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Review Article

Halting the Pandemic - Vaccine and Vaccination a Realistic Path Forward

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Abstract

The fight against the pandemic is not going well-but not for the reasons many people with political ideologies believe. A pandemic occurs when each infected person on the average infects more than one other person. It stops when each infected person infects less than one person. The end of a pandemic does not imply that the disease disappears-only that there are small local outbreaks and no large outbreaks. One starts with three observations about this pandemic. Recent worldwide COVID-19 pandemic, for example, has put tremendous pressure on pharmaceuticals scientists to be in quest of new drugs and vaccine to treat such deadly disease, and at this point, nobody knows what price tag has been estimated to develop such a vaccine by multi-drug companies involved with research and development of the drug. With recent growth in technology of Artificial Intelligence (AI) and its sub-component such as Machine Learning (ML) and Deep Learning (DL), dealing with epidemic of COVID-19 pandemic in a global form and overwhelming of data and consequently information and thus our knowledge of having power to deal with this devasting disease is way beyond our own human brain intelligence comprehension to process, thus we need to relay on AI, ML and DL innovative technology to handle all the aspects of such measure with a proper counter-measure.

Moreover, the integration of Artificial Intelligence (AI) with its components of Machine Learning (ML) and Deep Learning (DL) is changing and enhances the discovery of a drug that deals with COVID-19. AI, ML, and DL, along with other technologies such as Nanotechnology, are anticipated to make the quest or search for new pharmaceuticals by fat out much quicker, more cost-effective and cheaper as well.

Keywords: Pandemic; COVID-19; Vaccine and Vaccination Artificial Intelligence; Machine Learning; Deep Learning; Drug Delivery and Administration; Drug Distribution

Introduction

As we stated in abstract of this short review, the fight against the pandemic is not going well-but not for the reasons many people with political ideologies believe. A pandemic occurs when each infected person on the average infects more than one other person. It stops when each infected person infects less than one person. The end of a pandemic does not imply that the disease disappears-only that there are small local outbreaks and no large outbreaks. One starts with three observations about this pandemic.

First, we have built an environmental niche for air-borne viruses such as the flu and Covid-19 to efficiently move from one person to the next person. We breathe each other's air in mass transit, crowded bars, energy-efficient buildings with high rates of internal air circulation and other locations. These locations are the air-borne equivalents of sewage running down the center of the street that in the Middle Ages resulted in water-borne pandemics. It was not a question of if but of when a nasty virus would find these locations as home where it could move easily from person to person. We have had plenty of warning that would happen-in the average year 40,000 Americans die of the air-borne flue in spite of a yearly flu vaccination program that has gone on for decades.

Second, this virus has qualities perfectly suited for a pandemic that bypass most western public-health methods used to stop pandemics. With most diseases, people become infectious near the time they become sick. If one isolates people when they become sick and isolate people that have been in recent contact with that person, the pandemic is stopped. With Covid-19 many people become infected but do not become sick and thus invisibly spread the disease. Second, people are infectious many days before they become sick. We created an environment for efficient transfer of the virus between strangers in mass transit and many other locations-people do not know who they have been in contact with and thus those persons cannot be isolated. Third, contract tracing does not work well in the U.S. because less than half the population is willing to cooperate and 80% of the population does not answer phone calls from unknown numbers [1]. Last, COVID-19 is in the animal population that may make it impossible to eliminate and where we have limited control of the disease.

Third, culture has a major impact on whether a pandemic can be stopped. The progression and Covid-19 disease rates in the U.S. and Europe as a whole have been about the same-in spite of different government leaders and very different health systems. The Covid-19 rates in Europe by country are partly reflected in the U.S. by which groups settled different parts of the U.S. In contrast, China, Japan and South Korea have been able to control the pandemic even though those three countries have very different governments. Western culture emphasizes the rights of the individual where rule breaking is the norm while the eastern Confucian cultures emphasize the society over the individual. In Confucian societies there is massive social pressure to follow the rules, acceptance of government surveillance and a willingness to use the power of the government to follow the rules. Who is President of the U.S. or whether we have a national health care system is secondary to culture in determining the outcome of this pandemic. Culture changes over a period of centuries, not administrations.

