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A socio-economic analysis of the role of medical drones in the era of the COVID-19 pandemic

Abstract. Coronavirus is a large family of viruses that cause illness ranging from mild to severe symptoms. The high and fast transmission rate causes all activities in various fields, including the health and economic sector, to be carried out with caution. Different technologies are also developed to support health workers' performance and financial circumstances, including drones in multiple aspects of medical needs ranging from delivering drugs and medical devices to carrying out vital sign checks. This study uses a qualitative descriptive. Data was obtained utilizing observation and literature study. Medical drones have a strategic role in fighting the COVID-19 pandemic, starting from the enforcement of social distancing programs, COVID-19 transport specimens to disinfection facilities in large areas. Medical drones are the latest technology in the medical field that helps medical performance improve healthcare service quality. The use of drones in the health sector needs to be further developed.

Keywords: Medical Drone; Financial Circumstances; COVID-19; Medical Transportation; Social Distancing
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1. Introduction

COVID-19 is a huge family of viruses that brings in diseases ranging from mild to severe (Cusack, 2020). There stand at least 2 kinds of COVID-19 that are distinguished to end in illnesses that can cause intense symptoms, including Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) (Fu et al., 2021). COVID-19 is a new sort of illness that human beings have never come across previously. COVID-19 is breaking out so fast over the globe (Cusack, 2020). Coronavirus disease-2019 (COVID-19) is an infectious disease resulted from the dire respiratory syndrome coronavirus-2 (SARS-CoV-2), which holds

significant implications for patients. COVID-19 is zoonotic (transmitted between animals and humans) (Cusack, 2020; Fu et al., 2021) . The transmission of the COVID-19 disease spreads rapidly to patients with severe indications. COVID-19 originated in Wuhan city, Hubei Province, Central China, and has quickly spread to 72 countries (Li et al., 2020). The transmission of these cases is still not known for sure. However, the first case was linked to a fish market in Wuhan. From December 18 to December 29, 2019, five patients were treated with ARDS (Li et al., 2020). Coronavirus disease 2019 (COVID-19) outbreak declared a public health emergency of international concern by the World Health Organization on January 30, 2020. In fact, almost all countries have confirmed positive numbers of COVID-19 cases (Cusack, 2020; Fu et al., 2021). Coronavirus disease 2019 (COVID-19) is a serious concern, as the number of patients continues to grow massively around the world.

The spread of SARS-CoV-2 from humans to humans being the primary transmission source, so spread becomes more aggressive. SARS-CoV-2 transmission of symptomatic patients occurs via the droplet out when coughing or sneezing. Information of SARS-CoV-2 can use personal protective equipment and patients' isolation independently. Additionally, it has been studied that SARS-CoV-2 can be viable to aerosols (generated through the nebulizer) for at least 3 hours. SARS-CoV-2 leads to transmission prevention, focusing on maintaining distance and personal protective equipment such as masks, hand sanitizers, and others. SARS-CoV-2, in the process of healing, can be natural rather than through the administration of lopinavir/ritonavir or both (Fu et al., 2021). Also, the SARS-CoV-2 test kit is essential to help understand clinical performance. The high and fast transmission rate causes all activities in various fields, including the health sector, to be carried out with caution. Various personal protective equipment is worn to prevent transmission (Cusack, 2020). Different technologies were developed to support the performance of healthcare workers. The use of robots to provide patients' needs in every hospital ward and what is currently made uses drones in various medical conditions, ranging from providing medicines and medical devices to vital signs checks. These are often called medical drones in people with health problems (The Lancet Haematology, 2017).

Drones are pilotless aircraft. These aircraft are controlled automatically through a designed computer program or remote control from pilots on the ground or other vehicles. Drones can quickly reach their destination and allow them to be controlled remotely by humans (Macias et al., 2020). Drones can be a mode of transport to reach emergency areas in disaster-affected areas. The drone, better known as the Unmanned Aerial Vehicle (UAV), was initially developed for military purposes. Technological developments have made drones that are starting to be widely applied for civilian needs, especially in business, industry, and logistics and are currently developing in the medical field (Merkert & Bushell, 2020).

