# Patients Perspective—Benefits and Challenges of Artificial Intelligence

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**Abstract** Artificial Intelligence's implementation into medicine, research, and crisis management have changed the way healthcare are delivered to the population. The beneficial qualities of Artificial Intelligence in medicine are profound, but it is a field often subject to grandiloquent claims. Patient's perspective could be better and understood and their involvement in developing health technology software would prove greatly beneficial. As Taiwan's databases of medical information are growing, the cost of analyzing data is falling, and more and more professionals and investors are showing interest in being a part of this burgeoning phenomenon.

## 1 Artificial Intelligence: A Toolbox of Potential

As the once imagined future quickly becomes the present, technological advances are slowly becoming part and parcel of everyday life. Machine Intelligence, or more commonly, Artificial Intelligence (AI) is a branch of computer science involving machines and programs that can emulate critical thinking and decision-making skills similar to humans. Artificial Intelligence has made gathering, storing, organizing, and retrieving data extraordinarily efficient and is aiding in difficult decision making in various aspects of medical crisis. Studies have reviewed current applications of AI, as well as the opportunities and challenges it poses in the field of health care. To quote examples, severity scoring systems have utilized AI for some time now, and researchers are wondering if it can also be used to aid mental health workers in suicidal risk assessment or physicians in the screening of rare genetic conditions (Abazeed 2019).

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## 2 Artificial Intelligence and Decision Making in Health Systems

The ever increasing burden of illness, aging driven disability, multiple morbidities, as well as increased demand and cost of healthcare services, are among some of the challenges faced by health systems worldwide (Panch et al. 2018).

Health care systems have a framework that constitutes the collection and processing of information. Policymakers must effectively manage these systems by adjusting the organization, governance, and handling of finance and resources to achieve efficiency, i.e. health system outputs (health care services and public health) and system goals.

The delivery of health care is primarily a multistep process. The core information processing tasks involved include screening and diagnosis as well as monitoring and treatment. Breaking things down further, the general method of managing these processes across the vast areas of health system management and healthcare delivery involves the generation and testing of the hypothesis and then action (implementation). AI can potentially, within a health system, better hypothesis generation, and testing by revealing previously obscure trends in data. This is substantial at all levels of the system.

There are some AI applications already in use, specifically in public health, affecting health providers and patients alike. Some programs provide adverse drug reaction and interaction warnings during the prescription of medicine, patient reminder calls for appointments, decision-support tools for clinicians, and robotic surgical systems.

An interesting point to note is that Artificial Intelligence, despite being primed to alter patient engagement in healthcare, the patient's perspective on the matter is poorly understood (Nelson et al. 2020).

## 3 Ethical Concerns Around Use of Artificial Intelligence

The concerns raised around the plans to implement Artificial Intelligence into such a vital part of human life are many. Policies and guidelines for the use of this technology do exist but are they keeping up with the ongoing progress and development in machine learning and its implementation in medicine? Medical staff are some people at the very forefront of this process and there are efforts to educate, update and engage the community in conversation regarding the ethical concerns of AI. However, the complex nature of this technology leaves room for further discussions (Rigby 2019).

It is important that AI approaches in medical practice is lawful, ethical, and robust. The Eruopean Union (EU) guidelines for trustworthy AI state seven critical requirements for ethical AI: human agency and oversight, technical reliability and safety; privacy and data governance; transparency; diversity, non-discrimination, and fairness; societal and environmental wellbeing; and accountability (Kazim and

Koshiyama 2020). This includes tiered, risk-based guidance for tool validation for prevention of harm, recommendations to make the model understandable as well as fair and unbiased, and ensuring that human autonomy is preserved. In accordance with the guidelines, the implementation of AI should enhance and build upon the actions of humans through pathways that are transparent and traceable rather than black-box decision making.