In response to the pandemic, the recommendations of the medical-scientific elites have been to protect yourself with masks and social distancing until our "heroic" medical scientific community finds a vaccine. That is great advice for the Chinese government with a Confucian society and a government capable and willing to use the full force of the state to enforce such mandates. It is poor advice to a western democratic government. Their advice partly reflects self-interest but also reflects a socially-isolated community that does not understand U.S. culture. That is not surprising-we have many elites that went to elite high schools and universities and have little contact or understanding of the broader American culture. It places this elite at the center of power and money with a set of non-workable policies that blame bad outcomes on individuals. The question is then what would be the advice if we are serious about stopping a pandemic in a western democratic country-beyond social distancing and masks.

Vaccines

The need is to develop multiple vaccines because many of the vaccines may ultimately fail. The failures of 50 years of flu vaccines are a warning [2]. Flu viruses mutate and so will this virus. Perhaps of equal importance, Covid-19 is in the animal population. Denmark is in the process of destroying 17 million mink. Some of the mink caught COVID-19, the virus mutated with a change in the virus spike and the mink infected animal handlers. The animals are being destroyed because such mutations may make many human Covid-19 vaccines ineffective [3]. Multiple repeated vaccinations with multiple types of vaccines may be required with no assurance in advance that the vaccination strategy will do more than provide time. We have many diseases where we have not found effective long-term vaccines.

Engineered solutions

Almost all pandemics have been stopped by engineering. Water borne pandemics were stopped by sewer systems and clean water where we destroyed the environmental niche where these viruses grew and spread to man. For all we know, some new super virus has shown up in sewage or untreated water, but it has no effect on us because clean water and sewers stop all viruses. Malaria is controlled by draining the swamps and other methods to kill mosquitoes that transmit the disease to man.

We can stop this virus by filtering air or killing the viruses in air with proper ventilation systems where there are large crowds [4]. It is not necessary to clean all air-just where a lot of people are crowded together each day to get the disease transmission rate below one new infection for each person with the virus. The big industrial companies, some schools and my dentist have adopted this workable strategy. This solution works against all air-borne viruses and is compatible with western culture that values the individual with rule breaking. It is the equivalent of providing clean water rather than asking everyone to boil their water.

In many office, store, and factory environments this implies:

- Upgrading filters in the main ventilation systems and,
- Installing local cheap filter-fan systems that filter air to remove the viruses. Substantially higher air filtration rates are required to minimize transmission of the virus between people than used to heat and cool buildings. The low-cost option is local air-cleaning systems that consists of a high-quality filters with a fans-or potentially UV sterilization units with fans. This pandemic would be partly under control if there had been a full push to put in clean air systems.

The fastest and simplest way to implement such changes is to pass legislation which makes the insurance industry liable for the cost consequences of the spread of COVID-19 in congested indoor spaces unless appropriate engineering changes are made to the buildings. Insurance is required to obtain loans on commercial property. Such legislation would bring to bear all the resources of banks and financial institutions that back commercial mortgages to immediately fix the problem.

Engineering solutions are the standard will-work option to reduce risk. In the 1800s Chicago, Boston and many other cities burnt down because the cities were built of wood-the fire equivalent of a pandemic. Fire departments, the equivalent of the medical profession to diseases, were not able to stop these fires. The solutions were building codes that required using brick, concrete, stone, and cement in new buildings. The engineering fix stopped city-wide fires. The engineering solutions did not stop an occasional building from burning to the ground but no city-wide fires. The same will be true if we use engineering to stop this air-borne pandemic.

