Iran. Asian national average-based drugs, relying on the combination of that drug during the sale of the immature product may be challenging.<sup>[5,1]</sup> Currently, more than 1/2 of the active pharmaceutical ingredient (API) is made locally, so some are equipped with reputable companies in Asia and China and in some cases organizations affiliated in Europe and Japanese Europe. 19, is one of the biggest problems in the pharmaceutical industry. As of the eighth month of the Gregorian calendar, 2020, the number of people infected with SARS-CoV-2 in the Asian nation was zero.9 million with a mortality rate of 1.38%; that was in line with adjusted world statistics. The level associated with COVID-19 hospitals as a whole comes from overcoming the challenges associated with this.<sup>[4,7,12]</sup> The profitability of a home pharmacy in an Asian country has reached Rs. 1.4100000 crores

(equivalent to \$ 2.03 billion) for twenty (Please check, it seems incomplete). In India, the health care business covers every non-public sector and therefore the public sector. Asia plays an important role in the global pharmaceutical industry and is the most diverse group of scientists/engineers. The Indian pharmaceutical industry provides more than 50 percent of the global demand for vaccines. Asia is the third-largest producer of medicines in terms of volume and production of vaccines reaching 60% of global production. Asia contributes significantly to the United Nations' demand for BCG, Pertussis, contagion, and Tetanus, accounting for 40 to 70 percent.<sup>[5,13,25]</sup> The Asian country collectively supports the global need to vaccinate against infectious diseases and it reaches 90%.<sup>[34,15,23]</sup>

Traditional medicines manufactured in Asian countries and manufactured worldwide provide safety and quality. Asia offers the world's second-largest lake in medicine and biotech. The The average level of India's biotechnology sector with biopharmaceuticals, bio-services, bio-agriculture, bio-industry, and bioinformatics is expected to be 30 percent and reach the United States of America \$ 1025.19 billion with government information (Please be incomplete. line. check). This could be a real increase from Rs. 1,29 100000 crores in 2018.

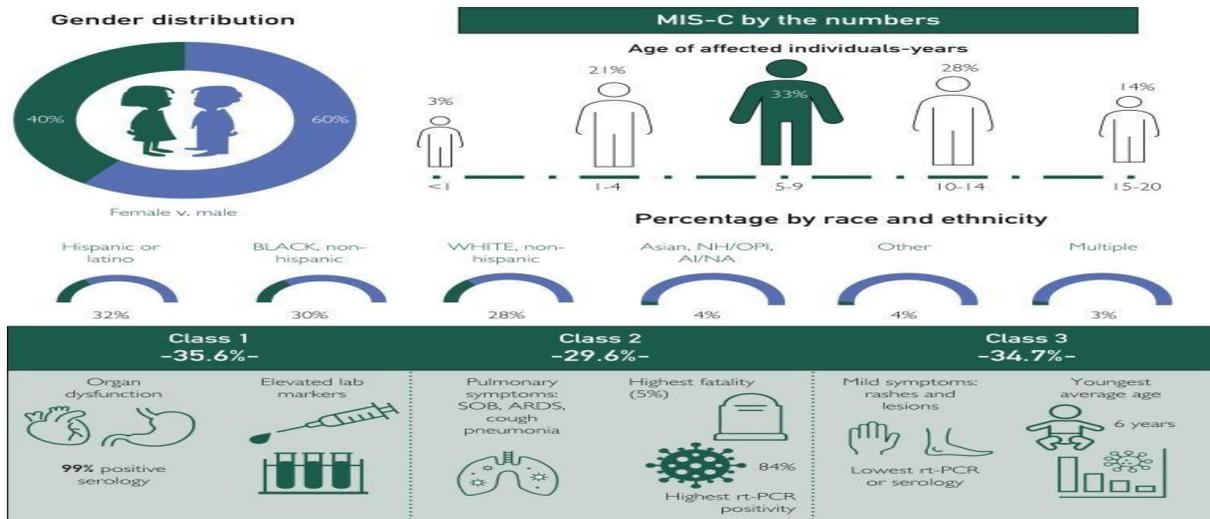
<sup>[27,23]</sup> Given the character of the Covid-19 epidemic, GoI must take important steps to eliminate technological and financial constraints, which could encourage the pharmaceutical industry to strengthen API production - thus reducing the dependence on the Chinese medical business. GoI has taken important steps to improve the compensation package of Rs. 13.76

billion to improve the domestic implementation of key metrics, drug coordinators, Apis, and medical devices. Many key representatives from the pharmaceutical industry and NITI Aayog have pointed out that promoting

authorization for medical infrastructure development, authorization from the local minister, and providing tax exemption and event support and promotion of pharmaceutical business institutions may benefit the market. -Sanitizer, face mask, disinfectant, surgical gloves, professional gear protective gear, scanners, infrared thermometers, test kits, respirators, ventilators, etc.<sup>[36,37,33]</sup> Many items require state-of-the-art coffee and can only be made in a factory.

**4. SHORT TERM AND LONG TERM EFFECTS**

Necessary changes, product supply, fear of purchasing and stocks, changes in legislation and communications changes and the promotion of remote communication technologies, and changes within the analysis and development (R&D) approach are seen as short-term effects of COVID-19 in the health market. The necessary changes, leading to shortages, in the context of the demand caused by the discovery of panic within the home oral medication, especially for chronic diseases thanks to the epidemic (related to COVID-19), as well as shortages due to fluctuations in supply and associated with COVID-19: improved hospitalization, cases of COVID-19 respiratory failure and growth should provide patients with ventilators, contributing to the shortage of medication.<sup>[28,31,32]</sup> The substance abuse unit is defined as "a supply chain that affects the way a health care provider prepares or releases a drug product or interferes with patient care when drug providers use another agent".<sup>[21,9,6]</sup> At the international level, several regulatory authorities have announced a proven list of shortages, most notably the potential treatment of COVID-19 and related respiratory diseases. For example, the U.S. Food and Drug Administration (FDA) shortlist includes anti-COVID- 19 anti-pharmaceutical, anti-inflammatory (HQC), and anti-malarial drugs (QC), as well as standard 10-drug COVID-given drugs and ninth with symptoms of metabolism. in critical care. units, azithromycin, dopamine, dobutamine, fentanyl, heparin, midazolam, propofol, and dexmedetomidine.<sup>[29,30]</sup>



**Fig. 2: Multisystem inflammatory syndrome in children (MIS-C) by the numbers. Epidemiological images derived from the Centres for Disease Control and Prevention data on 4018 reported cases of MIS-C as of**

June 2, 2021. Disease classifications from 570 MIS-C case report from March 2 to July 18, 2020. Percentages by race and ethnicity may exceed 100%. Multiple race identities could be selected. Race/ethnicity data were not reported for 276 of 4018 cases. Percentages of Asian, NH/OPI, and AI/NA were rounded up to 1%. AI = American Indian; ARDS = acute respiratory distress syndrome; NA = Native Alaskan; NH = Native Hawaiian; OPI = Other Pacific Islander; rt-PCR = real-time polymerase chain reaction; SOB = shortness of breath. Percentages by race and ethnicity may exceed 100%. Multiple race identities could be selected. Race/ethnicity data were not reported for 276 of 4018 cases. Percentages of Asian, NH/OPI, and AI/NA were rounded up to 1%. AI = American Indian; ARDS = acute respiratory distress syndrome; NA = Native Alaskan; NH = Native Hawaiian; OPI = Other Pacific Islander; rt-PCR = real-time polymerase chain reaction; SOB = shortness of breath.