An AI model is in a state of constant evolution. The matter to consider is how these inevitable changes to AI models should be regulated after they are granted approval for use in the clinic. This is addressed by the US Food and Drug Administration (FDA) whitepaper on modifications to software using machine learning models (FDA 2019) These are not formal guidelines yet; however, the framework that has been issued for discussion is thought-provoking and identifies the three main areas under which the AI can evolve: performance, input, and the software's intended use. The latter could be grounds for restarting the approval procedure, whereas other adjustments need only be recorded and subjected to periodical review (Tran et al. 2019).

## 4 Patient Perspectives About AI and Associated Health Technologies

It is without a doubt that humans and technologies can bring forth a new era of efficiency, achieving goals with higher proficiency in half the time. This collaboration has the potential to tackle many, if not most of the vulnerabilities of the current system.

There are many misconceptions and lack of complete information available to most in regards to AI in medicine and health care technologies. Will machine replace physicians? Does software have the ability to comprehend difficult lifestyles and situations and display empathy? Will the integrity of the physician–patient relationship be compromised and how transparent is the use of a patient's health data? Can AI make mistakes and if yes, what then?

Artificial Intelligence provides the exponential enhancement to human-driven science in gathering, filtering and organizing data. However, as in many ways, Artificial Intelligence and Health Technologies are still in their infancy, understanding the comprehension of the patients (the owners of this data) is pivotal in further developing the system to unlock its full potential. Patients' knowledge and awareness of Artificial Intelligence and the resulting technologies is mostly from mass media, educational events and some personal encounters.

Artificial Intelligence is set to alter the way patients access health care however, there is much to learn about the patient perspectives on the matter. (Nelson et al. 2020) People play a major role in their own health care being able to decide when, how and where to seek help in case of an illness or trauma. It is then vital that they know enough and fully comprehend their situation to be able to make sound decisions regarding the health care they will receive. (Cosgriff and Celi 2020).

The online symptom checker system's accuracy is an ongoing concern in the general community; however a major group of patient-users find an AI-assisted program such as this very useful. Formal validation studies gauging the symptom checker precision and efficacy in real-world practice could provide added useful insight into their value (Meyer et al. 2020).

A qualitative study conducted in dermatology assessed the potential for direct-to-patient and clinician decision-support AI tools in order to categorize lesions of the skin. This study showed that patients were receptive to the utilization of Artificial Intelligence for the screening of skin cancer if it can be done without sacrificing the integrity of the human physician–patient connection (Nelson et al. 2020). Another example is the wearable biometric monitoring devices (BMDs) coupled with AI that allow for the remote measurement and the analysis of patient data in real time. The data point collected from these devices are in the thousands and can assist in diagnosis, predicting outcomes and aiding health professionals pick the best treatment plan individually tailored to their patients. The reception to these devices has been favorable, however without the information on their usefulness to a patient its hard to comment on their effectiveness.

Another study found that in general, patients are not very optimistic about AI-based systems replacing radiologists in diagnostic interpretations. The patient wanted to be kept in the loop regarding every step of the diagnostic process. They also expressed the need for human interaction in the case of communicating the results. This study concluded that it is vital to involve patients in the development of Artificial Intelligence-based systems and technologies that deal with diagnosis, management, and prognosis as well as the development of ethical and legal frameworks within which these systems are allowed to operate (Ongena et al. 2019).

So far, Artificial Intelligence can only be developed for challenges that are already completely understood. It does not seem like human supervision would not be required for the operation of these systems to smooth out or make up for any flaws or possible deficits. AI is a tool to enhance and better the existing medical system in addition to its existing components. There are multiple bodies producing guidelines for the safe, trustworthy development of AI (Lennon et al. 2017). EU guidelines, promote the development of trustworthy AI across all disciplines, a US Food and Drug Administration whitepaper proposes a regulatory framework for constantly developing software in health care. Guidelines from the National Institution of Health and Care Excellence (NICE) handle the level of evidence required for new digital health intervention, and NHSX and Public Health England have reported intentions to produce their own AI guidelines (Abazeed 2019). This effort, coupled with data transparency, maintenance of physician–patient confidentiality and constant patient education and feedback, could potentially usher in the new age of health care, with Artificial Intelligence, Big Data and technology to aid us in our day to day lives as well as time of health crisis.

