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ROLE OF ENGINEERS IN COVID-19

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Abstract

In light of the current novel coronavirus (COVID-19) pandemic, as well as other viral outbreaks in the 21st century, there is a dire need for new diagnostic and therapeutic strategies to combat infectious diseases worldwide. As a convergence science, engineering has traditionally focused on the application of engineering principles to biological systems, collaboration across disciplines, and rapid translation of technologies from the bench top to the bedside. Given these strengths, engineers are particularly well suited to apply their skill set to the current crisis and viral outbreaks in general. This work introduces the basics of virology and epidemiology for engineers, and highlights important developments in the field of engineering relevant to the current pandemic, including in UV light-emitting, disinfection robots 3D-printed 'Made in Catalonia' ventilator, vaccine technology, and small-molecule drug delivery. COVID-19 serves as a call to arms for scientists across all disciplines, and tissue engineers are well trained to be leaders and contributors in this time of need.

Keywords: *COVID-19, pandemic, UV light-emitting, Disinfection robots 3D-printed, ventilator, vaccine technology.*

INTRODUCTION

A Corona Virus is a kind of virus which is mainly originated from Wuhan city of China which also well known as COVID-19. This virus has great impact in entire world due to its high infection rate. Which is mainly spread by COVID-19 infected people? Its origin is still unknown to us. Due to this pandemic situation a kind of war is going on. Where each and every fields of studies having an important to control the spread of this virus. Where medical science has leads most important role because doctors are major warrior for this war. Not only doctors our police service or municipality

they also play important role to control this situation. Where each and every person are fighting this war by following rules of government and some people also helps government by raising found to government. Then what is the role of Engineering? Or How Engineering helps to fight this war? Actually Engineering means dealing with Technology or Innovate new technologies to make humans life easy. The world is changing, and engineers are the ones behind so much of this development. They have great role in each and every field such as medical science, pharmaceutical science, building society, Introducing new machine, Automation of every things and etc.

2. ABOUT THE CORONAVIRUS

Coronaviruses are a large family of viruses that cause illness ranging from the common cold to the more severe diseases such as the Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV) and the current COVID-19. These viruses consist of a core of genetic material surrounded by an envelope with protein spikes, which gives it an appearance of a crown. Coronaviruses are zoonotic, meaning they are “transmitted from animals to humans.” In the current outbreak, it was found by the scientists that this Corona virus was a new strain. Thus, it was named ‘novel’ or new Corona with the appellation of ‘n-Corona’. It was later renamed as SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) by the International Committee on Taxonomy of Viruses, owing its similarities in genome structure with that of SARS virus. The SARS-CoV-2 is believed to have taken the following sequence- It originated from bats, and then transmitted to pangolins to humans. The sequence is yet to be confirmed. Until the source of this virus is identified and controlled, there is a risk of reintroduction of the virus in the human population and the risk of new outbreaks like the ones we are currently experiencing. It was the wet markets (selling live meat, fish, reptiles and wild animals) in Wuhan, where the virus It was believed to have spawned, precisely the Wuhan Seafood Wholesale Market. The problem with these Chinese wet markets was that all sorts of animals, ranging from fowl to wild animals, were sold there for their meat (for example monkeys, python, dogs, hares and pangolin etc.) without due care of hygiene. Previously, On rare occasions, a coronavirus may spread through contact with faces. In these wetmarkets,

2.1. How It Spread: It is believed that the virus was transmitted to humans through the fluid secreted from the respiratory system of the wild animals. Further, it spread from humans to humans while coughing and sneezing, shaking of hands, making contact with a surface or object that has the virus etc.This virus as various modes of transmission which are given below.

2.2. Respiratory transmission: While the basic outlines of disease transmission have not been upended by COVID-19, there are some nuances that could play an important role in the spread of the disease.t is mainly transmitted between people through "respiratory droplets" when symptomatic people sneeze or cough. This idea, that large droplets of virus-laden mucus are the primary mode of transmission, guides the CDC's advice to maintain at least a 6-foot distance between you and other people. The thinking is that gravity causes those large droplets (which are bigger than about .0002 inches, or 5 microns, in size) to fall to the ground within a distance of 6 feet from the infected person.

2.3. Aerosol transmission: In order for the virus to be spread without being coughed or sneezed in large drops of mucus, it has to somehow be able to suspend in the air for long enough to

infect passer-by.And that's another complicating factor in figuring out transmission: People emit virus particles in a range of sizes, and some are small enough to be considered aerosols, or fine particles that can stay suspended in the air for hours and can travel with air currents across tens of feet.