**Table 1** The world-wide reported short- and long impact of COVID-19 on pharmaceutical sector

Impact	Middle-East [31]	EU5 countries [30]	United States [12]	
Short-term Medication shortage due to induced demand	COVID-19 related	+10.8%: OTC category (cold, cough)	+10.8%: OTC category (vitamin-minerals,...)	Investigational treatments have seen a 2-fold increase
		+403%: Personal hygiene	+62%: Personal hygiene	Medicines used in hospitals for the treatment of COVID-19 have increased between 100% and 700% since the beginning of January
	General (panic buying)	+67%: ICU medications +23%: Lipid lowering	+7.0%: Highest volume growth in ATC N class of RX-category in Spain	7, 6, 5, 4 and 2 million excess prescription in hypertension, mental health, respiratory, diabetes and anxiety
	Supply shortage	+40%: Anti-diabetes +29.1%: Anti-hypertensives Medicines for chronic diseases are at high risk of shortage or supply chain		Supply shortage of both active APIs and finished products (About 40% of APIs for the U.S. generic drug market come from India) Supply shortage of the COVID-19 related complications treatment
R & D shifts	156 clinical trials are running for COVID-19	140 clinical trials are running for COVID-19		
Shifts towards tele-medicine	WhatsApp calls is the most preferred digital channel for both patient consultation and communication with peers	320% increase (v. PY) in remote interactions in Spain. The corresponding increase in Italy (v. PY) was 471%	70-80% reduction in the number of patient visits to doctor offices	
	Digital channel has wide adoption with over 75% of physicians but physicians prefer traditional F2F communication	51% decline in specialist consultations and 25% decline in GPs visits	Tele-medicine growth accounts for 23% of interactions	
Long-term Approval delays (non-COVID-related products)	Clinical trial 8% delay existing enrolment	Pharma companies report delay in new trial starts		
	16% delay new trials only 32% delay new trials and existing patient enrolment	Product launches delayed, disrupted or impacted		
Shifts towards self-sufficiency in pharma industry		Direct investment and free movement of capital from other countries		

*OTC* Over the Counter, *ICU* Intensive Care Unit, *ATC N* Anatomical Therapeutic Chemical Classification Nervous system, *U.S.* United States, *v. PY*: versus Previous Year, *F2F* Face-to-Face, *GPs* General Practitioners, *APIs* Active Pharmaceutical Ingredients, *R&D* Research and Development

Fig. 3: Table from (Ayati N, Saiyarsarai P, Nikfar S. Short- and long-term impacts of COVID-19 on the pharmaceutical sector. DARU Journal of Pharmaceutical Sciences. 2020 Dec; 28(2):799-805).

## 5. BRIEF ON PHARMA INDUSTRIES

India is now among the top five markets for medicines. There will be the introduction of new drugs, the introduction of new drugs, and testing of Phase II clinics throughout the year. In the wake of the growth in sales of generic medicines, the continued growth of chronic medicine, and the massive influx of domestic markets, the domestic medicine market is expected to register strong double-digit growth in the coming years.<sup>[24,3,8]</sup> The Indian Medical Industry, in particular, has been at the forefront of many specialties including complex drug production, development, and technology. With the benefit of being the most organized industry, pharmaceutical companies in India are growing at a rate of \$ 4.5 billion, registering a steady growth of 8-9% per annum. More than 20,000 registered units are separate across the country and reports say that 250 leading Indian pharmaceutical companies control 70% of the market share through strict price competition and government pricing rules.<sup>[22,18,19]</sup> India has a large staff of highly skilled management and technical staff and skilled workers. It has educated staff and English is widely used. Technical services are readily available.

### 5.1. Inexpensive Chemical Manufacturing

Its history of development, especially in the area of chemical improvement with the cost of various drug molecules is excellent. It provides many kinds of complex drugs and exports complex drugs. The profitability of the home pharmacy in India has reached Rs.1.4 lakh crores (equivalent to \$ 20.03 billion) in 2019 according to government data.<sup>[29,35,6]</sup> This is an increase from Rs.1.29 lakh crores in 2018. In India, the healthcare industry includes both the private sector and the public sector. India plays a vital role in the global pharmaceutical industry and has a large number of scientists/engineers who are well-versed in the industry. India's medical industry supplies more than 50 percent of the global demand for various vaccines.<sup>[10,11,16]</sup> India is the 3rd largest producer of medicines in terms of volume and vaccine production accounts for up to 60 percent of global production. India contributes significantly to the WHO requirement for BCG, Pertussis, Diphtheria, and Tetanus, accounting for 40 to 70 percent. India also supports the global demand for the measles vaccine and reaches 90 percent.<sup>[22,12,17]</sup>

## 6. IMPACT OF COVID-19 ON THE GLOBAL PHARMACEUTICAL INDUSTRY

The pharmaceutical business manages to avoid pollution as part of Smart Producing Practices (GMP). But for now, if you just remember the seriousness of the virus, the medical business should take precautionary measures to prevent infection and spread throughout bus rides, entry and exit procedures, flexible rooms, avoid touching doors, handles, etc. all production activities. On the website. Pharmaceutical sites should be aware of the different categories depending on the type of product and the individual participation in such activities. The various

functions should not be borne in mind such as the supply chain of all packaged and finished goods, the cleaning and cleaning of input containers, safety measures at all times of storage, maintenance measures between samples and reviews, necessary care during transport, safety measures in handling. And production activities, sanitation of all areas, public distance from bus routes, entry and exit procedures, all functions of muff./packaging/testing, etc. within the business.<sup>[16,19,20]</sup>

The health sector is responsible for the analysis, development, and distribution of pharmaceutical drugs. The business continues to grow, as the global market generates \$ 1.2 trillion in 2018 associated acquisition of 1.43 trillion accounting by 2020. Globally, the pharmaceutical industry is one of the largest and most profitable sectors, requiring highly skilled workers and senior staff. Corporations' square measures are required to meet national health standards and international technology development; equally, their employees should do the same. Working with a reputable and well-known agency in the pharmaceutical industry has become an easy way to thank conscientious employees who are ready to meet business standards.

Pharmaceutical companies are at the forefront of the Covid-19 epidemic; which shows a positive growth between trade and an increase in job opportunities that various industries have lost. With the sudden growth of job opportunities, it is necessary to match the right person to the job list. Collaborating with business advisors gives you access to the dedicated hiring resources needed to meet the growing demand for staff while at the same time reaching out to the most flexible people. Which will increase the risk of shortage. Although production in various industries and regions in China has been slowly resuming since late Feb, in the U.S. manufacturers of pharmaceuticals and medical devices, which supply directly and indirectly from China, are currently exposed to significant future risk and loss within 2 months. These square risks are mainly due to the limited size of China operations and production start-ups are prioritized.<sup>[18,29,30]</sup>



Fig. 4. Effect on Global Pharmaceutical Market.

**7. IMPACT OF COVID 19 ON THE INDIAN PHARMACEUTICAL INDUSTRY**

The profitability of the home pharmacy in India has reached Rs.1.4 lakh crores (equivalent to \$ 20.03 billion) in 2019 according to government data. This is an increase from Rs.1.29 lakh crores in 2018.<sup>[35,36,12]</sup> In India, the healthcare industry includes both the private sector and the public sector. India plays a vital role in the global pharmaceutical industry, and it has a large number of scientists/engineers who have good potential to take the industry forward. India's pharmaceutical industry supplies more than 50 percent of the global demand for a variety of vaccines. India is the 3rd largest producer of medicines in terms of volume and vaccine production accounts for up to 60 percent of

global production. India contributes significantly to the WHO requirement for BCG, Pertussis, Diphtheria a, and Tetanus, accounting for 40 to 70 percent. India also supports the global demand for measles vaccine and reaches 90 percent.<sup>[23,24]</sup>

Generic medicines manufactured in India and manufactured worldwide provide safety and quality. India contributes to the world's second-largest pharmaceutical and biotech labour force. The median growth rate of India's biotechnology sector which includes biopharmaceuticals, bio-services, bio-agriculture, bio-industry, and bioinformatics is expected to be 30 percent and reach the US \$ 100 billion by 2025.<sup>[29]</sup>

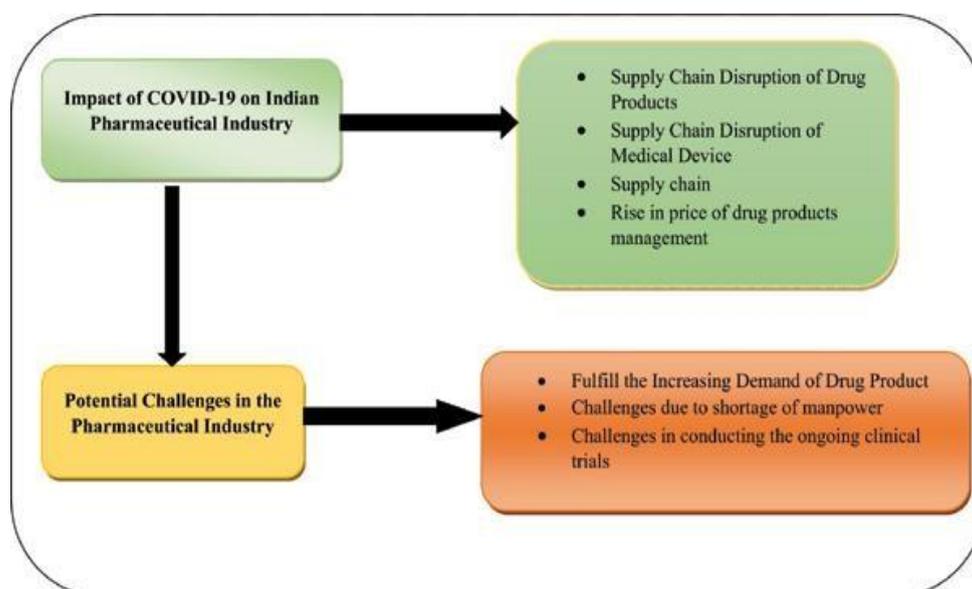


Fig. 5: The role of the Indian pharmaceutical industry in the COVID-19 pandemic.

