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Application of Intelligent Technologies on Response to Covid-19 and Occupational Safety in Healthcare Workers

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Dear Editor,

As a public health pandemic, the Covid-19 not only has affected the health of billions of people but also has crippled the world economy. As a result, it has created a heavy burden on health systems. Healthcare workers are at the forefront of responding to the outbreak and are at increased risk of infection, mainly due to long working hours, mental distress, fatigue, burnout, and physical and psychological violence. Hence, it can be argued that they are experiencing both occupational safety and health problems. Therefore, developing various technologies to tackle their problems is of crucial importance. Industry 4.0 is known as the fourth industrial revolution, which intends to improve the performance of health systems in controlling crises and also maintaining the safety and occupational health of employees. It's a smart system that is also known as the fourth industrial revolution, which consists of a combination of traditional and industrial methods to develop intelligent technologies. This industry is focused on some key factors such as automation, communications, and monitoring, which lead to an intelligent technology that can analyze and diagnose problems in a timely manner without human intervention. In this letter to the editor, we aimed to mention the applications of Industry 4.0 technologies for managing the COVID-19 pandemic with special emphasis on occupational safety and health of human resources (1, 2). The Industry 4.0 contains several tools which can be used to control the COVID-19 pandemic through artificial intelligence (AI), Internet of Things (IoT), big data, virtual reality, holography, cloud computing, autonomous robot, 3D scanning, 3D printing, and biosensors (2). These technologies can predict, identify, and control patients infected with Covid-19. Besides, they are useful for improving occupational safety and health in healthcare settings, particularly hospital environments (2). In the following, a brief discussion about these technologies is provided (2).

AI is a powerful tool to assess and screen people during the COVID-19 pandemic. This technology can be used for diagnosis, tracking, forecasting, early warning, treatment, and social control. Moreover, it's a broad concept of computer software designed to mimic or improve human decision-making. Hence, it can be used to enhance the power of imaging tools and assisting medical professionals. Images which are taken using the AI are highly useful for automating the scanning process, as well as transforming workflows to reduce contacts with patients. Moreover, this technology provides the best protection for imaging technicians. Also, AI can increase work efficiency by accurately identifying infection in X-ray and CT images (2, 3).

The next technology is the IoT, which refers to a network of interconnected physical objects such as sensors, health monitoring devices, smart meters, home appliances, autonomous vehicles, etc. These digital technologies can be applied to fight against the COVID-19. The IoT can create a system to monitor patients' clinical symptoms such as heart rate, blood pressure, and temperature of the patient remotely and also to use computed tomography scans to diagnose the disease (2, 4).

Big data is an analytic technique in the fourth industrial revolution, which allows to store and analyze a large amount of data (e.g., about infected patients) and providing a real-time evaluation. Hence, it is a powerful tool to recognize, explain, predict the pattern of COVID-19 infections and identifying effective treatments. Moreover, its information can be used for policymaking. This technology combines machine learning and AI to analyze raw data (structured and unstructured) collected by researchers,

mainly to find replicated algorithms and patterns for further analyses. Ultimately, the technology helps companies to improve their operations and making faster and smarter decisions (2-4).

As we know, the COVID-19 pandemic quickly led to the closure of universities, schools, and other training centers in the world. Using virtual reality and holography as other intelligent technologies, academic departments have rapidly pivoted toward digital and remote learning. It potentially can promote safety, comfort, and a feeling of control as well as reducing the spread of coronavirus expansion by implementing social distance measures. Therefore, this technology is useful for reducing occupational and public exposure and decreasing the cost burden of the disease for both peoples and governments (2, 5).

Machine learning (ML) and cloud computing are other technologies of the Fourth Industrial Revolution that, in addition to predicting the pattern of COVID-19 pandemic and patient's prognosis, can be used in medical image processing, disease tracking, and designing control strategies (6).

As the COVID-19 spread rapidly all around the world, the influx of patients into hospitals caused a heavy workload for medical staff. In the Fourth Industrial Revolution, robots can be used to sterilize the environments, screening patients, virtual visits and patient care, remote patient care, identifying and tracking patients, monitoring and managing restricted and quarantined areas. Regarding sterilization, that is one aspect of cleaning healthcare facilities, an autonomous wheeled mobile system that is called UV, sterilization robots can be used to disinfect hospital equipment and surfaces using ultraviolet (such as PX-UV). It also can be used to remove bedding and other contaminated materials from hospital rooms before autonomously disinfecting the environment (7, 8).

3D scanning of the thoracic chest using AI is a useful tool to detect and quantify the coronavirus. Its an intelligent and non-contact technology that uses several sensors and one/two cameras, which take several images about the exact shape and size of the physical object. Finally, a high-end computer analyses these data to be converted to a digital image (2).

The next intelligent technology is 3D printing, which has a clear role in protecting healthcare workers during the COVID-19 pandemic facilitating the production of personal protective equipment, especially respirators, goggles, and face shields (9).

Concerning the COVID-19 pandemic, Biosensors are another type of intelligent technology in the Fourth Industrial Revolution that, by converting biological signals into electrical signals, are capable of providing devices with easy to employ, sensitive, cost-saving, and high accuracy for detecting and tracking covid-19 patients.

Biosensors are powerful tools for early detection and monitoring of the symptoms of COVD-19, effective assessment of clinical progress, and determining the severity or critical trends of infection. This technology is actively using to improve portability, duration, and cost of PCR-based SARS-CoV-2 detection (2, 10).

The Fourth Industrial Revolution is redefining our life with its highly intelligent technologies. The combination of these measures can improve equity in access to healthcare services, reduce patients' need for intensive care, and accelerate implementing measures that improve or maintain occupational safety and healthcare of workers. Increasing patient satisfaction, reducing hospitalization, enhancing the speed of treatment, reducing healthcare costs are among other important benefits of using the technologies of the Fourth Industrial Revolution. The use of the abovementioned intelligent technologies, while improving the quality of governance during crises, would be a useful tool in the hand of governments to identify, track, monitor, and treat patients with COVID-19. Furthermore, it would be useful for managing human resources, medicine, and equipment. Finally, industry 4.0 can improve the resilience of communities and the environment in exposure during crises.

Footnotes

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