Sensors to warn of danger

We use smoke detectors to set off fire alarms. We use carbon monoxide sensors to warn us of faulty furnaces that heat our homes. Industry uses many other sensors to warn workers of danger. The loud horn warning of disaster is a staple of action movies. We need the same for the virus in air. COVID-19 is transmitted by particles in air from the lungs of one person to the lungs of another person. We do not have sensors to detect virus particles in air; but, we do have cheap technologies to measure how much air we inhale that has been recently in another person's lungs. People breathe in oxygen and breathe out carbon dioxide. If the carbon dioxide content of the room or subway car you are in is much above normal, you are breathing other people's air and getting their viruses unless outfitted with a carefully-fitted N-95 mask or equivalent. Cheap carbon dioxide detectors can set off alarms or tied to cell phones to give people warnings enabling them to leave the area. Such systems have been adopted by some organizations for workplace environments to warn people to open windows or leave the area; but none exist for public spaces such as mass transit and stores. They should be required for all public spaces.

Rate locations

Based on hazard. We can rate locations in terms of danger of transmitting an air-borne virus and require large lettering at entrance points to warn the public. An existing subway car would have a 10 painted on the side-indicating great location to get COVID-19. A private car would be given a rating of one. If the subway car ventilation or subway platform had a modified ventilation system to lower the risk, a lower number would be assigned. Rating locations will force out of business those businesses that do not clean up their act and reward businesses that create safer locations. It favors stores, cruise lines and airlines that have modified their ventilation systems to protect the public. The current policy of shutting down particular types of establishments such as bars based on the sign on the front door is insane-if we shut down businesses it should be on the risk to the public of each specific location.

Engineering solutions, sensors and warning labels are opposed by big-city mayors, governors, building owners and others because it places much of the blame and burden for stopping the pandemic on organizations rather than individuals. When shortcuts in Flint, Michigan resulted in dangerous-to-drink water, officials were held accountable. We need the same attitude if an air-borne disease outbreak because no clean air in public spaces.

Operational responses

COVID-19 is unusual in terms of who becomes ill and dies. With most infectious diseases, the very young and very old are most at risk. With Covid-19 the risks for those under 40 are low [5]. The damage being inflicted upon the younger generation by the current approach is massive. It is the older population that must be protected. That has practical implications. School for younger students without elderly parents or relatives at home. Have younger teachers do double shifts at school while older teachers do remote teaching. We need honesty about risks to different age groups followed by age-appropriate recommendations for a virus that hundreds of times more dangerous for a person in their 80s compared to a young person.

In this context, the Swedish strategy is noteworthy. They worked to isolate the old but not the young. They recognized that the pandemic would be a long drawn-out affair and that social isolation would collapse with time as is now seen in Europe and the U.S. Given the low risks of COVID-19 to the young, spread of COVID-19 and buildup of herd immunity by those with the lowest risk of illness would reduce disease transmission over time. Equally important, those most likely to catch Covid-19 were those in contact with the most people. Building up immunity in this group minimizes the future spread of Covid-19. While there is the general assumption that one needs 70% to stop a pandemic-that is not true. If those that are in close contact with many people catch the disease or are vaccinated, this drastically slows the spread of the disease. One wants politicians and prostitutes to be the first with immunity. Whether hermits have immunity by caching the disease or being vaccinated has no effect on the pandemic. It is too early to determine whether the Swedish strategy will succeed or fail but as the pandemic goes on, it is beginning to look like the right decision.

The failure to stop the pandemic reflects the poor advice of the medical-scientific elite that failed to account for western culture as much as the politicization of that advice. It was advice for an imaginary culture that does not exist in the west. The parallel pandemic failures of U.S. and Europe with a common culture combined with 50 years of failures in fighting the air-borne flu suggests we need better advice-a diverse set of experts with different backgrounds to find multiple solutions that can be implemented quickly.

Where would a panel of such experts come from to stop this and future air-borne pandemics?