**8. SUPPLY CHAIN DISRUPTION**

Globally, there has been a significant impact of Covid-19 on the supply chain. Due to the closure situation in

various countries, a small number of workers at the operational level have affected productivity. Similarly, the impact on transportation and the performance of

goods delayed delivery. Even then pharmacists around the world were doing their best to ensure the availability of medicines and were working around the clock in R&D to improve the vaccine. When the lockdown was opened, the situation got better. A deeper focus on risk management across all networking networks and chains is likely to continue, despite the inevitably increased costs. The chains on offer may be a patient with different delivery points and information. New technologies must emerge and transform the entire industry. The commercial impact of Covid-19 could affect the supply of finished drugs and active pharmaceutical ingredients (APIs) worldwide. China and India are the largest suppliers of finished volume products and APIs in the world. Factory closure in China and delays due to Covid-19 ports in ports have affected the production and delivery of API shipments.<sup>[10,11]</sup>

With the spread of coronavirus worldwide, the Pharmaceutical industry has had a major impact on costs. The importation of API from Indian manufacturers has been a major cost to international pharmaceutical companies, but the emergence of China and the Covid-19 EU distribution could limit global exports, thus increasing total costs to global and foreign manufacturers. Affecting consumers. At the operational level, it is clear that there has been an impact of job losses due to job delays, public distribution, continuous face masks, sewage disposal, low staff numbers, etc. All of these factors have led to a decline in overall productivity in the pharmaceutical industry. However, due to the nature of the epidemic, medical products were in high demand and the pharmaceutical industry saw a much-needed silver line and business.<sup>[33,13]</sup>

### 8.1. Over-reliance worldwide in China and India

An ongoing source of concern is the dependence of the global pharmaceutical chain in China and India on the basic priorities, intermediate, and active ingredients of the drugs or APIs used to produce generic medicines and many branded products. It is believed that 60 percent of the world's API is made in China, and if the Covid 19 virus continues unabated, it is uncertain when producers will return to business in full.<sup>[5,12,17]</sup>

- In the Chinese province of Wuhan, 500 international drug trials are still underway, according to reports, and it is facing disruptions. About 20% of global trials are now being conducted in China, up from about 10% five years ago, according to Global Data Plc.
- With the re-emergence of the disease this winter, the question of supply chain disruption remains a reality. It is clear that the virus will continue to cause havoc until the vaccine is produced, widely distributed, and given to a large portion of the world's population.
- At a recent European Commission meeting, the director of the U.S. Drug Research and Research Center Janet Woodcock pointed out that the number of Chinese API providers has doubled in the last

decade. He pointed out the dangers of over-reliance on goods in one global drug manufacturing world. Representatives of the European Fine Chemicals Group (EFCG) fully agreed with his concerns.<sup>[4,7,11]</sup>

- Bristol Myers Squibb, Merck, China-based BeiGene, and WuXi Apptec all deny any major impacts due to closures and product shortages and participation in drug testing.
- "Many of our sites in China and around the world have enabled us to reduce the risk associated with unexpected disruptions to work," WuXi Apptec CEO Edward Hu said in a statement sent to Barron. "As a result, COVID-19 did not have a significant impact on our delivery system."<sup>[1,13,25]</sup>
- This hypothesis is based on the belief that impact can be localized in certain areas, and even if experiments are affected, model data may be combined with other data.
- But there is another major concern that is thought to be a disruption, not only of the pharmaceutical industry but of related health care, including hospitals and biotech companies, will be affected.
- The FDA reported the first U.S. drug shortage due to the epidemic in March itself, which was the first indication that the world was not yet ready for any such disruption.
- No details were available about the shortage, but market observers were surprised by such initial reports of shortages.
- Generally, all companies store backup APIs.
- The FDA has revealed that it is aware of 20 drugs developed in China or based on Chinese APIs. "Obviously we are very concerned about the active ingredients from" affected areas in China, "the FDA said."<sup>[8,11]</sup>
- The United States and the European Union each make up one-quarter of FDA-registered sites worldwide, while China and India combined make up 31%. EFCG believes that more than 80% of the chemicals used to make drugs in Europe come from China and India. The United States, on the other hand, reportedly captures about 50% of the global pharmaceutical market and imports more than 50% of completed APIs and products, with some looking at more than 70%.<sup>[11,17]</sup>
- India supplies about 40% of the generic medicines sold in the world market. The WHO estimates that China accounts for 20% of global API output, though many in the industry double the figure. Following the outbreak, China had limited 10% of its exports but withdrew when the US threatened retaliatory measures.<sup>[8,13]</sup>
- As the epidemic raged, hospital equipment such as personal protective equipment (PPE), ventilators, and other medical equipment was also banned or restricted for export.
- The drug manufacturers had made sure that there was no shortage. "The situation is tense, but for now, we do not anticipate the effects of our market unless

it is disrupted by the Covid-19 outbreak in the next few months," Merck (MRK) said in a statement, according to Reuters.

- Experts then say that a shortage of generic drugs will be seen in the second and third quarters of the year. The prediction has been fulfilled.
- Private hospitals in the US are also experiencing abnormal fluctuations in their cells, according to an increase in the incidence of the disease.
- The research company Global Data found that up to 57 pharmaceutical products (from calcium supplements to cancer drugs, HIV treatment, and antibiotics) by large and small
- pharmaceutical companies could be at risk due to "general production and export restrictions across the country. -China."<sup>[29,31]</sup>
- And there may be research changes and greater reliance on the discovery of antimicrobial drugs is expected.
- Travel restrictions and staff shortages due to solitary confinement and other limitations add to the disruption of the carrier's supply of goods that reduce travel and wave equipment.
- The active reports of the vaccine Moderna and Pfizer are good news but distribution and feed models still need to be worked on. And it will take time for vaccines to reach more people.<sup>[20,23]</sup>

### 8.2. The current reality of the supply chain

There were already reports of drug shortages around the world before the outbreak. The FDA has reported an increase in the number of drug shortages from 2017 to 2018. More than 60% of the shortfall in 2019 was due to service delivery disruptions due to production and/or quality problems. A white IDC paper examining 532 leaders of global supply chain organizations states that COVID-19 will significantly increase the risk of a drug overdose, theft, and counterfeiting of sensitive products such as testing aids, vaccines, and antimicrobials.<sup>[10,18,21]</sup> Medication collection, transportation delays, and rising costs were some of the major concerns after the drug shortage. Another grouse was inventory prediction, which is said to be less reliable or faster to survive in any kind of disruption.

### 8.3. Post Pandemic Reality

The epidemic will not end with the sudden arrival of targets. The production capacity will take more time to return to normal and contribute to the availability of essential pharmaceutical ingredients, intermediate ingredients, active ingredients, manufacturing equipment and other essential ingredients needed in the production of drug products. Even before the epidemic hit, governments and pharmaceutical companies were working on domestic production to meet their needs rather than spending money. Over-reliance on China for essential ingredients has not been a long-term plan for many. According to the United Nations Industrial Development Organisation, local pharmaceutical production (LPP) can help vulnerable people gain access

to quality medicines, reduce dependence on international supply, and make it easier to control counterfeit products entering emerging markets. Also, an efficient supply chain data matrix module is required to close the gaps. Companies need to make a detailed price distribution and analyze the risk of their purchase chain from end to end.<sup>[5,12,14]</sup> Businesses can use digital platforms to compile data, document problems, and create faster processes for internal and external teams. Digital data can provide capabilities with real-time accuracy and validate real-time sharing numbers with partners.

### 8.4. Drug development opportunities

The disease outbreak, however, also has opportunities for US pharmaceutical companies engaged in vaccine and drug development. Globally, several organizations have worked and are working to develop the vaccines supported by Regulatory agencies and spending millions of dollars for development purposes. Phase-wise clinical trials were carried out and various Covid-19 vaccines were developed. A coronavirus disease 2019 (COVID-19) vaccine can prevent you from getting COVID-19 or from becoming seriously ill or dying due to COVID-19.<sup>[4,11]</sup> Each COVID-19 vaccine causes the immune system to make antibodies against COVID-19. The COVID-19 vaccine uses a harmless version of the spike-like structure of the COVID-19 virus called S protein.

The main types of COVID-19 vaccines available in the U.S. or researched include:

#### (i) Messenger RNA (mRNA) vaccine

This type of vaccine uses genetic mRNA to give your cells instructions on how to make the S-protein found on the surface of the COVID-19 virus. After vaccination, your muscle cells begin to form S-protein fragments and express themselves in the cellular space. This causes your body to build up the immune system. If you later become infected with COVID-19, these antibodies will fight off the virus. After delivering the instructions, the mRNA is immediately broken. It does not enter the nucleus of your cells, where your DNA is stored. Both Pfizer-Biotech and Modern COVID-19 formulations use mRNA.

