Smart Technologies to Mitigate and Manage The Pandemic: Today and Tomorrow

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ABSTRACT

COVID 19 pandemic has affected the modern world in an unimaginable way. Outbreak of the coronavirus and months long total lockdown in major parts of the world has highlighted the lacunas in disaster management and unpreparedness of the world for such a type of pandemic and "unexpected" future pandemic. All the efforts put in combating this infectious virus and to deal with adverse effects of pandemic has proved that use of technology is the only and would be the only effective solution. Each and every sector including the health sector has no option other than adoption of newer technologies in innovative engineering ways. This paper tries to suggest use of various technologies including Artificial Intelligence (AI), cloud computing, big data, blockchain, 5G and smart applications, Internet of Things (IoT), drones, robotics. These and few more digital technologies have been playing a crucial role in effective management of pandemic. This focussed review and discussion is expected to create awareness and motivation to the health care sector for using all the major Industry 4.0 technologies leading to Medicine 4.0. This technological revolution in healthcare and allied sectors will help in effective management of pandemic.

Keywords: COVID 19, Coronavirus, disaster management, emerging technologies, pandemic, health care.

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INTRODUCTION

Today, every part of the world is fighting the spread of the corona virus, or COVID-19, which has been declared an epidemic by the World Health Organization (WHO). According to the World Health Organization, more than 4.7 million COVID-19 cases in 216 countries are said to have killed 1.2 million lives, which is not over yet. This catastrophic loss of human and economic life is a great concern to mankind.

This is not the first time the world has experienced an epidemic.The Spanish Influenza or Influenza of 1918 was one of the worst diseases caused by the H1N1 virus in human history, with a genetic predisposition to bird offspring. It is estimated that one third of the world's population is affected. The disease has claimed the lives of 50 million people, with a significant number of deaths reported in the United States. Nearly four decades later, in 1957-

58, a devastating pandemic caused by a virus (H2N2) broke out. The first few cases have been reported in Singapore and Hong Kong. Over the next few months, an Asian flu spread to the United States and the United Kingdom. According to the World Health Organization, the flu is estimated to have

killed 10-40 lakh people. However, another catastrophic plague struck the Earth in 1968. This was the first case reported in the city called the Hong Kong flu, which spread to countries such as Vietnam, India and the Philippines. Infection is caused by the H5N2 virus. As soldiers returned home from the Vietnam War, the Hong Kong flu hit the United States. According to the Center for Disease Control and Prevention (CDC), about 1 million people in the United States have died from the flu, the world number 10 million. This century saw its first outbreak in 2009-2010 caused by the influenza A (H1N1) virus. According to the World Health Organization, the number of H1N1 deaths reported in 2009 ranged from 1 to 4 million [1,2].

The human corona virus disease COVID-19, first reported in Wuhan, China, then spread worldwide [3,4], has now become the fifth pandemic. The corona virus was officially designated as the acute respiratory syndrome corona virus 2 (SARS-CoV-2) by the International Committee on the Classification of Viruses on the basis of phylogenetic analysis [5]. The virus is thought to be infected with the animal corona virus, which was later developed to spread from person to person. Because the virus is highly contagious, it spreads rapidly and is constantly changing in humans. In such cases, all aspects of disaster management come into play, and the only solution to control the spread is to use technology.

The COVID 19 epidemic has left many governments around the world, including developed countries, unable to determine the extent of the problem and prepare themselves to deal with the disease. These injustices have forced to cover the world and cause economic loss. Larger parts of the world are affected by this lock than an infectious disease [6,7]. In fact, adopting a variety of digital technologies can help better manage infections.

It should be noted that this is not the end of the epidemic, and that being prepared to spread and unite the epidemic on an individual level is important for the development of mankind. The use of advanced technology with new engineering methods will be crucial in the fight against the coming epidemic. To move forward in this way, identifying areas to focus on, the development of new technologies and their adoption will be key factors. It shows that there is limited awareness about the adoption of these technologies for effective use, in addition to the many technologies that are currently available for epidemics due to COVID. Advanced technology will always be the hope of avoiding any uncontrollable problem.

