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### Artificial Intelligence Will Alter Healthcare.

We live in a world of rapidly developing technologies. What seemed impossible yesterday became our reality today. We can make a video call anywhere in the world and watch planes fly in real time. We pay with cryptocurrency and travel in self-driving cars. In restaurants, food is brought to us by robot waiters, and "smart" tech manages our homes. Artificial intelligence is already firmly integrated into many areas of our lives. But what about such an important and technological and at the same time sensitive and vulnerable area as healthcare? In the next 20 years, the implementation of artificial intelligence in healthcare can provide unique technological opportunities that will raise the practice and delivery of medicine to the highest levels; however, it can also bring negative consequences that should be considered.

Artificial intelligence contributes to the accessibility of healthcare for many people. Google's Dr. Lily Peng in her TEDx talk states that AI can democratize healthcare and helps doctors in India prevent blindness of millions of people. According to Dr. Peng, there are 415 million people in this world with diabetes, and 62 million people are in India. Each one is at risk for diabetic retinopathy, vision loss due to diabetes. Dr. Peng explains that it is preventable blindness, and the key to prevention is regular screening. However, there is significant shortage of ophthalmologists, especially in developing countries. Dr. Peng suggests, in India there are only 15 000 eye doctors for 62 million diabetic patients. She has developed an AI system that

diagnoses diabetic retinopathy by reading retinal images. According to Dr. Peng, the algorithm was trained to read images that doctors had labeled for diabetic eye disease, and it turned to be pretty accurate. She emphasizes that this algorithm received regulatory approval in Europe in 2019. (Peng). This is a perfect example how implementation of AI in healthcare changes the way people receive care. Definitely, this system has a potential to solve the problem of shortage ophthalmologists and save people's eyesight in India and other developing countries.

Chris Griffith in his article "Doctor Google Will See You Now" for The Australian mentions that Dr. Peng also studied machine learning for breast cancer diagnosis. According to Peng, up to one in twelve breast cancers are misdiagnosed. She explains that machines studying mammograms can mark areas where there is likely to be cancer and then doctors can work with this information. (Griffith). The widespread use of AI may cause concern that AI will take away our jobs. However, according to Peng, the use of AI helps doctors rather than usurping their role. She believes that machine learning can make preventive medicine real in developing countries by providing cheaper but accurate testing. (Griffith).

Artificial intelligence is beneficial because it is efficient. Denise Grady, a science reporter in The New York Times, in his article "A.I. Took a Test to Detect Lung Cancer. It Got an A" suggests that AI is most promising in areas of recognizing patterns and interpreting images. She explains that researchers can train computers to recognize specific patterns associated with pneumonia or cancer by feeding huge amount of information into systems called artificial neural networks. According to Grady, the process of deep learning is already used enabling computers to identify objects and understand speech in self – driving cars. The author refers to study in which researchers applied AI to CT scans used to screen people for lung cancer. Studies have

found that screening can reduce risk of dying from lung cancer. However, Grady points that test has pitfalls and can miss tumors or mistake benign spots for malignancies. She explains, the researchers decided to improve the system and help it do better. They created a neural network with multiple layers of processing and trained it by giving it many CT scans from patients with known diagnoses. Then, it was time for test. Grady quotes Dr. Daniel Tse, a project manager at Google, who says, “We gave it (AI) a final exam on data it’s never seen after we spent a lot of time training, and the result we saw on final exam – it got an A.” According to test results, from 6716 cases, the deep learning system was 94 percent accurate. Pitted against six expert radiologists, the system beat the doctors. (Grady). Impressive. Researchers have found the weak point and found the way to improve it bringing the deep learning model at the doctor level and above. However, the question remains. Would AI put radiologists out of business? When asked this question, Dr. Eric Topol, director of the Scripps Research Translational Institute in La Jolla, Calif said, “Gosh, no!” The idea is to help doctors, not replace them, explains Denise Grady. Dr. Topol warns about potential hazards saying, “A radiologist who misreads the scan may harm one patient, but a flawed AI system in widespread use could injure many.” (Grady). In other words, these systems should be studied and tested thoroughly before they could be implemented for widespread use.