#### (ii) Vector's goal

In this type of vaccine, genes from the COVID-19 virus are incorporated into a modified version of a different virus (viral vector). When a viral vector invades your cells, it delivers genes from the COVID-19 virus that gives your cells instructions on how to make copies of the protein S. When your cells show S-proteins in their places, your immune system responds by building antibodies and protective white blood cells. If you later become infected with COVID-19, the immune system will fight off the virus.

Viral vector vaccines cannot cause you to become infected with the COVID-19 virus or the viral vector

virus. Also, the genes that are introduced do not become part of your DNA. The Janssen / Johnson & Johnson COVID-19 vaccine is a vector vaccine. AstraZeneca and Oxford University also have a vector vaccine for COVID-19.<sup>[11]</sup>

### (iii) Protein subunit vaccine

Subunit vaccines only include parts of the virus that rejuvenate your immune system. This type of COVID-19 vaccine contains harmless S proteins. When your immune system detects S-proteins, it creates antibodies and protective white blood cells. If you later become infected with COVID-19, the immune system will fight

off the virus.

### (iv) Novavax works with the protein subunit vaccine COVID-19

The U.S. The Food and Drug Administration has approved the Pfizer-BioNTech COVID-19 vaccine, now called Comirnaty, to prevent COVID-19 in people 16 years of age and older. The vaccine is under approved emergency use for children aged 5 to 11 and 12 to 15 years. The FDA has also approved the use of emergency drugs in the modern vaccine Moderna and Janssen / Johnson & Johnson COVID-19.<sup>[4,21]</sup>



**Fig.6. Covid vaccine supply chain.**

## 9. Different Indian Companies Roles In Pandemic

### 9.1. Ranbaxy

Ranbaxy is one of the leading pharmaceutical companies in India and was founded in 1961. Ranbaxy is a research-based giant and became a limited public company in 1973. Countries. Ranbaxy also has a reputation for its 11 top production facilities in countries such as China, India, Brazil, South Africa, and Nigeria. The company has also won numerous awards and accolades for its initial efforts in emerging global markets. Ranbaxy is also a member of the Indian Pharmaceutical Alliance and the Organization of Pharmaceutical Producers of India. In the current situation, Ranbaxy controls more than 5% of the Indian pharmaceutical market. The Ranbaxy product portfolio is diverse and includes drugs that target nutrition, infectious diseases, gastro-enteritis, pain control, cardiovascular diseases, skin diseases, and neurological-related diseases.

The epidemic will seriously affect temporary operations and profitability as some countries have announced closures that will reduce staffing on public transport. Apart from this, in companies that produce non-essential products during the violence, the chances are that their performance will be suspended or maintained at the bone

level. In a study conducted in India, it was estimated that the majority of employees and professionals surveyed accounting for 67% confirmed that jobs in BPOs and MNCs would be at high risk during the spread of COVID-19 (Economic Times, 2020). In addition to having an epidemic, it should also be considered that the client may have different conditions and management as they live in a different country. In different countries where organizations and branches of MNCs may face different problems as the control of the virus is context and related to government decisions.

Temporary performance and profitability will be significantly affected. Even if homework is considered, the level of productivity will not be as high as that of ordinary jobs. Other performance issues from home mode should also be considered. Therefore, companies must review their goals, objectives, and expectations by 2020 and address the disruption of the supply chain and prioritize those with the greatest need (Businesswire, 2020).

<sup>[7-13]</sup>Epidemics like COVID-19 are beyond the control of a company, no matter how large. MNCs should consider suspending their operations if they do not consider

homework because, in countries with lockdown, people are barred from leaving their homes. If they persist in asking their staff to report, the lack of public transportation will be a problem.

Given this situation, continuity plans are very useful. Managers should analyze the situation in detail. Preparation programs should address personality factors including hygiene, employee education, labour movement, and evictions, sick leave policies as these are critical to employee well-being (Staples, 2020). In addition, performance issues should be focused. In the case of a selected MNC, other required service delivery plans should be considered.

### 9.2. Dr. Reddy's Laboratories

Dr. Reddy's Laboratories is one of the popular pharmaceutical companies with bases in more than 100 countries. The medicines of Dr. Reddy's Laboratories Limited are easily available all across the globe. Dr. Reddy's Pharmaceutical Company is very customer friendly. It takes care of the fact that maximum people get benefited by the products of this pharmaceutical company. It commercialized various treatments so as to provide high-tech treatment to the masses. It tries to meet the medical needs of the people. Dr. Reddy's Laboratories (DRL) is working on expanding several products and expanding its market portfolio of Covid products. For example, it works to deliver a 1 ml liquid injection of Gilead redeliver, a drug widely used in Covid patients with moderate to severe symptoms.<sup>[2,11,21]</sup>

Similarly, with its oral favipiravir, which it sells under contract with Japanese founder FujiFilm, it aims to grow markets across India, the company said. Regarding MSD drug Molnupiravir, which is currently being tested in India, the company said it had already shared temporary information with the drug regulator. DRL is also experimenting with the expansion of labels on soft 2-DG or 2-Deoxy-d-Glucose patients developed by the Institute of Nuclear Medicine & Allied Sciences, a unit of the Defence Research and Development Organisation.<sup>[5,31]</sup>

### 9.3. Cipla

Cipla was founded by Khwaja Abdul Hameed in 1935 and was known as 'The Chemical, Industrial and Pharmaceutical Laboratories', though it is better known by the acronym 'Cipla' today. Cipla was registered in August 1935 as a public limited enterprise and it began with an authorized capital of Rs. 6 lakh. Though set up in 1935, it was only in 1937 that Cipla began manufacturing and marketing its pharmaceutical products.<sup>[4,12,17]</sup>

Today, the company has its facilities spread across several locations across India such as Mumbai, Goa, Patalganga, Kurkumbh, Bangalore, and Vikhroli. Cipla Ltd has obtained India's regulatory approval to sell the antiretroviral drug favipiravir to treat COVID-19, the

drugmaker said on Friday, as coronavirus infection in the world's third-worst hit country showed no signs of slowing down.

India's Director General of Drug Administration has granted Cipla immediate approval to manufacture and sell favipiravir in an effort to meet the "urgent and unmet" need for COVID-19 treatment options in the country, the company said. Indian drug manufacturers including Glenmark Pharmaceuticals Ltd are rushing to provide standard types of favipiravir, developed by Japan's Fujifilm Holdings Corp as an anti-flu drug Avigan. India reported more than 49,000 new cases of the novel coronavirus and the deaths of 740 young people on Friday, marking a dramatic increase in daily conditions, as officials in some provinces lamented the shortage of essential drugs for those hospitalized.<sup>[14]</sup>

Globally, coronavirus cases exceed 15.5 million. Cipla said it would introduce favipiravir as "Ciplenza" in the first week of August, with a total of 68 Indian rupees (91 cents) per 200 mg tablet. Separately on Friday, Indian small drug manufacturer, Jenburkt Pharmaceuticals Ltd said it would launch its own version of favipiravir, valued at 39 rupees per tablet. Glenmark, on the other hand, sells the favipiravir tablet for 75 rupees, and the patient usually needs 122 pills in 14 days to receive treatment, the company said.<sup>[11]</sup>

### 9.4. Sun Pharmaceuticals

Sun Pharmaceuticals was set up in 1983 and the company started off with only 5 products to cure psychiatric illnesses. Sun Pharma is known worldwide as the manufacturer of specialty Active Pharmaceuticals Ingredients and formulations. However, the company is also concerned with chronic treatments such as cardiology, psychiatry, neurology, gastroenterology, diabetology, and respiratory ailments. Active Pharmaceuticals Ingredients (API) include peptides, steroids, hormones, and anti-cancer drugs and their quality is internationally approved. The international offices of Sun Pharmaceuticals Industries Ltd. are located in the British Virgin Islands, Russia, and Bangladesh. In India, the offices are in Vapi, Silvassa, Panoli, Ahmednagar, and Chennai. An Indian drug manufacturer, Sun Pharmaceutical Industries Ltd, said on Friday it was testing a plant-based drug, AQCH, to treat COVID-19 as part of a mid-phase trial, expected results in October.<sup>[11,15,19]</sup>

AQCH is derived from the tropical, climbing *Cocculus hirsutus* tree, which is used in Asia for its obvious medicinal properties. The company said the study would be conducted in 12 centers in India for 210 patients and that public safety research on the drug had been completed. "AQCH, designed for dengue, has shown widespread antimicrobial effect in in-vitro studies and is therefore being evaluated as a potential treatment for COVID-19," the company said in a statement. Drug manufacturers around the world are rushing to develop a

drug or vaccine for a rapidly spreading novel that has killed more than 390,000 people and devastated financial markets. Two other Indian companies, Glenmark Pharmaceuticals Ltd and Strides Pharma Science Ltd, are also conducting potential clinical trials in India for COVID-19. Sun Pharma received approval from the Drugs Controller General of India (DCGI) for the AQCH trial in April, data from India's clinical trial register showed.