COVID 19 pandemic has highlighted following areas which are required to be focussed.

1. Sudden rise in demand of critical care facilities (resources)
2. Preventive medicine and health care facilities (health care)
3. Disaster management.
4. Use of positioning technologies to get precise locations for putting relief efforts
5. Use of faster and effective mass communication.

The use of the latest technologies on an emergency basis can help reduce the risk of infection and control the loss of life and the economy. Countries such as South Korea, China, Japan and the United States have been similarly demonstrated in this epidemic situation due to COVID - 19. Many applications and various innovative technologies have been identified by these countries to effectively manage the epidemic.

EMERGING TECHNOLOGIES FOR PANDEMIC MANAGEMENT

Artificial intelligence (AI), cloud computing, big data, volume chain, 5G and smart applications, IoT application, drones and robotics are some of the technologies that can be implemented to effectively manage the epidemic. Many such emerging technologies can be efficiently implemented on an emergency basis to improve the effectiveness of global efforts in epidemic surveillance, virus surveillance, prevention, control, treatment, resource allocation and vaccine development. It is well known that all of these emerging technologies led to Industrial 4.0, the fourth industrial revolution [8,9,10]. Similarly, this pandemic situation has opened the doors for the transformation of Medicine into the next revolution (Medicine 4.0), by adopting all of these engineering technologies. The medical profession should not miss this "unnecessary" opportunity, and engineers should contribute to this.

Some of the technologies that have played a key role in managing the COVID epidemic and the technologies that need to be implemented in engineering innovative ways are briefly discussed.

Artificial intelligence (AI)
AI is becoming an integral part of every sector, including the health sector. AI-based data analysis and prognosis modelling tools involve medical professionals in understanding disease transmission, medication, and treatment.

Using AI platforms, it is easy for researchers working on COVID 19 to quickly discover and view research published by various researchers to expand research work on solving various problems related to COVID-19 eruptions. Countries like China have started implemented AI & Big Data to fight the corona virus.

AI research centers have designed AI-based risk assessment tools that provide a clear solution to epidemic-related confusions. E.g. One such advanced tool is to distinguish whether the patient has a common cold, flu, or COVID-19. Furthermore, it indicates whether COVID-19 should be recommended for testing or whether any other tests should be recommended. One of the multinational technology research centers has developed AI-based systems that can display a large moving population of up to 200 people per minute and detect changes in their body temperature without interfering with the flow of people. Such technologies have been implemented in congested areas, hospitals, bus stations, and airports. Such a system helps to identify and isolate victims, and protects the population from infection. Virus detection and the development of vaccines are key areas where AI technology can contribute.

Big Data

Big data analysis can help quickly identify affected individuals and monitor a person's movements. This helps control the spread of viruses. Facial recognition techniques can also identify mask wearers. Such technologies help to track and monitor the movement of isolated individuals. CCTV cameras with facial recognition technologies can detect and monitor the movement of victims.

Cloud Computing

Using the Internet allows you to make real-time decisions using large amounts of necessary information stored on a computer platform. It is possible to model disease and different needs at different levels (hospital level, national level, etc.).

Telemedicine

A patient can avoid coming to the hospital by video calls from well-trained medical professionals. Quality telecommunications infrastructure with virtual reality and magnified reality can improve the quality of such remote consulting.

Blockchain

Provides real-time data on disease control processes and helps improve the quality of supply chain management.

5G and Smart Applications

High speed communication is possible even in remote areas. The improved quality of telemedicine appointments due to high speed communication enables patients from rural areas to seek expert advice.

Internet of Things (IoT)

IoT technology can be very effective in managing infections such as COVID-19, especially in detection, communication tracking, isolation compliance, and patient care. Infact, this technology will transform the medical field into Medicine 4.0, which is similar to Industry 4.0.