2.4. Contact transmission: There's one other route that's thought to play a role in the spread of COVID-19: contact transmission. In that situation, viral particles emitted from the respiratory tract of an infected individual land on a surface. Then, another person touches that object, then touches their nose, mouth or eyes. The virus then sneaks into the body via the mucous membranes, infecting the second person.

2.5. Preventions Equipment's: There are various equipment's which are helps to prevent the spread of this virus. The equipment's are

- Sphygmomanometer and infrared thermometer - sphygmomanometers should have calibration date stickers.
- Pulse oximeter.
- Glucometer including appropriate strips and lancets.
- Alcohol wipes, gloves, lubricating jelly.
- Alcohol gel for hands.
- PPE KIT

With numbers of patients skyrocketing, stopping the spread of Covid-19 is an immediate concern. Multiple readers urged engineering companies to design, develop and manufacture more diagnostic kits, as well as improving logistics to distribute them quicker.

3. ROLE OF ENGINEERS

The answers are hugely encouraging, with many good ideas and willing helpers. They will hopefully provide inspiration for potential volunteers and maybe even guidance for under-pressure officials, who could use this engineering expertise to help minimise the worst of the virus' impact. Engineering solutions would have been especially effective early on during the outbreak, before measures like lockdown were introduced. But even during lockdown, they could help minimise the spread of the virus in the parts of society that are still open, such as banks and supermarkets. When you look at the potential that engineering can bring to this in a public health (preventive) rather than a medical (restorative) setting, it shows how much we're actually missing. It may be that these particular (disinfectant) solutions are not workable at scale, but the point is that engineers could probably come up with other design solutions that would work. It's their job. Everyone should follow social distancing and other temporary rules. But with potentially months of restrictions ahead and the possibility of the outbreak stretching on, here are six ways that engineers could help. Following criticism of the government's comparatively low level of testing, one member suggested engineers could install "intelligent body temperature detectors at schools, supermarkets, etc". Other cutting-edge engineering could help lower infection rates. "Cleaning solutions and material development with inbuilt anti-bacterial properties being developed into our design solutions would be positive," said Daniel Marsh.

3.1. Support the NHS: More hospital spaces are needed for patients as the NHS comes under increasing strain. The ExCel Centre in East London is being co-opted as a field hospital and could reportedly hold up to 4,000 patients. Following similar measures in China, readers suggested engineers could help build new hospitals, including by designing and manufacturing buildings using offsite construction. Improving Personal Protective Equipment (PPE) for NHS staff was a common suggestion. "NHS masks are 'one size fits all'," said William Richardson. "To state the obvious, everyone's face is slightly different." Member Caroline Rose suggested improvements could include

atmosphere control and filtering, and decontamination. UV decontamination units could reduce waste – and therefore demand – on essential equipment, said one reader. With multiple efforts ongoing to develop a vaccine, Paul Rosenberger said companies should prepare for increased demand for injection needles.

3.2. Spread Stem knowledge: While pupils might have hoped for a break during school closures, teaching is ongoing. This could be a great opportunity to educate and inspire a future generation of engineers, said Dave Hughes.

3.3. Prevent future outbreaks: Engineers should carry out a full assessment of medical equipment that might be required in similar situations, said Rich Pearson, to ensure that designs can be open-sourced and shared with manufacturers when needed. Industry itself should have a frank appraisal of its international activity to help prevent a repeat of this pandemic, said Paul Thurgood. Companies and employees might need to act differently in future**.**

3.4. Run the country: Others suggested practical ways of helping the government, including giving guidance on statistical modelling and risk assessment, managing supply chains and assisting planning.

3.5. Latest Development Invention to Control COVID-19: In response to cases of COVID-19 rising worldwide, the World Health Organization has recently warned that the pandemic is "accelerating." Thankfully, it does say the trajectory can still be changed. That's why the global scientific community is pulling together in order to develop viable treatments and vaccines to combat the spread of the infectious disease. Much in the same vein, the world is in desperate need of ingenious solutions to widespread issues such as supply shortages of medical equipment.