# 5 Taiwan's Health Technology Journey and Initiatives in Global Crisis

Taiwan's single-payer system successfully implemented adoption of Health Information Technology (HIT) on a national scale; from flash drive to health cloud and big data to open data (Iqbal et al. 2017; Li et al. 2018). Taiwan's innovative history within the health technology arena has made it a strategic contender in the global marathon of innovations. Local and international multidisciplinary collaboration has been critical to this ongoing success whilst the hackathon model has been imperative in fostering the required alliance. We hope that through events we can begin to address not only the technical issues that surround health, but the additional barriers of cost, accessibility and usability. It is certainly a time of great growth and excitement surrounding Health technology innovations and only through collaborative work can we hope to reach its full potential (Iqbal et al. 2018).

The Health Information Technology advancements has expedited the gathering of observational health data in Taiwan and worldwide. This is easily reflected in the universal coverage of the 23 million Taiwanese populace with the hundred percent e-claims and very accessible clinics and hospitals (Li et al. 2015). The National Health Insurance Research Database (NHIRD) was established by the NHI 20 years ago. This system gathers information on patient visits from all over Taiwan (Fig. 1) This
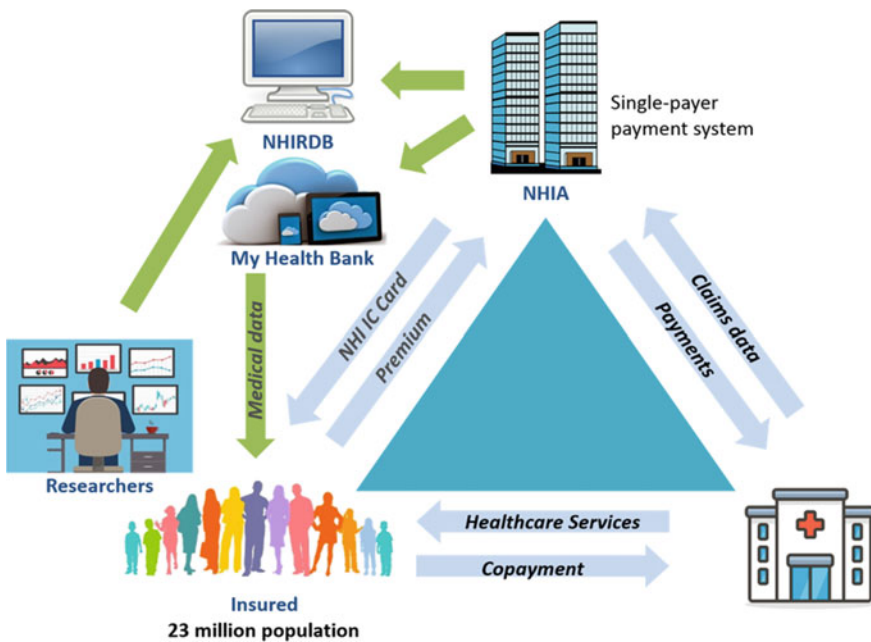


**Fig. 1** Taiwan's national health insurance administration structure

extensive, detailed, specific data gathered by the cumulative healthcare body is the cornerstone of clinical research and healthcare (Hsing and Ioannidis 2015).