- **Medical-scientific elite:** These are the medical experts in human viruses, and this could be expanded to another research or short review article.
- **Agriculture:** All the experience in fighting global pandemics is in the agricultural sector-fighting off viruses killing cattle, hogs, birds, dogs, cats, mink, and other animals. They are the only ones with front-line experience in fighting global pandemics and the only ones who understand the virus as it moves through and mutates in the animal community.
- **Military:** Unlike most other elites, military officers have real-world experience about most of society. Military officers in their first command lead soldiers mostly with high-school educations from across the country with different backgrounds. To a military officer, it would be obvious that many of the isolation and mask strategies would have high failure rates and that alternative strategies are required. Second, military officers understand you go to war with the weapons you have. If you suggested to a military commander a strategy of a holding action for a year or two while develop a weapon (such as a vaccine), you would be considered crazy. Last, they are in the world of hard choices where people die. To use one example, in developing vaccines one way to accelerate development is challenge testing. Give the vaccines to volunteers and then expose them to the virus-unlike vaccinating lots of people and seeing how many get Covid versus the rest of the population as the disease spreads through the population. Challenge testing provides much more definitive results in how good the vaccine really is. For a military commander, putting a 1000 or 10,000 volunteers at risk that could save a 100,000 people is the right decision. The scientific elites rejected this option on moral and ethical grounds; but, they do not have any special moral or ethical talents. Furthermore, in a democracy is undemocratic and unacceptable that an unelected elite make such decisions, the military understands this.
- **Engineering and industry:** Some industries are installing ventilation systems to protect workers on the job against air-borne viruses. This is no different than the ventilation systems used in industrial plants to protect workers against hazardous gases from welding and other activities-both are 1960s technologies. Some of the airlines are beginning to make ventilation and other changes aboard aircraft to reduce risks of transmission because pandemics are bad for business-as are many dental offices to protect dentists

and many offices of engineering professors given that such changes are fast and quick for an office environment. That competence and capability is needed.

- **Special people:** The example in this case is Bill Gates where his foundation has been on a campaign to wipe out diseases. He has the knowledge and skills. More important, he will tell hard truths, something one will not necessarily receive from a panel experts that run large institutions and what to protect those institutions.

We do not know how this pandemic will end. The vaccines may be a success, or the virus may mutate around the vaccines and we may be back where we are today in a year from now. Viruses exchange genetic material with other viruses and one of these other viruses may learn how to take advantage of this air-borne niche to create a new pandemic where neither our tests nor existing vaccines are of any value. COVID-19 provides a starting point to anyone wanting to modify the virus to start a new pandemic-an option that may be attractive to some terrorist groups and certain nations. They now know we are incapable of stopping such an attack and if you come from a society of young people, the damage will be primarily in the west.

What we can be sure of is that sooner or later another virus will find the environmental niche that Covid-19 found and start a new global pandemic unless we chose to destroy this environmental niche. Because moving today to such solutions will shorten this pandemic, it is also the short-term no-regrets policy. The question is how many dead bodies does it take? to educate the political class, national press and others to move to clean up the air in crowed places-the 21st century version of building sewers, clean water systems and fire-resistant cities.

One of the most challenging aspects of CORONA Virus that we are facing, which is even as difficult as finding the right anti-virus or vaccine itself, is its delivery, distribution, and administration system of this drug, due to the nature of its worldwide impacts on the global population. Thus, implementing a smart AI system and ML, DL sub-system in addition to nanoscience and nanotechnology have driven the hunt for the discovery of anti-virus among the pharmaceutical companies involved in R&D effort of the discovery of the appropriate one, is an invadable circumstance for it, in order, to be very cost-effective during the time that COVID-19 death toll is on such terrible rise on daily bases around the world. In the United States alone, the death toll is around 2500-3000 people per day, according to CNN news around months of November and December 2020 time frame.