### 9.5. Aurobindo pharma

Aurobindo Pharma is an India-based private pharmaceutical company having a presence around the world. Aurobindo Pharma was set up in the year 1986 and started its operations in 1988-89 in Pondicherry, India. Now, the company is headquartered in Hyderabad, India. Aurobindo Pharma is one of the most respected generic pharmaceuticals and active pharmaceutical ingredients (API) manufacturing companies in the world. Aurobindo Pharma operates in over 100 countries across the world. Further, the pharmaceutical major markets are over 180 APIs and 250 formulations throughout these destinations. This Indian pharmaceutical major has filed over 110 DMFs and 90 ANDAs for the USA market. So far, Aurobindo has received 45 ANDA approvals (both final and tentative) from the USA alone. Aurobindo pharma products cover segments such as antibiotics, antiretrovirals, CVS, CNS, gastroenterological, anti-allergic drugs, etc. Aurobindo Pharma is currently working on vaccines for the 'bulk' of the Covid-19 epidemic.<sup>[14]</sup>

It is in the process of doubling its production capacity from the current 220 million volumes in the introduction of bulk volumes to a total volume of 480 million volumes by June 2021. Referring to the Covid-19 vaccine, the company told investors: "More and more vaccines are being developed that improve lethal skills and interpersonal skills." Hyderabad company's internal Covid vaccine: SARS COV-2 vaccine is based on company ownership, repetitive, competent, and reduced to deliver a vaccine for vesicular stomatitis.

#### 9.5.1. Covaxx trials

Aurobindo also entered into a special licensing agreement with Covaxx, a US-based company to develop, sell and manufacture UB-612, the first Movitope Peptide Vaccine-based vaccine for Covid-19 in India and the United Nations Children's Fund (UNICEF). It showed "promising safety and immune effects in the Covaxx phase-I clinical trial conducted in Taiwan," the company said. In addition, Aurobindo also collaborated with the Council for Scientific and Industrial Research (CSIR) to develop a number of Covid-19 vaccines.

#### 9.5.2. Other vaccines

Aurobindo also developed a pneumococcal conjugate (PCV) vaccine with global market size of \$ 6.2 billion. The drug manufacturer successfully completed Phase I and Phase II studies. "The Phase III clinical trial is

expected to begin in March 2021," he said. It expects to submit the product to regulatory authorities in Q4 of FY22.<sup>[26,29]</sup>

### 10. Covid Impact, Challenges, And Opportunities Faced By Pharma Industries

The coronavirus epidemic and the resulting arrests had a devastating effect on all major economic sectors, yet they are returning as a blessing to the Indian pharmaceutical industry. Although part of the pharmaceutical industry has been affected by the supply and export of active ingredients from China, Covid-19 has provided some opportunities in the pharmaceutical industry, particularly in the Republic of India. In the generic market, the Republic of India is facing stiff competition from China for the supply of arthropod types at a lower price. The Republic of India imports 70% of the API it wants from China<sup>[4,7]</sup> This created many problems for many home-grown pharmaceutical companies that produce an important type of arthropod. India's health security was under threat due to China's heavy reliance on it, including shortages in providing an important type of arthropod. Dozens of key arthropods were important in reducing the burden of acute illnesses such as TB, diabetes, and vascular diseases in the Republic of India. This reliance on Indian pharmaceutical firms on the Chinese arthropod genre has caused great concern for national health security, prompting GoI to organize a team to explore the internal API sector. Given the nature of the Covid-19 epidemic, GoI should take it seriously. Measures to remove technical and financial barriers could encourage the pharmaceutical business to build API production - thereby reducing the dependence of the pharmaceutical business on China.<sup>[7,11]</sup> GoI has taken important steps by raising the associate degree incentive package of Rs. 13.76 billion to improve domestic production of basic essentials, drug connectors, arthropod type, and medical equipment. Many key representatives from the pharmaceutical industry and NITI Aayog have been advising that promoting the authorization of pharmaceutical infrastructure development, approval from the space department, and providing tax exemptions and event sponsorship and promotion of pharmaceutical business facilities may benefit the market.

In this epidemic situation, a decisive step is needed to add sanitizer treatments, face masks, disinfectants, surgical gloves, health gear gears, scanners, infrared thermometers, test kits, respirators, ventilators, etc. Most items require a minimum technical and can be easily made in the factory.<sup>[14]</sup> The National Health Protection Fund, a government-funded assistance program, which benefits 100 million poor families in the country, provides a combined degree of insurance for up to Rs. five hundred thousand families each year to be admitted to secondary health care and tertiary institutions. Fundraiser for Ayushman Asian Country Pradhan Mantri The month of the Gregorian calendar Arogya Yojana (AB-PMJAY) is Rs. 6400 million. Vision 2020 is a GoI-

related degree program to create the Republic of India as a global leader in drug development and the licensing period for new manufacturing facilities has been reduced to save on investment. the government has given Rs. The total production of 6,940 joins compensation between 5-20% of ongoing sales and 3 mega drug paraphernalia consolidation programs to further aggressive local price aggression. the number of medicines in the Republic of India is expected to grow between 9-12% over 5 consecutive years, making the Republic of India one of the top ten countries in terms of medical costs.<sup>[4,7,24]</sup> The high growth in home sales will depend more on the ability of firms to align their product portfolio in the treatment of chronic diseases such as vas, anti-diabetes, antidepressants, and anti-cancer, which are on the rise. The government has taken a number of steps to reduce costs and reduce the cost of aid. The rapid introduction of generic medicines on the market is still entrenched and is expected to benefit Indian pharmaceutical companies. Focusing on rural health systems, remedies and vaccines can provide an environment for the development of pharmaceutical firms.

The COVID-19 epidemic has exposed weaknesses within a range of international industry supply chains and although consumer confidence is growing, blurring is closer to traditional standards. Businesses within the sector area of the sector appear to be facing a wide range of risks at the end of the year, six of which - with lower than average customer confidence, drug fraud, patents, and customer growth expectations - are publicly listed below.<sup>[15]</sup>

### 10.1. Decreased demand for the right drug

While at the top of this epidemic it seems, it is not over yet. The global unit of COVID-19 case numbers is rising worldwide and outbreaks are still affecting countries such as the Asian country. Continuous effects of COVID-19 may have a significant impact on trade up to the end of the year, in part due to declining client confidence suggesting that it may not be in line with the standard demand for prescription drugs. In addition, the purchasing power of clients may remain low as the situation continues to be a global challenge.

For businesses that have been resistant for the past few months to lower demand than average, long-term visibility is wise. Some commercial observers predict that the pharmaceutical industry is back on track to recover rapidly, as it was in a previous epidemic. Factors such as the qualifications associated with the aging of the international population, the increase in chronic diseases, and the development of modern therapies encourage growth as the epidemic slows and the economy recovers. Upcoming patents are unhealthy news for a few major pharmacists, yet the good news is for companies that are keen to develop generic drugs and for clients who want lower drug costs.<sup>[31,33,35]</sup> Several major over-the-counter drugs could miss out on

USA variations this year, 1 and Lucentis, which sold more than \$ 1.6 billion by 2020, and Bystolic, a high-quality drug, with a market value of \$ 600 million in 2019.

For large manufacturers, these patents can pose a significant risk. For the remainder of the trade, the outcome may seem chaotic and will open up new opportunities for small producers. Drug fraud is still a major commercial challenge - and the worst of all COVID-19. Commercial observers expect that misconduct across the epidemic could lead to higher health fraud rates than average this year. Vial labeled 'COVID-19 Vaccine' with a red stamp announcing 'FAKE' on the label - counterfeit vaccine program. The US government had already received \$ 8 billion by March 16 - and \$ 4 billion returned as part of resolving PurduePharma-related various opioid-related cases.

In the US, there are local laws that make it easier to prevent or disclose health care fraud, 3 such as the False Claims Act, which encourages those who speak ill of them to come forward about potential fraudulent transaction pricing, testing fraud, smart production practices (GMP) fraud and trade. These laws may help to reduce the number of drug frauds that occur throughout the epidemic; however, we have a tendency that the local unit still seems to be experiencing significant year-round stability - which could have a significant impact on trade.