3.6. Reverse-engineered 3D-printed ventilators: After the outbreak soared to uncontrollable levels in Italy this month, Dr Daniele Macchini famously wrote that a scarcity in the medical equipment required treating patients means that "every ventilator becomes like gold." Despite the possibility of being sued by the medical technology company that manufactures a specific ventilator, the volunteers reverse-engineered the piece that was required and were able to print it in a matter of hours to help save lives.

3.7. The snorkeling mask ventilator: Only a few days after helping an Italian hospital by playing their part in fixing the broken supply chain for ventilators, the same group of engineers shared a 3D printed design for an adapter that converts snorkel masks into ventilators. Through the use of the adapter, a converted "Easybreath" snorkel mask becomes a functional C-PAP mask for oxygen therapy — a treatment that is critical for the recovery of people with severe cases of COVID-19. Robots helping populations affected by the pandemic worldwide Countries throughout the world are deploying robots to help amidst the growing crisis. In Bangkok, Chulalongkorn University has teamed up with Advanced Info Service (AIS) to develop robots that utilize 5G technology to monitor coronavirus patients while keeping doctors in the loop from afar. As Business Insider points out, the city of Wuhan, where the outbreak started, is using robots to spray disinfectant throughout urban spaces.

3.8. Coronavirus isolation pods made by Mexican engineer: Special fully-sealed isolation pods were recently created by Mexican engineer Fernando Aviles for safely transporting COVID-19 patients. The specially-designed pods are equipped with air pumps that create a negative pressure within the sealed space.The negative pressure means that, even if the plastic lining of the pod is torn during the transfer of a patient, any fluids will remain inside the isolation pod — an ingenious method for stopping the spread

of the infectious disease amongst healthcare workers.

3.9. UV light-emitting disinfection robots: UV light disinfectant robots weren't specifically developed for the COVID-19 pandemic and they haven't been definitively proven to be effective at eradicating the virus (SARS COV-2) from surfaces — and yet, demand has skyrocketed to the point that companies are sending truckloads of the machines to different countries worldwide. Hospitals worldwide seem to be trusting that this is true, as demand is sky-high for the robots which use eight light bulbs to emit concentrated UV-C ultraviolet light over hospital surfaces. This type of light has been shown to destroy viruses, bacteria, and other harmful microbes by damaging their DNA and RNA so that they can no longer multiply.

3.10. Oxford University and King's College prototype ventilator for mass production: Engineers, anaesthetists, and surgeons from the University of Oxford and King's College London are working on one of the many new ventilator designs needed to help patients with severe conditions. Though it is less advanced than other existing ventilator designs, it has been designed for its quick construction and deployment time.

3.11. 3D-printed 'Made in Catalonia' ventilator: After Italy, Spain currently has the second-highest death toll in the world for the coronavirus — at over 3,400 deaths, Spain has recently surpassed the number of deaths in China. As with any country currently suffering a wave of COVID-19 cases, ventilators are in very high demand.

3.12. Artificial intelligence used to analyze self-isolation habits: Some countries have taken longer than others to announce police-enforced lockdowns. In the United Kingdom, for example, the decision was only enforced yesterday. According to research by Vivacity Labs, a start-up that makes camera-based traffic sensors, the enforcement was severely needed.

3.13. U.S. army corps engineers convert buildings to provide 10,000 new beds: Confirmed cases of the coronavirus have surged in New York in the last week. With over 25,000 cases and 210 deaths at the time of writing, it has become the epicenter of coronavirus cases in the U.S.That's why the United States Army Corps of Engineers has stepped in to convert buildings into hospitals in order to create new ICU space for the growing number of patients. The plan is expected to provide 10,000 hospital beds in the state of New York.

3.14. Spain to use AI and robots to quadruple testing capacity: As well as a great necessity for ventilators, and hospital beds, there is also a need to test huge numbers of people while keeping up with the growing number of infections. In Spain, they have turned to AI and robotics to enhance the country's testing capability.According to Bloomberg, Spain has been testing between 15,000 and 20,000 people a day. Now, the country will use robots and AI to quadruple that capacity.

CONCLUSION

The world faces a global health-care crisis of unheralded magnitude. The rate of infection and mortality from COVID-19 make it unlike any virus seen in this century. Engineers and Scientists are banding together to combat the threat of SAR-CoV-2. Engineers have a rare set of tools and can make substantial contributions to our understanding of viral disease and contribute toward the critical development of diagnostic and therapeutic platforms. Together, we can overcome this current pandemic and work to prevent and mitigate future viral outbreaks.

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