Non- Contact Movement (Drones and Robots)

Self-driving cars, drones, and robots help the epidemic to avoid large-scale human contact.

Robots can be used for many applications such as grocery distribution, sterilization of hospitals, and patrolling the streets.

Drones can be used to deliver food, monitor populations, deliver sanitary boxes and medicines to isolated areas, heat imaging, refining and more. Countries like China often use drones and robots to fight the corona virus.

Additive Manufacturing

This technology sets a new character for the manufacturing industry that maintains business continuity during these epidemics. Remote operations in the factory with remote monitoring of complex processes are made possible by combination production. Without endangering employees by enabling remote operation in the factory and remotely monitoring important processes. Safety devices can be manufactured for health workers and patients using 3D printing technology without risk to employees.

Remote Working Technologies to Support Social Distancing (online mode)

By effectively using technology and allowing people to work from home one can avoid business losses in an epidemic. Technologies for accessing data from remote locations, enterprise applications (ERP software), virtual meetings, cloud conferencing can be used effectively to maintain social distance in the workplace and to prevent people from traveling to public places. Many disciplines, including education, have managed all teaching, learning and administrative tasks using new technologies such

as smartphones, Microsoft teams, Zoom, Google Meat, Google Classroom, WhatsApp, Telegram and many more tools [11]. You can also use some of the software available to ERP for administrative tasks with these tools. Lab experience can also be provided to students through the use of virtual labs.

Development of Biosensors

The development of biosensors helps to diagnose and analyze infections. Glucometers and oximeters are some examples of biosensors. Laser guns and heat scanners are implemented for temperature measurements. Air conditioners are an integral part of hospitals and help in the growth of the virus. Biosensors can help detect and filter viruses and air pollutants, which can help control the spread of the virus.

Some attempts to adopt emerging technologies include: (i) Microsoft Bing has introduced an interactive COVID-19 map to provide widespread disease news; (ii) Sixfold has published a free live map of the crossing times for lorries so that all supply chains in Europe can understand the expected delays in receiving exports; (iii) the social platform, Dictok has partnered with the WHO on COVID-19 to provide timely and timely facts to their users, and has provided a live stream from the WHO where users can ask questions and search for COVID-19 related answers; (iv) In India, Geo, BSNL, Airtel and many other telecom operators use caller rhythms to spread awareness about the epidemic.

There are challenges in managing post-coital conditions in many healthcare sectors, including dental and oral medicine [12,13] services, pharmaceuticals [14-15], and solid waste management [16]. The integration of the technologies mentioned above will definitely help in managing future epidemics and save millions of human lives.

CONCLUSION

Emerging technologies and accepting it always make life easier. In particular, technologies can play an important role in making life easier in disasters and epidemics. Preparation for any disaster or epidemic depends largely on the effective implementation of new technologies, both individually and collectively.

This study highlights the various emerging technologies and their function of effectively managing the epidemic, mainly in the health sector. The sudden increase in the need for complex maintenance facilities, the development of preventive medicine and health facilities, the use of fitting technologies to obtain effective locations for effective disaster management, and the use of fast and effective mass communication are highly recommended in innovative ways that use technology.

AI and big data-based risk assessment tools help to understand the spread of the disease, medication, treatment and quick identification of affected individuals. Large data stored on the Internet with cloud computing and blockchain enables real-time decision-making on disease modeling and its spread. Allows telemedicine remote consultation with virtual and magnified reality. High-speed communication with 5G smart applications and the use of IoT facilitates detection, communication tracking, cluster identification, isolation compliance, and patient and geriatric care. There will be a revolution in the healthcare sector using IoT in the true sense.

Non-contact manufacturing such as the use of drones and robots, combination manufacturing, 3-D printing and remote working technologies (online mode) contribute to the management of this pan in all sectors including the health sector.

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