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Impact of COVID 19 Pandemic Crisis on the Health System and Pharmaceutical Industry

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Abstract: The magnitude of the COVID-19 pandemic has an enormous impact on the health system and pharmaceutical industry in almost every country globally. Health services have been disrupted at many dimensions globally; communicating with patients at homes away from clinics was commonly practiced in order to provide safety actions to the healthcare team. These measures affected the economic income of the hospitals in addition to health insurers as well. Additionally, drug makers' inability to get active pharmaceutical ingredients from Chinese factories was considered another challenge in this situation. The severe interruption of trading and traveling worldwide has resulted in a harmful impact on the real economy. Treatment of coronavirus infection was taken place by different protocols and based on the already existing medications. Most countries race to the rapid development of a vaccine.

Keywords: COVID-19; crisis; health system; pharmaceutical industry; vaccine.

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1. Introduction

Coronavirus infectious disease (Covid-19) first took rise in Wuhan city, China, in December 2019. The virus has spread globally to the point that the World Health Organization (WHO) declared a global pandemic on 11th March 2020 [1]. Covid-19 is transmitted mainly during coughing and sneezing; fecal-oral transmission was also reported in a few cases [2]. Therefore, these compelled governments to apply movement restrictions to curb the spread of coronavirus and break the transmission chain. This includes the lockdown of entire cities, shutting down schools, education centers, and higher learning institutions, and enforcing stay at home rules and work from home schemes for employees [3]–[5].

The person, group, or organization cannot cope with their daily life using normal routine procedures [6]. Three forms of crisis exist: gradual threat, periodic threat, and sudden threat; the Covid-19 crisis obviously can be called a ‘sudden threat’, as the crisis suddenly occurred [7]. There are many reasons Covid-19 has been categorized as a sudden threat. Firstly, it can kill healthy adults, especially the elderly, with chronic health conditions [8]. Second, it is highly spreadable. The person carrying the virus can transmit it to several others, and some

may be asymptomatic [9]. In addition, lockdown and social distancing steps to avoid Covid-19 spread lead to increased domestic violence rates, including physical, emotional, and sexual abuse [10].

Since there is no treatment or vaccine for the current virus infection, for those affected with the most severe symptoms, the healthcare system is focusing on ensuring the access of appropriately intensive services with maintaining the protection procedure against the virus [11]. The health care staff are worked to extreme levels to deliver the best possible care in this period [12]. Besides, hospitals must prepare now for how they will treat patients, allocate resources, and staff wards. Nearly 95 000 critical care beds are available in U.S. hospitals today, including surgical and specialty unit beds [13]. Conservative estimates suggest that we may need almost twice this amount should the COVID-19 pandemic, especially if sustained [14]. Furthermore, the COVID19 outbreak this pandemic has affected the pharmaceutical industry immensely; the type and quantity of products in demand changed, regulation for diagnostic and treatment was revised, there were changes to the research and development process, slow-down of industry growth, approval delays, and the implementation of self-sufficiency measures with regards to the supply chain [15]. This article will discuss the impact of Covid-19 and strategies to manage this crisis in terms of the healthcare system and the pharmaceutical industry.

2. Influence of Covid-19 pandemic crisis on the healthcare system

The Covid-19 pandemic is currently a globally threatening economic crisis for almost all sectors, including the healthcare system. Physical and mental collapses among healthcare providers and inadequate facilities and infrastructure of the healthcare practice settings are remaining highly challengeable. Health care workers, especially dentists, otolaryngologists, head and neck surgeons, gastroenterologists, pulmonologists, respiratory therapists, speech therapists, infectious disease physicians, and ophthalmologists, are at the greatest chance to be infected with the virus [16]–[18]. About 20% of healthcare frontlines contracted the virus in Italy, with some losing their lives in the process [19]. Besides, the physicians and other healthcare providers are constantly worried about getting the infection, and suffering watching infected patients die alone has contributed to the increase in symptoms of depression and anxiety within them [20]. To remove this workload faced by healthcare workers, the Ministry of Health in Singapore recommended all doctors to cease further admission of non-Singaporean patients with immediate effect [21].

Healthcare workers must not be taken away by tasks such as ensuring safe staffing levels, communicating administrative information to patients at home, and re-organizing outpatient clinic lists from them, prioritizing direct clinical duties [22]. However, according to a 3- week survey on several countries in May 2020 by WHO, the pandemic disrupted health services either partially or fully [23]. Additionally, the Centers for Disease Control and Prevention (CDC), American Dental Association (ADA), and state dental boards and associations in the United States have all issued guidance to advise dentists to halt elective dental services and treat only patients requiring emergency dental procedures which in turn affecting the dental and oral health clinics income with the rapid increase in confirmed cases of COVID-19 [24].

