What has COVID-19 done for us?

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The early 2020s will be studied by historians as a time of global uncertainty when an unknown pathogen caused a public health emergency that brought the world to the brink. It may also be remembered as a time of unparalleled co-operation and advancement in technologies, prompted by the COVID pandemic, that provided enduring benefits for generations to come.

Just as the two world wars of the 20th Century were the deadliest and most attritional in history, they also triggered developments in medicine, jet propulsion and cryptology that ultimately led to the general prescribing of penicillin, mass air transit and the dawn of the computer age.

The quickest and most obvious legacy of COVID was mass vaccination programmes around the world which has already led to a step change in public perceptions of diagnostics and population-wide inoculation.

The profile it gave to the industry has since led to greater investment in methods and devices for detecting a wide range of conditions. In addition, we can expect established, over-the-counter tests for things like fertility and pregnancy to become more informative. Diagnosing serious illnesses, including cancers and heart disease, is likely to become simpler and quicker, because of advances in diagnostic technology created by interest in the sector generated by COVID.

Also, by improving testing and diagnoses, we need to ensure that we are not widening health inequalities. Those who push for better and earlier treatment tend to be educated, middle class people with a bit of money who are used to dealing with systems and being heard. There's a whole other class of poorer, particularly older people, who are less likely to push and more likely to accept what they are told.

So, what other than advances in diagnostic technology, has the experience of COVID given us? Here are just a few examples.

Artificial Intelligence

AI has changed the way disease outbreaks are monitored and managed, saving lives. During the pandemic applications included tracking people with novel strains by detecting visual signs of the virus on computerised tomography (CT) lung scans and monitoring changes in body temperature through the use of wearable sensors.

AI has also been applied to open-source data track the spread of the disease allowing public health planners to predict potential new case numbers by area as well as identifying most at-risk populations.

Other applications include delivering medical supplies by drone, disinfecting patient rooms, and scanning approved drug databases for medicines that might work against the virus.

Blockchain

Blockchain technology – normally associated with the production of cryptocurrencies – emerged as a key technology to help decision makers produce fast, robust, transparent, and inexpensive solutions during an unprecedented public health emergency. As well as helping to track the spread of the disease, it was also used to managing insurance payments and maintain medical supply chains and donation tracking pathways. Blockchain technology was particularly useful in monitoring outbreaks by creating ledgers that were both secure and could be updated hundreds of times per day. It also improved diagnostic accuracy and treatment effectiveness, streamlined isolation of outbreak clusters, tracked drug supply chains and supplies, managed clinical data, and identified patterns of symptoms.

Telehealth technologies

In the face of extraordinary restrictions on population movement and contact, new and more creative uses of existing telehealth technologies were required to permit clinicians to continue treating patients while complying with contact and travel rules and stay-at-home orders.

Because of the high virulence of the disease, especially within hospitals, telehealth technologies became a cost-effective means of slowing transmission rates, reducing pressures on hospital capacity by filtering out those with moderate symptoms and keeping them at home.
Telehealth technologies permitted physicians to continue consulting by using audio-visual, real-time, two-way interactive communications including video 'visits' through webcam-enabled computers, tablets, and smartphones, chatbots and automated algorithms.

3D Printing

Travel and contact restrictions coupled with a need for new and previously little used medical hardware – including ventilator valves, breathing filters, test kits and face mask clasps – to help treat COVID-19 also posed a novel, logistical problem.

The use of 3D printing as a disruptive technology came into its own, keeping costs down and saving lives. It allowed hospitals and public health authorities to use computer aided design (CAD) and locally sourced materials to produce often small numbers of critical products. One area in which 3D printing was crucial was in development of entirely new products, including plastic door handle adaptors that enable easy elbow opening to prevent the further spread of the virus.

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Gene-editing technologies

From public health officials reporting the COVID outbreak to the World Health Organization (WHO), it took scientists only a fortnight to isolate the virus and figure out the full sequence of its genetic material. The disclosure of the genetic code went a long way to pinpointing the origins and the spread of the disease, and also to pharmaceutical targets for drug development. Advancements in gene-editing technologies – in particular of CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats)-Cas9 (CRISPR-associated protein 9) – were instrumental in developing a vaccine.

Nanotechnology

Nano-based products were developed and deployed to assist in the containment, diagnosis and treatment of COVID-19. Nanotechnology is a multi-disciplinary field that utilises nano-sized particles and devices for different applications, including diagnostics, targeted drug delivery and production of therapeutic materials. Nanoparticles of gold and silver have been used in biomedical and diagnostic applications, for the detection of viral particles. Nanotechnology has been shown to help treat viral infections through various mechanisms. Nanoparticles can act as antiviral drug delivery systems, interacting and binding to a virus, thereby preventing it from attaching and entering a host cell.

Synthetic biology

COVID presented an ideal, real-world test-case for scientists to use biology, engineering, genetics, chemistry, and computer science to substantially alter the genotype of the virus. In the context of the pandemic, synthetic biology is seen as the next phase in the progress of vaccination development. Because it is being utilised as a design tool, it is helping to make vaccines more effective than ever.

The Bill and Melinda Gates Foundation and the National Institutes of Health invested in synthetic biology to help engineer vaccines that would be scalable to a level of billions as well as being able to work without refrigeration.The synthetic biology body Ginkgo Bioworks gifted $25m of resources to public and private teams to help cure, prevent and treat novel coronaviruses. In addition, several companies worked to develop experimental vaccines containing synthetic strands of RNA or DNA that code for protein molecules on the surface of the virus.

Drones

Throughout the pandemic, drones have been deployed on the front line to help contain the spread of COVID. As well as being used for purposes of disinfection, street patrols, food and medicine delivery in quarantined districts, the Chinese government adapted and co-opted industrial drones to help improve disease detection and crowd management. Devices were used to monitor quarantine measures, to facilitate aerial broadcasting, conduct aerial thermal sensing, monitor traffic, and deliver medical supplies in infected areas, often replacing helicopter patrols for law enforcement and transportation.

Robots

Robots were also used to help contain the spread of COVID, including disinfecting hospitals, decontaminating public and private spaces and handling biohazardous waste as well as delivering food and medication. Robots continue to be used for a range of clinical functions, including taking patients' temperatures and substituting as medical assistants to help minimise person-to-person transmission. Self-navigating, ultraviolet, disinfection autonomous robots were deployed to decontaminate hospitals, isolation wards, intensive care units and operating rooms by spreading UV light to destroy pathogens. In China robots were adapted to provide security, inspection, and delivery services. In Hong Kong and South Korea, the Israeli Temi robot was used in nursing homes to allow families to communicate with quarantined residents through video calls, as well as being utilised in hospitals, airports, and offices.