In fact, without the implementation of these types of technology within our research for new drugs will be going to waste, simply because it includes money that will be spent on testing, therapies that may fail somewhere between phases of concept, research and development, trial analysis and regulatory approval before it goes to full production and finally distribution of it for public consumptions. In today's combination of technologies and the marketplace, there is no doubt in anybody mined that would think differently by not integrating artificial intelligence in the day-to-day operation at the magnitude that today's pharmaceutical companies are involved.

Indeed, nanoscience and nanotechnology become very handy when biopharmaceutical scientists are working toward a hunt for a new drug and require collecting much information from a lot of trusted data, if not real-time, but at least near-real-time, thus they need a partnership with AI, ML and DL systems.

These are a few examples that Artificial Intelligence and Nanoscience and Nanotechnology can shake a hand and complement each other very well.

If the proponents of these techniques are right, AI and machine learning will usher in an era of quicker, cheaper, and more effective drug discovery.

Figure-1 illustrates the world of size and scale of dimensions we need to deal with in biopharmaceutical research for a new drug.

In conclusion, there should be no doubt that most organizations and enterprises of big size with multi-billion dollar revenue, such as pharmaceutical companies dealing with the small size of the quantum space, rely on deploying artificial intelligence with all its sub-components, as illustrated in figure 1, since it needs to discover a new drug and deliver them to their market-share or find a new market for it to be cost-effective and profitable.

As we state at the beginning of this chapter, and we can express here again, "Nanotechnology" is the engineering and manufacturing of materials at the atomic and molecular scale. In its strictest definition from the National Nanotechnology Initiative (NNI), nanotechnology refers to structures roughly in the 1 - 100 nm size regime in at least one dimension. Despite this size and scale restriction, nanotechnology commonly refers to structures that are up to several hundred nanometers in size and that are developed by top-down or bottom-up engineering of individual components. Given the definition of nanotechnology as a summary here, one could easily see the amount of data that we are collecting at the scale of nano for the right-information at the real-time stage for Data Analysis (DA) and Data Predictive (DP) will be beyond normal human capabilities. Thus, relying on AI system along with ML and DL sub-system is natural and makes all kind of sense from Research and Development (R&D) point of view to delivery, distribution, and administration perspective of any drug demand for a combination and integration of Artificial Intelligence as well as Nanotechnology or Nanoscience together, driving the Good Clinical Practice (GCP) on top of all these efforts.

Note that: Good Clinical Practice (GCP) compliance provides public assurance that the rights, safety, and well-being of human subjects involved in research are protected, and it is an international quality standard that is provided by International Conference on Harmonization (ICH), an international body that defines standards, which governments can transpose into regulations for clinical trials involving human subjects. GCP guidelines include protection of human rights as a subject in "Clinical Trial".

It also assures the safety and efficacy of the newly developed compounds. GCP Guidelines include standards on how clinical trials should be conducted; define the roles and responsibilities of clinical trial sponsors, clinical research investigators, and monitors. In the pharmaceutical industry, monitors are often called Clinical Research Associates.

Artificial intelligence, machine learning, and deep learning

Due to recent advances in the digital world, the new and most modern drugs delivery and administration as well as their distribution of them are taking the advantages of this revolutionary technical progress and with the next generation of Artificial Intelligence (AI) with its sub-components Machine Learning (ML) and Deep Learning (DL) and their integrations into most modern pharmaceutical manufacturing, technically, are taking more and more advantages of such innovative systems Furthermore, recent technical progress in AI, ML and DL, allows the revenue from these commerce sites to be more enhancing and driven by these combined components. The fundamental relationship between AI, ML, and DL is presented in figure 1 [1].