This pandemic has dramatically changed outpatient care delivery; the patient's appointments had been postponed to decrease the transmitting risk to either patients or health care workers. Physicians have moved away from personal visits to distanced visits, especially in the UK and USA, whenever possible [24]. For patients suffering from a chronic illness

requiring frequent visits, check-ups, and follow-ups, this poses a major challenge. There are obstacles to receiving treatment from healthcare personnel and facilities [25]. Many patients are encouraged to stay at home, avoiding visits to clinics and hospitals to reduce the risk of exposure [26].

It was estimated by the American Hospital Association (AHA) report that the hospitals and health systems income lost over $50 billion monthly over the period between 1st March 2020, to 30th June 2020. The financial burden covers the cost of patient hospitalization due to COVID-19 infection, reduction and/or cancellation of service provision due to risk of virus transmission leading to reduced hospital income, the burden of cost from purchase of personnel protective equipment (PPE), and provision of additional services to support frontline workers: certain hospitals have taken to supporting child care, housing, and transportation [27]. The weaknesses in patient care delivery have been seen in the form of the high cost of healthcare, insufficiency of PPE including WHO-approved protective face masks, and limitations in accessibility to treatment in the intensive care unit (ICU), including limited availability of beds and assisted breathing equipment (ventilators) for admitted patients [28]. Most of the hospitals were closed temporarily in Wuhan city, china and the hospitals in Iran struggle to survive with the coronavirus outbreak [21].

Furthermore, health insurers have also been affected, as was observed in the US, whereby companies have struggled with paying insurance benefits to hospitals. With no positive progress in the healthcare industry's financial burden, the US federal government has included these companies in the federal relief stimulus package under discussion [21]. The healthcare systems are especially challenged in developing and underdeveloped countries. In contrast, these countries will not face this pandemic with their weak health systems [25].

3. Management and recovery strategy of the health care system

The current global response toward Covid-19 crisis aims to flatten the epidemic curve by slowed and interrupting the transmission between people. The most concerning problem will be the collapse of the health care system due to the rapid contagion of the virus, resulting in not providing patients with the proper treatment they require [29]. Therefore, rapid changes and adaptations to the health care system needed to be implemented in response to the increasing burden of infected people. The pattern of hospital admissions has changed the Covid-19 pandemic [22]. The routine outpatient tasks should be minimized to reduce crowding and transmission outside clinics and practice social distancing inside health treatment facilities, including clinics and hospitals. Patients should be seated six feet apart while waiting to be called for inspection/treatment while wearing a face mask and taught how to properly cough and sneeze to prevent viral transmission [30]. In order to reduce the number of patients that visit the hospitals, the appointments are being moved to telephone or video calls when possible. Some hospitals are considering off-site phlebotomy centers, including couriers delivering medications as well [22].

The required significant expansion of medical beds and critical care is already being empowered by canceling elective work, repurposing operating theatres, and the use of private facilities [22]. In areas such as Milan, temporary treatment facilities were created in the Emergency Room (ER) and triage area in the University Hospital. The screening was conducted for all patients who access the ER with respiratory symptoms. A multidisciplinary discussion of compromised patients was activated to define the therapeutic program and potential candidacy to invasive procedures [31]. To minimize the burden of hospitalization of

infected people and promote pandemic control, appropriate screening of community and patients under investigation will be timely directed to predetermined medical establishments; when this is not accessible either due to poor safety or availability, home care for the patient with mild symptoms and the option of being in the care of family members should be taken into consideration. The main clinical manifestations of persons bearing the Covid-19 virus are fever, pharyngalgia, lethargy, affected bowel movement, and other various symptoms [34], [35]. The infection may rapidly affect the patient, especially those with present chronic illnesses such as diabetes, cardiovascular disease, malignancy exhibiting acute respiratory distress syndrome (ARDS), sepsis, and multiple organ dysfunction, severely or critically affecting the patient's well-being.