For developers, taking preventive measures | stopping | preventing fraud and encouraging internal discussions about deceptive behavior can help prevent problems with health care fraud.<sup>[12]</sup> Expected customer growth and difficulty managing a full life Fraud certainly go hand in hand with another major threat to the pharmaceutical industry: poor health. Pharmaceutical companies measure the square under extensive customer feedback, which means that overall management may be more important than usual for the rest of the year. At the same time, consumers are predicting more from the drug trade and it is becoming more and more common for consumers to immediately consider the price of greenback drugs. Pharmaceutical companies may need to be compelled to manage expectations for growing customers and be prepared to respond to comprehensive problems throughout the year - such as the problems that will arise as supply chains are still being phased out by COVID-19.<sup>[1,3]</sup>

### 10.2. Information breaches and other cyber threats

As client information becomes more useful, the number of cyberattacks also increases. The square footage of pharmaceutical companies is very common in cybersecurity threats. According to IBM's 2020 Violations Report, cyberattack attacks are worth more than \$ 5 million in trading in the last year, 4 creating the fourth most influential trade, soon after health care, energy, and finance. production technologies - such as industrial IoT sensors - can create additional production

centers that are often under attack.<sup>[11,31]</sup>

As cybercrime becomes an additional major threat to trade, investments in cyber security may need to be forced to increase. companies will also be required to apply high- level Internet security policies in the workplace and remote employees, or take advantage of costly information breaches. Investment in IoT security may be necessary for those who use the technology.

**10.3. Provide chain interference**

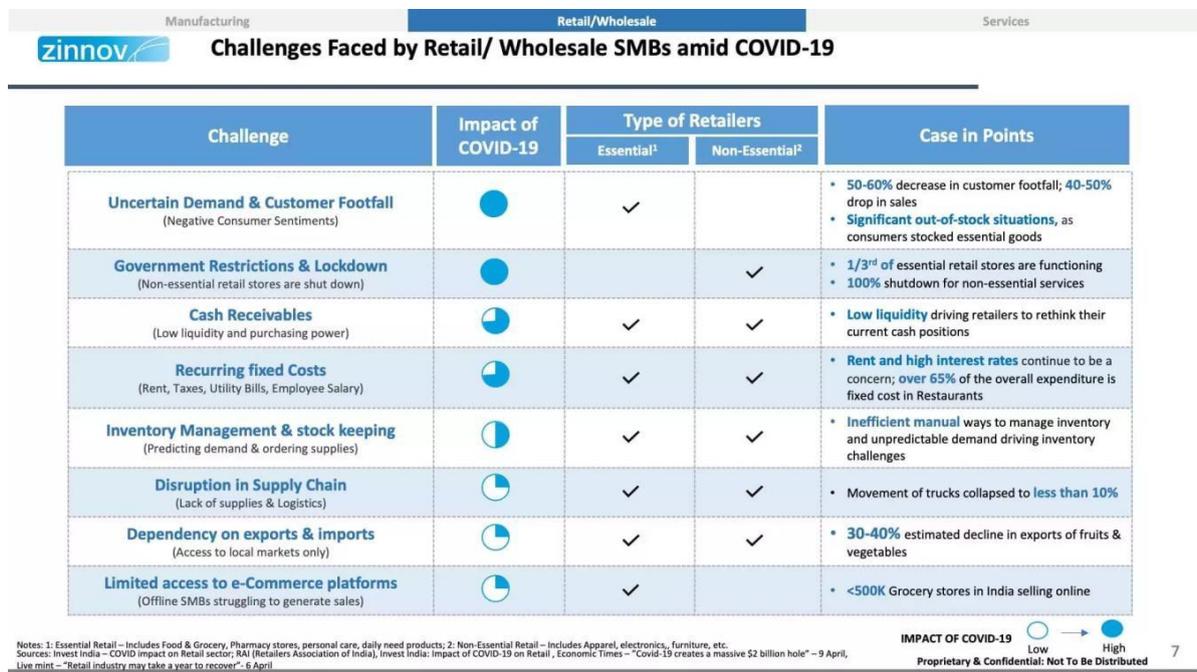
While global supply chains have not fallen under the pressure of COVID-19, the epidemic has exposed major weaknesses in the supply of medicines. Lean provides that commercial chains that have been invested in recent decades do not appear to be able to withstand rapid shocks or production problems caused by epidemic events. As a result, longer production times and an

unexpected need to square measure undoubtedly cause problems at the end of the year.<sup>[21]</sup> The supply chain may be prone to intentionally disrupting cybercrime.

In addition, misconceptions and openness in the supply chain may make the diversity of those challenges even worse.

**10.4. How can producers get used to it by 2021**

While traditional approaches may seem obvious, pharmacists may face significant risks at the end of the year. A fragile world provides chains, an increase in the number of health fraud cases and a weak demand can create challenges for developers. The proliferation of cyberbullying may create problems for developers - especially those who are investing heavily in new production technologies. Managing these risks will no doubt be crucial to business success by 2021.<sup>[17]</sup>



**Fig. 6: Challenges faced by retail / wholesale due to Covid-19.**

**11. Strategies To Reduce The Side Effects Of Covid 19 That Make Some Progress In ClinicalTrials**

To ensure the continuity of clinical trials throughout the COVID-19 epidemic, the following mitigation measures may be used: adopting participatory disciplinary measures, adjusting clinical evaluation procedures, providing material and chain management assistance, receiving remote information updates, and viewing the clinic website, and providing additional website support. The strategy for adopting participatory punishment measures involves using whatever measures are needed to ensure that clinical trial participants are able to perform the required experimental tasks remotely. An effective way to implement this proposal is to use a blockchain-based system that will enable participants to perform a variety of tasks such as granting written consent to Associate in Nursing in a seamless and secure

manner. Alternatively, the strategy involves taking steps to ensure that, upon access to the experimental website, participants receive the necessary support to help them perform the required research tasks. Such support can help reduce risks for participants and increase the benefits of participating in clinical trials. The mitigation strategy for changing clinical trial protocols incorporates the concept and application of replacement trial models. Such a life currently requires clinical trial administrators to obtain the necessary support from the appropriate regulatory authorities. Equally, the strategy of providing logistic offers and providing} network management support includes providing any assistance needed to ensure remote management of drug supply systems and laboratories. A useful approach to such remote management is that it corrects {information | information | details} that integrates participant data and makes it

available to members of the review team in a timely manner. Similarly, a strategy for receiving remote information. Reviewing and viewing the clinic's website involves applying changes to ensure that information is monitored remotely. This could be a huge bid to solve problems based on COVID-19 especially the reduction of clinical website staff and the poor quality of clinical analysis coordinators (CRAs). Another way to assist in the review of remote information is the use of electronic devices for participants. The mitigation strategy for providing website support services includes providing assistance in the form of continuous training of staff and additional staff. Such measures can strengthen the website and thus increase its ability to achieve its goals effectively.<sup>[12,18,21,24]</sup>

### 11.1. Inclusion / Terms of Variation

Subjects included (a) disclosed in actual analysis, (b) in English; (c) completed and disclosed between January 1, 2020, and Sept 05, 2020; (d) highlighted the impact of COVID-19 on clinical trials; (e) focusing on patients from internationally listed countries. The decision to include or exclude research is based on the provision of data related to the impact of COVID-19 on the trial. Appropriate subjects offered as full review texts were highly considered during this review; whereas, abbreviations while not the full text was not included.<sup>[11,13,24]</sup>

### 11.2. Data Release

The results of the site search were initially scanned to find acceptable subject titles. Selected topics are then screened additionally as full texts, and people who meet the eligibility requirements are considered to make the final choice. All literature reviews (including quotes and articles of full text or reports) were performed separately by four researchers (BS, MA, IB, and BR). Released information primarily covers the research source, authors, sample size, research value, design, settings/location, value, and effect.<sup>[31]</sup>

### 11.3. How to Check Quality

All systematic reviews include a method of criticism or analysis of the analytical evidence. The purpose of this study was to evaluate the quality of the research method and to determine the extent to which the research has turned itself into an opportunity for bias, behavior, and analysis. The Joanna Briggs Institute (JBI) Checklist for Analytical Cross-Sectional Studies Literary literature produced a total of 554 million articles, of which 553,999,915 review articles or duplicate articles were not included in the initial assessment.<sup>[1,7,17,23]</sup> Therefore, only relevant articles and summaries have been extensively reviewed, and recently, eighty-one articles were published in the review process resulting in six eligible articles (four review reports and 2 articles) closed during this review. We tend to use the PRISMA diagram to illustrate the flow of data through various stages of systematic review, mapping the number of known, closed, and unqualified records. Therefore, only relevant

articles and summaries have been extensively reviewed, and recently, eighty-one articles were published in the review process which resulted in six eligible articles (four review reports and 2 articles) closed during this review. We tend to use the PRISMA diagram to show the flow of data through various stages of systematic review, mapping the number of known, closed, and unencrypted records.<sup>[19,32]</sup>

### 11.4. Problems in clinical trial management: current ideas

At universities and in the pharmaceutical business, effective management and timely testing activities are essential due to the huge investment (the US \$ 20–50 million per test). In addition, large testing centers sometimes use multiple tests for any purpose of their time, enrolling thousands of patients on multiple sites around the world. Therefore, this epidemic disrupts work design, and decision-making, and creates workspaces that could have a significant impact on the amount of money and patient safety through medical interruptions leading to potential injury.