In past several years Artificial Intelligence (AI) and with its recent innovative steps toward next generation of these AIs, known as Super Artificial Intelligence (SAI) a need for Machine Learning (ML) is inevitable, consequently machine learning has made remarkable progress in recent years in support of these AIs and SAIs due to speed of information and data processing that we impose to these super machine for better decision making as their human partner. Geo-distribution of data in form of Big-Data (BD) needs to be processed at speed of electron, since these data comes from every direction as fast internet can transfer them to a central repository for processing, thus AI need to learn from these data with help of its sub-component ML, which totally dependent and driven by its sub-set known as Deep Learning (DL). Deep learning is an step that compares historical data from pat to incoming and present data to learn from it and hand of its leering to machine learning and this machine transfer it to AI for final stage, where artificial intelligence is in the loop to help his human master mind for best possible decision making in order to maintain his/her resiliency and integrity of his or her organization as stakeholder of that operation per its Service Level Agreement (SLA) and Use Case assigned to such organization. This perspective and process steps of learning can be achieved via Deep Neural Network (DNN) driving deep learning, then machine learning and finally make artificial intelligence a super artificial intelligence to help his human partner.

Figure 1: Artificial Intelligence, Machine Learning, and Deep Learning at Work.

It is very important that going forward with title of this book "Artificial Intelligence Driven by Machine Learning and Deep Learning" we get to know "What is Difference Between Artificial

Intelligence (AI), Machine Learning (ML), and Deep Learning (DL)?".

Although we did describe each of these above entities, namely AI, ML and DL, we briefly go over each of these systems as a summary of their definition to capture what it was said about each one of them.

As figure 3 shows and illustrates, AI, ML and DL terms overlap and are loosely used by most folks involved in these technologies and are also easily confused, so let us start with some short definition of each of them, in this section here.

Figure 2: Quantum Space of Nano Pharmaceutical World (Source: Illustration by Michele Marconi).

Figure 3: Inter-Relationship Between AI, ML, and DL (Courtesy of Oracle).

Artificial intelligence (AI)

Means getting a computer to mimic its partner "Human" behavior in some way by utilizing a principle know to us as Neural Network technique. Artificial intelligence as an academic discipline was founded in 1956. The goal then, as now, was to get computers to perform tasks regarded as uniquely human: things that required intelligence. Initially, researchers worked on problems like playing checkers and solving logic problems.

If you looked at the output of one of those checkers playing programs you could see some form of "artificial intelligence" behind those moves, particularly when the computer beat you. Early successes caused the first researchers to exhibit almost boundless enthusiasm for the possibilities of AI, matched only by the extent to which they misjudged just how hard some problems were.

Artificial intelligence, then, refers to the output of a computer. The computer is doing something intelligent, so it is exhibiting intelligence that is artificial.

The term AI does not say anything about how those problems are solved. There are many different techniques including rule-based or expert systems. And one category of techniques started becoming more widely used in the 1980s: machine learning.

Machine learning (ML)

Is a subset of AI, and it consists of the techniques that enable computers to figure things out from the data and deliver AI applications. See figure 3 and figure 4 as well.

The reason that those early researchers found some problems to be much harder is that those problems simply were not amenable to the early techniques used for AI. Hard-coded algorithms or fixed, rule-based systems just did not work very well for things like image recognition or extracting meaning from text.

The solution turned out to be not just mimicking human behavior (AI) but mimicking how humans learn.

Think about how you learned to read. You did not sit down and learn spelling and grammar before picking up your first book. You read simple books, graduating to more complex ones over time. You actually learned the rules (and exceptions) of spelling and grammar from your reading. Put another way, you processed a lot of data and learned from it.

That is exactly the idea with machine learning. Feed an algorithm (as opposed to your brain) a lot of data and let it figure things out. Feed an algorithm a lot of data on financial transactions, tell it which ones are fraudulent, and let it work out what indicates fraud so it can predict fraud in the future. Or feed it information about your customer base and let it figure out how best to segment them.

As these algorithms developed, they could tackle many problems. But some things that humans found easy (like speech or handwriting recognition) were still hard for machines. However, if machine learning is about mimicking how humans learn, why not go all the way, and try to mimic the human brain? That is the idea behind Neural Networks (NN). See Chapter 4 of the book (Zohuri and Zadeh) [6] for more details.