2. Research Method

The method used in this study is the study of literature. Authors use literature studies to search for various written sources, books, articles and journals, and documents relevant to the studied problem. The information obtained from this literature study is used as a reference to reinforce existing arguments. In this study, eleven reference sources consisting of various journals related to the role of medical drones were used to introduce medical needs in the era of the COVID-19 pandemic. The analysis technique used is descriptive analysis, namely content analysis intended to detail a particular message or text. The design of this analysis is not designed to test specific hypotheses or test the relationship between variables.

3. Result and Discussion

This article states that medical drones have a very strategic role during the COVID-19 pandemic (Amukele, 2019; Amukele et al., 2015). The high number of COVID-19 cases resulted in all individuals having to do social distancing. Dissimilar medical drones play a role in fighting COVID-19, both in enforcing social distancing programs, sending COVID-19 specimens, monitoring using thermal cameras to prevent transmission of COVID-19 to disinfection in large areas (Macias et al., 2018). Drones allow the delivery of medical materials under challenging regions and minimize people meeting face-to-face to hinder transmitting COVID-19. Thus drones are the right solution as a tool to support the success of humanity to fight COVID-19 (The Lancet Haematology, 2017).

3.1. What is a medical drone?

The medical drone is a technology that uses drones as a means of transportation to support medical needs. Medical drones are usually involved in the rapid delivery of vaccines, medicines, and direct supplies to locations where they are needed (Amukele, 2019; 2020). Medical drones are currently still being used for experiments and research. Medical drones can be mistaken for military drones by civilians causing people to become anxious, especially in countries with a history of being attacked by military drones (Jeyabalan et al., 2020). Medical drones become a finding for the future as part of medical aid (Nimilan et al., 2019). Medical drones are used to provide more comprehensive health care coverage. Medical drones can travel to their destination before an ambulance arrives on the scene (Dhivya et al., 2018). Medical drones are needed to provide adequate service to large areas. Medical drones will also increase a person's independence in paying attention to their health needs. Also, medical drones play a role in monitoring patients living at home with dementia or other diseases that require special monitoring (Merkert & Bushell, 2020). Medical drone technology allows more people to receive medical care/needs at home without going to hospitals or other health facilities. Medical drones are a highly developed technology using controllable applications. Medical drones are used because they are considered safe and effective to assist medical services. Medical drones can be a health management strategy, especially in regulating hard-to-reach resources (Fu et al., 2021).

Medical drones are also carried out between two different hospitals and sending specimens or patient data. Rapid transfer of samples to well-equipped laboratories and return of drugs that match the diagnosis can save the patient (Robakowska et al., 2019). This transfer is possible between a hospital in remote areas with limited supplies and a hospital in a city with good facilities. Medical drones need proper planning and cooperation in the service process (Robakowska et al., 2019). Medical drones are the answer to speeding up medical service time in emergencies.

3.2. Drones as medical transportation

Fast response times and the ability to navigate rugged terrain using regular transportation make drones the top choice for medical delivery. Drones as a medical transport mode will proliferate shortly and replace most deliveries directly. Drone transport can help in exceptional disaster circumstances. To speed up the availability of vaccines and reduce costs, drones as medical transportation can prove that drones are cost-effective and useful in various circumstances to address the problem (Poljak & Šterbenc, 2020). Drone transport can reach the desired distance at a constant speed at a cost that is still affordable. Also, the drone size is not too large, and unmanned makes it easy to send medical needs in rugged terrain. Delivery of specimens from one hospital to another is also possible. In 2014, Médecins Sans Frontières (MSF) conducted a test specimen shipment using drones to deliver tuberculosis samples from one hospital to another. These experiments show that drones can provide viable laboratory samples in 25% of the time it takes compared to ground transport shipments (Amukele, 2019; Amukele et al., 2015).