There is no vaccine or specific medications proven to be effective for Covid-19; most of the treatment either is symptomatic and supportive. The patient receiving supportive management of the disease will depend on the severity of the disease observed, considering the possibility of quarantine and hospitalization necessity [38]. Treatment options for patients with complications include continuous renal replacement therapy (CRRT), invasive mechanical ventilation, and even extracorporeal membrane oxygenation (ECMO). As part of critical management schemes involving corticosteroids and antivirals, medical therapy has also been encouraged [38]. The discharge of the patient from the hospital requires two samples taken 24 hours apart from the patient's respiratory tract to be tested negative for viral load at the laboratory [40]. The recommendation of WHO for Covid-19 suspected individuals is as illustrated in Figure 1.

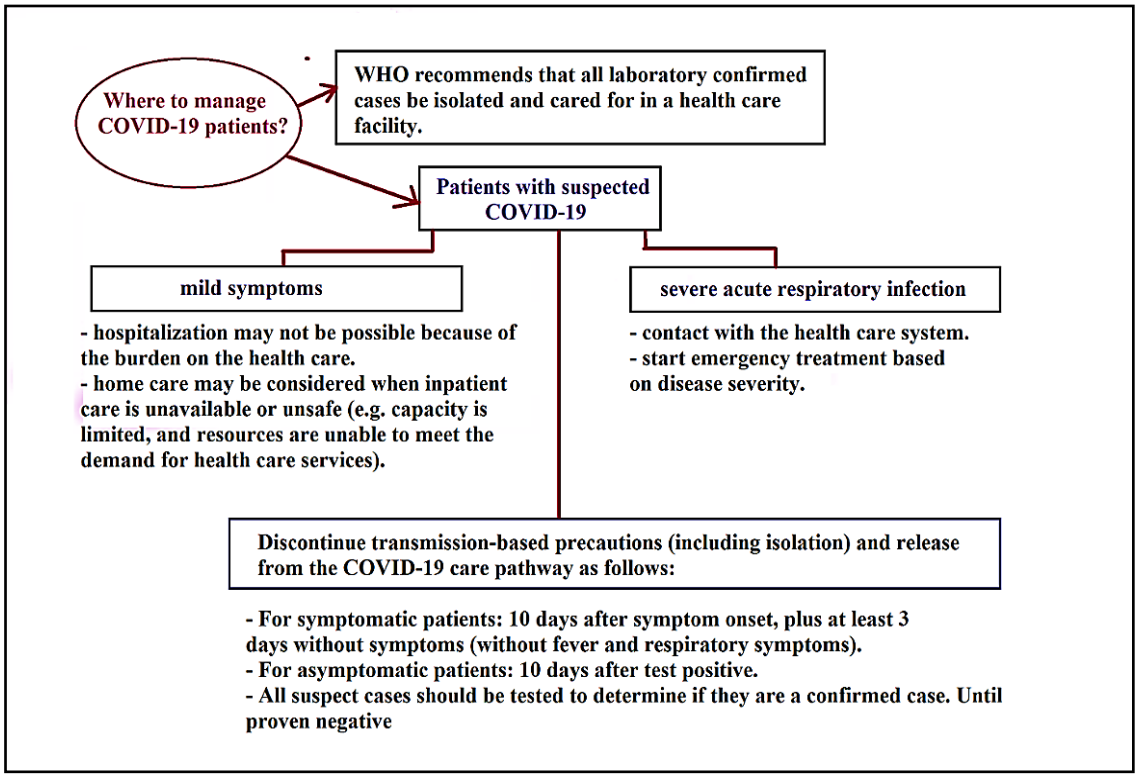

Figure 1. Non-clinical management of patients under investigation for Covid-19.

Furthermore, additional crucial steps must be applied by health care workers to avoid unnecessary contact with patients and their immediate surroundings, including medical equipment [41]. For instance, patients should be seated and maintain a distance of six feet away from doctors until the physical examination period; furthermore, doctors should adopt specific

practices after meeting each new patient, including putting on a face mask, washing their hands with water and soap, and liberal application of sanitizing agents [30, 42]. Likewise, dentists should take extra precautions when interacting with patients. They are at higher risk of infection due to being in proximity to the patients' oral cavity and exposure to breathing and air droplets during treatment [43]. Thus the American Dental Association (ADA) has advised best practices for dentists, next to the general precautions/ guidelines, including tracing the patient's recent travel history, recording patients' body temperature, assessing signs and symptoms of respiratory tract infection; disinfection of the oral cavity with 1% hydrogen peroxide before starting treatment, using high volume suction during treatment; using a dental dam, and sanitizing public surface areas frequently, such as seats, bathrooms and door handles [43].