The idea of using artificial neurons (neurons, connected by synapses, are the major elements in your brain) had been around for a while. And neural networks simulated in software started being used for certain problems. They showed a lot of promise and could solve some complex problems that other algorithms could not tackle.

But machine learning still got stuck on many things that elementary school children tackled with ease: how many dogs are in this picture or are they really wolves? Walk over there and bring me the ripe banana. What made this character in the book cry so much?

It turned out that the problem was not with the concept of machine learning. Or even with the idea of mimicking the human brain. It was just that simple neural networks with 100s or even 1000s of neurons, connected in a relatively simple manner, just could not duplicate what the human brain could do. It should not be a surprise if you think about it; human brains have around 86 billion neurons and very complex interconnectivity.

Deep learning (DL)

Meanwhile, is a subset of machine learning as it is illustrated in Figure-4, that enables computers to solve more complex problems.

Put it in simple form, deep learning is all about using neural networks with more neurons, layers and interconnectivity. We are still a long way off from mimicking the human brain in all its complexity, but we are moving in that direction.

When you read about advances in computing from autonomous cars to Go-playing supercomputers to speech recognition, that is deep learning under the covers. You experience some form of artificial intelligence. Behind the scenes, that AI is powered by some form of deep learning (Zohuri and Zadeh) [6].

Figure 4: Neural Networks Conceptual Schematic.

Conclusion

In conclusion, as it was described in abstract and content of this article, dealing with such devasting and unknown disease, requires tremendous knowledge to be gathered in a short period of time, in order to have power of action and reaction how to deal with this global pandemic, both from granular and holistic point of view [7].

To be powerful enough and being able to take on such horrible pandemic, we need to collect data globally to increase our information along with knowledge gathered from this information. Such process is way over beyond our own brain intelligence to process [8], thus we have no choice except to rely on Artificial Intelligence, Machine Learning and Deep Learning system tools to be augmented with the effort toward halting such disease on spot so we can prevent all its devasting adverse side-effects that we have recently encountered both Nationally and Internationally.

As we have seen as adverse side-effects of COVID-19, businesses are shutdown, economy has gone upside down, people have been out of their jobs and consequently suffering from lack of steady income to live their normal life, depression among the folks is on the rise due to being confined within their own home with stay at home order and we can go on and on with situation in hand with this pandemic.

Even though, some sort of countermeasure in form of new vaccinations are available to us to fight this horrible disease, we still have not managed to administer them to our arms at hundred percent delivery structure due to lack of an effective infrastructure either. On an all, we need to come up with better means of distribution and delivery system on top of research and development of such vaccine to halt this pandemic and this were we need Human Intelligence and Artificial Intelligence work as a team and hand-in-hand.

Bibliography

1. "News at a glance". *Science* 370.6517 (2020): 640.
2. https://www.cdc.gov/flu/vaccines-work/vaccineeffect.htm
3. Christa Lesté-Lasserre. "Pandemic dooms Danish mink-and mink research". *Science* 370.6518 (2020): 754.
4. https://www.forbes.com/sites/jamesconca/2020/08/11/engineering-solutions-may-be-better-for-coronavirus-than-social-ones/#416a7aa66680
5. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-age.html
6. Zohuri B and Zadeh S. "Artificial Intelligence Driven by Machine Learning and Deep Learning". Nova Science Pub Inc, first edition (2020).
7. Zohuri B and Rahmani M F. ""A Model to Forecast Future Paradigms, Volume 1 Introduction to Knowledge Is Power in Four Dimensions". 1st Edition, 2019, Apple Academic Press (2019).
8. Zohuri B and Rahmani MF. "Artificial Intelligence Versus Human Intelligence: A New Technological Race". *Acta Scientific Pharmaceutical Sciences* 4.5 (2020).