To date, a few institutions and organizations have already suspended their clinical trials. There are a number of important challenges in the midst of the current epidemic which include: (a) limited access to clinics primarily for important or important travel, (b) there is a problem with hiring patients returning home, or some are reluctant to go to clinics, (c) at the moment, surgery may expose staff or patients at risk of infection, (d) further research may result in a higher rate of discontinuation, and (e) inability to fulfill trial obligations by additional sponsors such as contractors (i.e., sales research, PPE, or site monitoring), and (f) deviations from research timelines may affect information reliability due to delays in testing and observation.<sup>[26]</sup>

Significantly, COVID-19 prevents many institutions from continuing their existing experimental activities. Disruption of trial programs has resources, ethics, and care implications. In order to proceed with the trial, you need to follow the control tips and regularly review this infection trend, oversee training policies and travel restrictions, predict future COVID-19 and understand important risk indicators. support these methods, recommendations, and acceptable policies should be followed at testing sites, and a risk-based decision should use evidence from each epidemiologist and health policymaker. These test-related options may reflect on flexible research sites, extension programs, scheduled trial closure changes, viewing and evaluation activities, access to websites, and, wherever appropriate, the use of machine-readable statement models. As these changes require time and resources, it is therefore important to have strong ownership that tracks risk/issues along with high interaction between decision-making and strategic planning.

Significantly, telemedicine pregnancy has existed for the past 20 years. However, its integration into clinical practice has certain physical and legal challenges, primarily involving the amount of use and compensation that is the far-reaching side of innovation or technical shortcomings. However, the use of telemedicine methods has become very popular and widely accepted by health authorities, physicians, and patients when the epidemic, as well as the positive effects of related interventions, are widely described and rumoured worldwide.<sup>[14,36]</sup>

## 12. Investment Development and Future Growth

During the Covid violence, several attempts were made by the Union's cabinet to develop the company's business, which included a change in Foreign Direct Investment policy to allow FDI to estimate up to 100 pcs under the automated system of manufacturing medical equipment under arrest. Conditions. According to DPIIT information, the company sector has attracted an additional FDI inflow of US \$ 16.54 billion between April 2000 and 2020 June. Most of the investments created within the corporate sector during the Covid disaster include sterilization and disinfectant cabinets, portable and retractable disinfectants, alcohol-free and non-bleach disinfectants, and a wheelchair-based contraceptive unit especially in hospitals by researchers.<sup>[14,8]</sup>

Six drug manufacturers have signed MoUs with Hidalgo (Mexico) to determine the largest company to be assembled and supplied in North America. Jubilant Generics Ltd. entered into a special contract with the opponents of Gilead Science. production and sale of the Covid drug Ramdev Shivir in 127 countries, and India The Telangana government has arranged for the Union Government to consolidate the company city Hyderabad with the help of Rs. 3418 million. Sales record of Rs. fifty-two large integers according to the PMBJP at a fair value to the general public. India has announced plans to work with the Netherlands for the purpose of joint qualifications to produce digital health facilities. government. started the PLI theme for company sector price Rs. 15,000 crore. India also plans to raise Rs. a total of 100000 large funds to strengthen the company sector to make homemade medicinal ingredients by 2023.<sup>[27]</sup> the govt. authorized the extension/renewal of the existing drug procurement policy and added one single-product antibiotic to the current list of 103 drugs.

The National Health Protection Fund, a Government-sponsored care program, which benefits 100 million poor families in the country, provides a combined degree of insurance for up to Rs. five 100000 per family p.a. hospitalization of secondary care and tertiary education. Funds allocated to the insurance team The calendar month of Ayushman Bharat Pradhan Mantri Gregorian Arogya Yojana (AB-PMJAY) is Rs. 6400 million. The company Vision 2020 is a GoI-related degree program to create Bharat a world leader in drug

development and the licensing period for new production facilities has been reduced to save on investment. Government. Provided Rs. 6,940 mass production combined with profits between 5-20% of continuous sales and 3 mega drug parcel schemes to further local price struggle.<sup>[7]</sup>

Drug exports to Bharat are expected to grow between 9-12% over the next 5 years, making Bharat one of the top 10 medical countries. The high growth in home sales will depend on the flexibility of companies to align their product portfolio in the chronic treatment of diseases such as vas, anti-diabetes, antidepressants, and anti-cancer, which is growing.

The government has taken a number of steps to reduce prices and reduce the cost of attendance. The rapid introduction of generic medicines on the market is still entrenched and it is expected that studies in Indian pharmacies will be studied. Focusing on rural health systems, and preserving medicines and vaccines can provide an event venue for pharmaceutical firms.

The spread of the new coronavirus, which causes COVID-19, has a diode in the national and international public health emergency. International health systems face a major challenge in preventing, limiting, and overcoming the effects of the spread of COVID-19, providing timely medical care, adequate drug treatment, and reducing the risk of essential drug shortages. Pharmaceutical production was hampered by restrictions on the work of factories, infected workers, and the inadequacies of materials; therefore, transit transactions have exceeded limits (The line appears to be incomplete, please check) (West et al. 2020). On the other hand, there has been a tendency for more information on diode-containing research drugs in the stock of drugs needed in critically ill patients, especially sedatives and opioids

(Shuman et al. 2020). Outbreaks appear to be exacerbated during pregnancy and in patients with multiple sclerosis. The high impact of the epidemic has led to a shortage of essential (and life-saving) medicines, which are also needed to treat critically ill patients. the main problem was the need for improvement because the effect on the supply and access to medicines was evident (Golan et al. 2020).<sup>[12]</sup>

Covid-19 has not failed to contribute to the replacement of supermarkets. There are very few diode components that can be associated with advanced degrees of risk of drug shortages in warehouses, pharmacies, and hospitals. Many factors determining this risk were the large volume of orders for the purpose of preserving pharmacies, difficulty within the supply chain in terms of supply, restrictions within the production process, purchasing drugs in fear, and independent protective equipment from voters (Boškoski et al. 2020; Romano et al. 2021). In a number of countries, authorities are being pressured

to take drastic measures. For example, legal obligations on the number of drugs that can be purchased by voters. Also, in line with new EU guidelines, pharmacies are allowed to bring medicines to their homes.

India will see the largest number of integration and acquisitions (M&A) in the medical and healthcare sector, according to telecommunications company Grant Thornton. A survey conducted in 100 companies revealed that a quarter of all respondents had hoped to be recognized in the pharmaceutical industry. The growth of Indian Pharmacy companies will also be stimulated by rapidly growing molecules in the diabetes, skincare, and eye care segment. In addition, pharmaceutical companies such as Cipla, Ranbaxy, Dr. Reddy's Labs, and Lupine may be part of the 'Jan Aushadhi' government project. In an effort to sell the project, the Government may undermine private companies to buy more drugs that are common to them.<sup>[9,4,7]</sup>

### 13. CONCLUSION

The global epidemic of COVID-19 may be related to a variety of short- and long-term effects on the healthcare market, particularly the pharmaceutical industry; which can be seen from each international and indigenous perspective. These different impacts may guide policymakers in building knowledge and evidence for combat-related challenges. In order to be effective in preventing long-term problems, short-term impacts should be identified and measured with acceptable data analysis. The identification of those outcomes is important to the policymaker to guide further evidence-based visits to overcome the associated challenges, and this may be even more important in the context of developing countries with additional daunting resources and marketing markets. The covid-19 virus has created significant difficulties in developing a number of studies that will be used effectively to prevent viral risk but to acknowledge production inefficiencies within the financial system.