With the COVID19 outbreak, the pharmaceutical industry has had to provide more than what is covered by community pharmacists' standard practices. First, the industry has had to prevent and control the outbreak and respond to patients' drug needs [36]. The industry needs to team up with healthcare organizations, professionals, and government agencies in response to managing the service requirements listed below [36]:

- Drafting of specialized service guidance pharmacies and practitioners.
- Establishing emergency drug formularies based on treatment guidelines.
- Organizing with suppliers and traders to provide drug companies and distributors to ensure adequate supply, storage, and transport of identified formulary drugs.
- Providing access to pharmaceutical services on an event basis.
- Reducing face-to-face contact in patients by setting up remote dispensary services to protect patients and pharmacists from getting infected.
- Disbursing information to the community about the prevention of infection and management of disease management.
- Participation in human trials aimed at identifying, investigating, and developing relevant medications according to national and international guidelines.

The successful experience in Wuhan, China, is noteworthy because of the significant changes the government took in managing the Covid-19 crisis, where the hospitals were re-divided into two separate areas: one sanitized area for the staff and another area for incoming and outgoing patients. Additionally, five different pathways were established to protect personnel and patients: patient, administrative staff, medical staff, cleaning staff, and waste passageway [14]. Patients were provided with surgical masks to minimize transmission. Critical cases were addressed by urgently purchasing medical rescue equipment oxygenation [44]. All medical staff had instructions to abide by the Chinese Guideline's standard protocol to protect themselves and during COVID19 patient treatment. Patients not showing increased body temperature were allowed to leave the treatment facility within 24 hours to allow for more incoming patients and decrease the possibility of cross-infection [45]. Additional medical personnel trained in contagious diseases were recruited. Lead experts from Wuhan Union Hospital and Sichuan province were enlisted into the scene. They were instrumental in the smooth running of the hospital. They were instrumental in taking care of the basic needs and safety of essential frontlines [45].

4. Covid-19's impact on the pharmaceutical industry

The pharmaceutical industry plays a key role in delivering life-saving products/services to society. The pharmaceutical industry's several challenges were observed in the management

of the pandemic, including trouble meeting the demand for protective gear and diagnostic testing facilities [46]. With China monopolizing the world's active ingredients manufacture (up to 60% of China's production), pharmaceutical companies rely heavily on compounds produced in China [47]. The Covid-19 crisis has had a direct effect on shortage in medical supplies, supply chain uncertainty, logistics, and transport, owing to the shutdown of factories, especially in China, where most drug products are from. The obstacles faced in business deals and the movement of goods and resources posed a threat to the real economy [48]– [50].

Several pharmaceutical companies faced insufficient active pharmaceutical ingredients (APIs) supply prior to the Covid-19 outbreak that resulted in some inadequate essential drugs supply while some others had a stockpile of APIs stored away; the companies either sold these supplies at exorbitant prices or refused to sell their supplies due to inadequate amounts in their stockpile [21]. Indian pharmaceutical companies are the largest buyers of China-made APIs for use in their drug manufacture due to China's monopoly in the API manufacture and export [51]. With no other reliable active ingredient supplies or major drug manufacturers available, the international community relies on India for generic drugs. Moreover, national drug manufacturers would answer their national demands first before the international community [52]. Accordingly, several meetings between the Indian government and crucial players in the industry were held to increase APIs' national production volume [51].

The ability to source raw supplies, produce and deliver drugs has been limited due to rules to avoid Covid-19 outbreak from spreading. This is a huge challenge in developing and underdeveloped countries that do not have national production capacities [52]. This reliance on import puts a huge burden on these countries to negotiate to price for treatment options for those in need [53]. In prioritizing the production of drugs and equipment targeted against COVID19, a void in the production of drugs for other chronic diseases is created [25]. The outbreak's effect on the health sector was the rising death tolls due to insufficient drug supply, unavailability of vaccine treatment options, poor hospital treatment capacity, and lack of quarantine facilities to manage increasing COVID19 infections [21].

5. Is the vaccine or specific treatment coming soon?

The drug development (pipeline) consists of early research development comprising identification and screening of compounds, more complex laboratory analysis, testing in animals, and human clinical testing. New compound discovery to the marketplace can take a decade or more; therefore, numerous medications used for Covid-19 treatments are those that already exist. However, it is a global imperative that the development and production of a vaccine in the nearest future is necessary for the global fight against COVID19, seeing the great need for a safe and reliable vaccine and an even greater need for it to be administered to those in need rapidly to prevent new or recurring outbreaks [54]. Pharmaceutical companies such as Johnson & Johnson and Sanofi are putting in major efforts to develop their vaccine. In late July 2020, Johnson & Johnson announced that it had begun early-stage human trials after their vaccine has shown promising results when used in monkeys. Giant pharma Pfizer is also in the race for developing a vaccine in collaboration with German biotechnology giant BioNTech. In early July, Pfizer announced that the vaccine produced an immune response in people during an early-stage clinical trial. They added that the vaccine did cause side effects such as fever at higher doses [55].