Drone technology can also be combined with the telemedicine field. Drone technology can be facilitated using communication and medical equipment that enables patient care through telecommunications technology. Drone technology has evolved rapidly in the past decade; its use is appropriate for various situations, including medicines' delivery (Cheskes et al., 2020). Drone technology is expected to have lax regulations to unlock exciting new medical drone transport breakthroughs. Drone technology has enormous benefits in reducing pollution, reaching hazardous and disaster-prone areas, and improving emergency preparedness (Alsamhi et al., 2019). However, this technology must continue to be developed because it can be constrained in commercial networks, especially in remote environmental areas, disaster relief, or combat. In emergency cases, drones have also been used to deliver Automatic External Defibrillators (AEDs) to medical personnel assisting individuals having a heart attack. The delivery of the AED using drones is considered more effective and faster when compared to sending AEDs via ambulance (Starks et al., 2020). A computer-based simulation study shows that adequately placed drones can reach 96% of the district's population in less than 1 minute. The drone is in stark contrast to the traditional ambulance response time, which achieves only 4.3% of cases. During the COVID-19 pandemic like today, especially in the antigen swab examination facility and Polymerase Chain Reaction Test (PCR Test) examination, speed diagnosis and sample delivery from remote areas to more adequate facilities are needed. Drones, in this case, can play a role (Lu, 2020).

3.3. Drones as surveillance epidemiology

Drones are currently being developed to monitor disaster sites, areas with biological and chemical hazards and track the spread of infectious diseases in a room. Drones in epidemiology are used to monitor dangerous disaster areas, and research and track illness spread (Fu et al., 2021). Drones have become a tool in the future in epidemiology. The use of drones has been proven in gathering information on the number of patients requiring treatment and triage in high-risk environments or natural disaster sites (Kumar et al., 2021). When the COVID-19 epidemic began to occur in China, the government deployed impressive technology to monitor its vigilance program. The lockdown system, in this case, was drones. The use of drones equipped with loudspeakers provides instructions and encourages people not to leave the house. The drone is also applied in various European countries (Li et al., 2020; Kumar et al., 2021).

Drone technology can be developed to predict the high risk of COVID-19 in certain areas (Kumar et al., 2021). The advantage of drone technology is that it is relatively cheap to obtain high-resolution, real-time temporal and spatial information. Drone technology suitable for epidemiological research. In some countries, drones have been used even more in the health sector (Amukele, 2019; Amukele et al., 2015; Amukele, 2020).

3.4. The role of medicine in the era of the COVID-19 pandemic

The part of drone technology in the health sector is very diverse, especially during the COVID-19 pandemic. One example is a drone with a temperature detector that can be used as an initial preventive measure for COVID-19. Drones equipped with thermal cameras will automatically comprehensively detect everyone due to the high infrared rays used in crowded areas to assist management and evacuation on site. Drones can also be used to disinfect large areas or locations that are difficult to access. This method is used for drones to fight this coronavirus, thus reducing human mobility around places at high risk of COVID-19 (Robakowska et al., 2019).

As countries worldwide are looking for practical solutions to reduce the COVID-19 pandemic and reduce the death toll for medical workers, they are the front line who are significantly at risk while carrying out their duties. Drones are the right and fast choice to be used as a tool to aid medical performance, as they can safely monitor public open spaces, broadcast messages through loudspeakers, view crowd activity and disinfect large areas (Macias et al., 2020).

Drones also act as transportation of COVID-19 specimens from one hospital to another. Compared to ordinary vehicles, drones can have better performance. The effectiveness of screening over a wider area, even to remote locations, can be carried out. In the COVID-19 vaccination program currently being carried out by various countries, drones also play a vital role. At least the vaccination program must quickly occur. For this reason, in locations that are difficult to reach by traditional transportation (cars, trains, planes), drones can be a solution so that the herd immunity program can occur in a fast time (Fu et al., 2021).

4. Conclusion

The medical drone is the latest technology in the medical field that helps medical performance improve health services quality. During the COVID-19 pandemic, medical drones had taken their place. They were used as a solution to fight COVID-19, starting from transporting COVID-19 specimens to the tools used to monitor the success of the distancing program. In the future, the use of drones in the health sector needs to be further developed; some shortcomings, such as complicated commercial networks to drone accidents, must be resolved immediately.

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