### REFERENCES

1. Čivljak R., Markotić A., Kuzman I. The third coronavirus epidemic in the third millennium: what's next? *Croat Med J.*, 2020; 61(1): 1–4. - PMC - PubMed
2. World Health Organization WHO Coronavirus Disease (COVID-19) Dashboard. <https://covid19.who.int> Accessed July 17, 2021.
3. Guan W., Ni Z., Hu Y., et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med.*, 2020; 382(18): 1708–1720. - PMC - PubMed
4. Richardson S., Hirsch J.S., Narasimhan M., et al. Presenting Characteristics, Comorbidities, and Outcomes among 5700 Patients Hospitalized with COVID-19 in the New York City Area. *JAMA*, 2020; 323(20): 2052–2059. PMC - PubMed
5. Docherty A.B., Harrison E.M., Green C.A., et al. Features of 20 133 UK patients in hospital with COVID-19 using the ISARIC WHO Clinical Characterisation Protocol: prospective observational cohort study. *BMJ.*, 2020; 369: 1985. PMC - PubMed
6. Huang C., Wang Y., Li X., et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*, 2020; 395(10223): 497–506. PMC - PubMed
7. Qin J., You C., Lin Q., Hu T., Yu S., Zhou X.-H. Estimation of incubation period distribution of COVID-19 using disease onset forward time: a novel cross-sectional and forward follow-up study. *Sci Adv.*, 2020; 6(33). - PMC - PubMed
8. Chatterjee, P. *Indian pharma threatened by COVID-19 shutdowns in China* [Internet]. *The Lancet*, 29 February 2020. [Cited: 19 March 2020]. Available at: <https://www.thelancet.com/journals/lancet...>
9. European Pharmaceutical Review. *India should reduce dependence on China for APIs, says an industry insider* [Internet]. *European Pharmaceutical Review*, 13 March 2020. [Cited: 22 March 2020] Available at <https://www.europeanpharmaceuticalreview.com/news/115163...>
10. James, T. *India's Growing Dependence on Imports in the area of Bulk Drugs* [Internet]. *RIS*. February, 2015. [Cited: 21 March 2020]. Available at: <https://www.ris.org.in/sites/default/files/...>
11. ET Burea. *ICRA downgrades Indian pharma on China lockdown* [Internet]. *Economic Times*. 21 February, 2020. [Cited: 16 March 2020]. Available at: <https://economictimes.indiatimes.com/markets/...>
12. Arnum, P. *Indian Government Looks To Increase Domestic API Mfg* [Internet]. *DCAT*. 25 March, 2020 [Cited: 25 March 2020] Available at: <https://dcatvci.org/6411-indian-government...>
13. PIB Delhi. *Cabinet approves Promotion of domestic manufacturing of critical Key Starting Materials/Drug Intermediates and Active Pharmaceutical Ingredients in the country* [Internet]. *PIB Delhi*. 21 March, 2020. [Cited: 25 March 2020].
14. Academy E. ECA Academy, Handling of APIs and Excipients - New Guidelines in Chapter 5 of EU GMP Guide. Available At: <https://www.gmp-compliance.org/gmp-news/handling-of-apis-and-excipients-..., 2013>.
15. Aministraton, U.S.F.a.D. Current and Resolved Drug Shortages and Discontinuations Reported to FDA, 2020.
16. Alazmi A., Alhamdan H., Abualezz R., Bahadig F., Abonofal N., Osman M. (2017). Patients' Knowledge and Attitude toward the Disposal of Medications. *J. Pharmaceutics*, 2017; 8516741. 10.1155/2017/8516741 - DOI - PMC - PubMed
17. Alruthia Y. S., Alkofide H., Alajmi R. h., Balkhi B., Alghamdi A., Alnasser A., et al. Drug Shortages in Large Hospitals in Riyadh: a Cross-Sectional Study. *Ann. Saudi Med*, 2017; 37: 375–385. 10.5144/0256-4947.2017.375 - DOI - PMC -

- PubMed.
18. Alsheikh M., Seoane-Vazquez E., Rittenhouse B., Fox E. R., Fanikos J. A Comparison of Drug Shortages in the Hospital Setting in the United States and Saudi Arabia: an Exploratory Analysis. *Hosp. Pharm*, 2016; 51: 370–375. 10.1310/hpj5105-370 - DOI - PMC - PubMed.
  19. American Society of Health System Pharmacists ASHP. Available at: <https://www.ashp.org/Drug-Shortages/Shortage-Resources/Drug-Shortages-St...> Accessed June 30, 2020, 2020.
  20. Ashp and Healthcare ASHP Drug Shortages Statistics. Atif M., Malik I., Mushtaq I., Asghar S. (2019). Medicines Shortages in Pakistan: a Qualitative Study to Explore Current Situation, Reasons and Possible Solutions to Overcome the Barriers. *BMJ open* 9, e027028. 10.1136/bmjopen-2018-027028 - DOI - PMC - PubMed, 2020.
  21. Ayati N., Saiyarsarai P., Nikfar S. Short and Long Term Impacts of COVID-19 on the Pharmaceutical Sector. *DARU J. Pharm. Sci.*, 2020; 28: 799–805. 10.1007/s40199-020-00358-5 - DOI - PMC - PubMed.
  22. Babar Z.-U.-D. Ten Recommendations to Improve Pharmacy Practice in Low and Middle-Income Countries (LMICs). *J. Pharm. Pol. Pract*, 2021; 14: 1–5. 10.1186/s40545-020-00288-2 - DOI - PMC - PubMed.
  23. Badreldin H. A., Atallah B. Global Drug Shortages Due to COVID-19: Impact on Patient Care and Mitigation Strategies. *Res. Soc. Administrative Pharm*, 2021; 17: 1946–1949. 10.1016/j.sapharm.2020.05.017 - DOI - PMC - PubMed.
  24. Ballinger J. R. 99Mo Shortage in Nuclear Medicine: Crisis or challenge?. *J. Labelled Compounds Radiopharm. Official J. Int. Isotope Soc*, 2010; 53: 167–168.
  25. Banerjee R., Thurm C. W., Fox E. R., Hersh A. L. Antibiotic Shortages in Paediatrics. *Paediatrics* 142. 10.1542/peds.2018-0858 - DOI - PubMed, 2018.
  26. Bazargani Y. T., Ewen M., De Boer A., Leufkens H. G., Mantel-Teeuwisse A. K. Essential Medicines Are More Available Than Other Medicines Around the globe. *PloS one* 9. 10.1371/journal.pone.0087576 - DOI - PMC - PubMed, 2014.
  27. Becker D. J., Talwar S., Levy B. P., Thorn M., Roitman J., Blum R. H., et al. Impact of Oncology Drug Shortages on Patient Therapy: Unplanned Treatment Changes. *Jop*, 2013; 9: e122–e128. 10.1200/jop.2012.000799 - DOI - PMC - PubMed
  28. Bengt C. D., Burka A. T. Heparin Drug Shortage Conservation Strategies. *Fed. Pract*, 2019; 36: 449–454. - PMC - PubMed
  29. World Health Organization. FIFA/COVID-19 virtual press conference. Published March 23, 2020. Accessed June 7, [https://www.who.int/docs/default-source/coronaviruse/transcripts/who-audio-emergencies-coronavirus-press-conference-full-23mar2020.pdf?sfvrsn=846ecb41\\_4](https://www.who.int/docs/default-source/coronaviruse/transcripts/who-audio-emergencies-coronavirus-press-conference-full-23mar2020.pdf?sfvrsn=846ecb41_4), 2020.
  30. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. *JAMA*. [published online February 24, 2020]. doi:10.1001/jama.2020.2648 [PubMed] [CrossRef] [Google Scholar], 2019.
  31. Indian Council of Medical Research. Advisory for use of Cartridge Based Nucleic Acid Amplification Test (CBNAAT) using Cepheid Xpert Xpress SARS- CoV2. Published May 9. Accessed June 29, 2020 [https://www.icmr.gov.in/pdf/covid/labs/Cepheid\\_Xpert\\_Xpress\\_SARS-CoV2\\_advisory\\_v2.pdf](https://www.icmr.gov.in/pdf/covid/labs/Cepheid_Xpert_Xpress_SARS-CoV2_advisory_v2.pdf), 2020.
  32. Rosenberg ES, Dufort EM, Udo T, et al. Association of treatment with hydroxychloroquine or azithromycin with in-hospital mortality in patients with COVID-19 in New York State. *JAMA*, 2020; 323: 2493-2502. doi:10.1001/jama.2020.8630 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
  33. Xiang Y.T., Yang Y., Li W., Zhang L., Zhang Q., Cheung T., Ng C.H. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry*, 2020; 7(March (3)): 228–229. [PMC free article] [PubMed] [Google Scholar]
  34. Levin AT, Hanage WP, Owusu-Boaitey N, et al. Assessing the age specificity of infection fatality rates for COVID-19: Systematic review, meta-analysis, and public policy implications. *Euro J Epidemiol*, 2020; 35(12): 1123–1138.
  35. COVID-19 significantly impacts health services for noncommunicable diseases. *Who.int*. Available from: <https://www.who.int/news/item/01-06-2020-covid-19-significantly-impacts-health-services-for-noncommunicable-diseases>. Accessed August 25, 2020.
  36. Chang AY, Cullen MR, Harrington RA, Barry M. The impact of novel coronavirus COVID-19 on noncommunicable disease patients and health systems: a review. *J Intern Med*, 2021; 289(4): 450–462. doi:10.1111/joim.13184
  37. Lessons from the past on how to revive the US economy after COVID-19. *Mckinsey.com*; 2020. Available from: <https://www.mckinsey.com/industries/public-and-social-sector/our-insights/lessons-from-the-past-on-how-to-revive-the-us-economy-after-covid-19>. Accessed September 10, 2020.