Implementation of AI in healthcare raises the issue of the safety of patient health information. Blake Murdoch, a legal scholar, bioethicist, health privacy expert and science communicator, is concerned about patient data access, use and control in private hands. In his article "Privacy and artificial intelligence: challenges for protecting health information in a new era.", Murdoch explain that many AI technological discoveries are made in an academic

research. Then these technologies undergo a commercialization process and end up owned and controlled by private corporations. This means they will have an important role to play in obtaining, using, and protecting patient data. Murdoch points that FDA now certifies the institutions who develop and maintain AI rather than focusing on the AI which will constantly be changing. Author emphasizes unique features of AI technologies that use large amount of data, can be prone to certain types of errors and biases, and sometimes cannot easily or even feasibly be supervised by human medical professionals. “Because of the unique features of AI, the regulatory systems used for approval and ongoing oversight will also need to be unique”, says Murdoch. He cites as an example a situation when Google, after developing an app DeepMind partnered with Royal Free London NHS Foundation Trust, subsequently took direct control over DeepMind's app, effectively transferring control over stored patient data from the United Kingdom to the United States. The author states that appropriate precautions should be taken to preserve the data of patients and their freedom of action.

Despite all the uniqueness, AI cannot replace doctors. Enrico Coiera, professor, who work on decision support and communication processes in biomedicine, explains that big companies are heavily investing in AI. So heavily, that there is discussion that has gone from building tools to help doctors to possibilities replace doctors. According to Coiera, there are a lot of papers published demonstrating that AI technologies are equal or even superior to humans. However, professor Coiera suggests that AIs are “brilliant idiots” because they do fantastic at solving simple single tasks as identifying objects on the picture but cannot tell you what is happening on the picture. (Coiera). AIs are obviously can process and analyze huge amount of information that humans can't. Humans in turn have perspective intelligence and can analyze

information in context. Enrico Coiera sates that it should be “marriage made in heaven” between AI and humans because we are good at different things.

Artificial intelligence is often mentioned as a possible solution for freeing up time for doctors and facilitating a person-centred relationship between a doctor and a patient. The article "The impact of artificial intelligence on the person-centred, doctor-patient relationship: some problems and solutions.", written by four authors suggests that the use of AI tools in assistive role can help ensure that these tools have a positive impact on person-centred doctor-patient relationships. According to authors. It is hoped that AI technologies will save time for doctors and doctors will be able to use this saved time to improve the relationship between doctor and patient. Empathy is the cornerstone of such relationship. However, doctors do not have time to develop sensitive and trusting relationships. One of the authors explains that the Watson artificial intelligence tool for oncology takes 40 seconds to collect and analyze data, and then form treatment recommendations based on the available data. For comparison, manual data collection and analysis takes an average of 20 minutes, reducing to 12 minutes when oncologists get better acquainted with cases. However, it is unclear whether this time saved will be used to improve the doctor-patient relationship. (Sauerbrei).

When I started the research for this essay, I was in a neutral position regarding the use of AI in healthcare, not quite understanding what AI is, how it works, and how it can be used in healthcare. At first glance, the use of such technologies may seem like something terrible that can take doctors jobs and worsen the quality of care received for patients. However, the implementation of AI technologies, like many other things, has its advantages and consequences. With AI, healthcare will become available to more people, especially in developing countries.

Data can be collected and analyzed by AI tools, which will free up time for doctors and allow them to build more personality-oriented relationships. Based on AI data, doctors will be able to make diagnoses more accurately and in a shorter time. Healthcare will be able to enjoy all these benefits if there is proper regulation and supervision capable of ensuring the protection of health information. If we do not overestimate the abilities of AI and will supervise it, we will have the opportunity to use unique abilities of these technologies. I would say it is like a "superpower" that, if used correctly and responsibly, can save millions of lives.

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