Successful progression of vaccine discovery from the laboratory to clinical trials will need to establish new ways to collaborate between several key parties, including the

pharmaceutical industry itself, government, and researchers. Each party will have to contribute their strengths towards a common objective: to develop, produce, and deliver vaccines to the global population. The parties will cover research, development, large-scale manufacture, use of novel technologies, facilities and infrastructure, distribution, and delivery of the vaccines at an international scale [56]. The Coalition for Epidemic Preparedness Innovations (CEPI) has estimated that a requirement of at least US$2 billion would be needed to solely research and develop three COVID19 vaccines within the next one to one and a half year; this does not include production or delivery costs [57].

Recently, Russia produces the first batch of the novel coronavirus vaccine developed by the Gamaleya research institute. However, some scientists said they fear that Moscow may be putting national prestige before safety amid the global race to develop a vaccine against the disease with this fast regulatory approval. Global public opinion strongly expects that when a Covid-19 vaccine is produced, it must be available to all. It would certainly be unacceptable if huge profits are distributed to shareholders while people worldwide suffer [21].

6. Lesson learned from various Covid-19 pandemic

There are three stages approach for crisis management; the pre-crisis stage (prevention and preparation), the crisis stage (response), and the post-crisis stage (learning and revision) [58]. Several lessons need to be learned from the Coronavirus pandemic to allow us to defeat it and anticipate potential new crises. Bat coronaviruses have been reported as the responsible agent for the SARS and MERS outbreaks in 2003 and the current SARS-CoV-2 outbreak. Future epidemics arising from these bat coronaviruses are bound to occur, as there is no way of eliminating them from bats worldwide [59]. An innovative mindset coupled with new technologies and approaches focusing on fast market delivery is required to eliminate the Covid-19 virus and potentially future coronaviruses [59]. Actually, the main cause of the current crisis is not the virus only, but the way of economic system works as a whole, which highlights the intrinsic discrepancies and dysfunctions of the production system [48].

In order for us to have the opportunity to manage future pandemic threats rapidly and effectively, major changes in the system are needed [52], [60]–[62]:

- Accelerated drug discovery can be achieved via screening current databases for compounds proven to be safe and implementing novel methods, such as using artificial intelligence to screen antivirals that can be used rapidly in large-scale human tests.
- The primary health care systems need to create a potential infrastructure to fight against epidemics and train health care workers to be able to deliver vaccines competently, track patterns in disease, and serve as early informers that can be vigilant to future disease spread.
- Surveillance of disease through a database that easily accessible to relevant organizations and sharing this information between countries.
- Information to personnel with the relevant training at the local and global levels that are able to act during an epidemic rapidly should be accessible to governments. Data on available treatments in storage or need to be redirected during an outbreak should also be available to the government.
- It is necessary to create a system for the development, approval, and rapid delivery of safe and effective treatment to the global population to discover novel, contagious pathogens.

- Experts from different countries can offer solutions to several of the challenges faced by scientists. When these problems and their relevant data are shared on open platforms, this provides an avenue for other experts to contribute their ideas on how to solve these problems.
- With the COVID-19 outbreak putting the global population in an emergency, relevant authorities should manage the outbreak directly while aiming to minimize damages as side effects. It is imperative to ensure that the supply of therapeutics is adequate. This ensures that medical treatment can be delivered quickly and reduces interruptions in the healthcare delivery system, whose smooth operation relies on a ready supply of medication, diagnostic tools, and preventive medicine.

These policies need to encourage financing in research and development in areas that are severely under-represented in order for society to derive value from the innovations in the pharmaceutical industry. At the same time, this allows innovations to flourish. For example, patents promote investment in research by providing market dominance over a period of several years, increasing competition in the market, which will reduce the market price of the product and subsequently improve market access.

7. Conclusions

The covid-19 virus is considered a sudden threat that involves many aspects, including the health care system and the pharmaceutical industry. This virus has created an observable crisis that has evolved many lessons that can be used effectively not to limit the risk of viruses but to recognize the dysfunction of production among the economic system.

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Conflicts of Interest

The authors declare no conflict of interest.

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