Following the SARS outbreak in 2003, Taiwan established a public health response system in preparation for another potential crisis. During the recent COVID19 (Novel Coronavirus) pandemic, teams of officials were well-prepared to promptly launch into action (Wang et al. 2020). While the outbreak was still in its infancy, Taiwan leveraged its national health insurance database and integrated it with its immigration and customs database to initiate the construction of big data for analytics. If an individual visited a clinic or hospital, that data would generate alerts based on the patient's symptoms and travel history. At the nation's borders, those considered low risk were sent a pass via text message allowing them entry. Anyone considered high risk was put into self-isolation and monitored through their mobile phone to ensure that they remained at home during the quarantine period. Given the continuing global spread of the disease, studying Taiwan's quick response and the management of disease outcomes may be beneficial for other countries.

## 6   MyHealthbank—eMask Initiative

In 2014, the NHI Administration established the official website for the MyHealth-Bank system. The main purpose of MyHealthBank is to provide NHI insured with their personal health-related information, to give right accessing their health care information, and to empower them for manage their own health. MyHealthBank contains AI based risk prediction models for certain disease like liver cancer however, needed further (Iqbal et al. 2017; Li et al. 2018).

During the COVID19 Health crisis, the eMask facility was introduced. This feature allowed people to purchase facemasks online instead of having to crowd Pharmacies and exposing themselves to potential illness. This initiative was well-received by the populace. Due to high demand, name-based rationing was applied to masks. The Central Epidemic Command Center (CECC) announced on March 2020 that an online ordering mechanism will be added to the name-based rationing system for face masks on March 12, 2020. The purpose of this new mechanism is to better ensure even distribution and make it more convenient to obtain face masks for people such as office workers and students who lack the time to go to pharmacies and public health centers. The government has been working tirelessly with the private sector to develop and test the new mechanism, which serves as an addition to existing distribution channels, i.e., pharmacies contracted by the Taiwan National Health Insurance Administration and local public health centers. The mechanism allowed people to order at a designated website using their NHI card or Citizen Digital Certificate or through the NHI app ("National Health Insurance Administration, Ministry of Health and Welfare, Taiwan (ROC)" 2020).

The CECC ran the first round of online orders beginning on March 12, 2020 and constituted a trial run, with an estimated seven million face masks (equal to the weekly allotment of 2.33 million people) being made available ("National Health
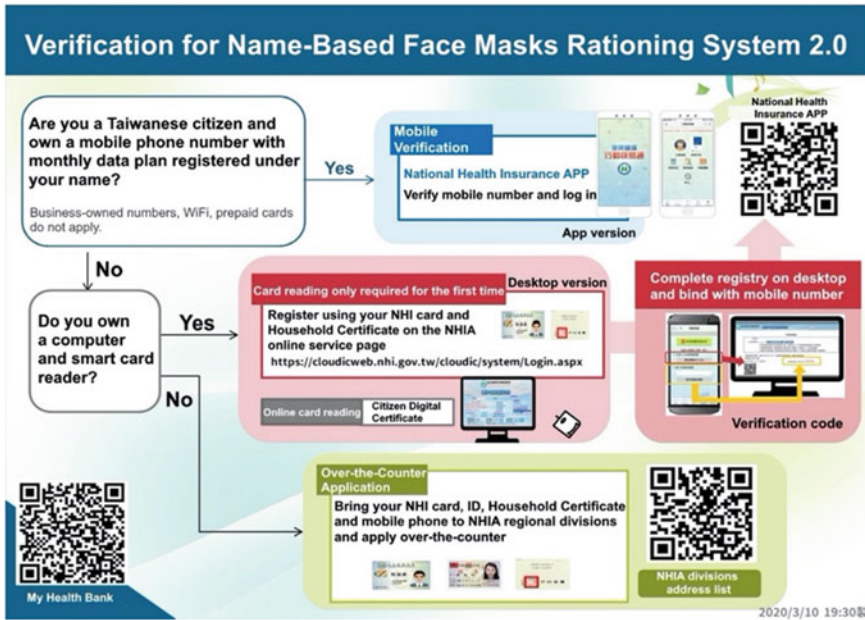
**Fig. 2** Verification ways for name-based mask reservation via MyhealthBank

Insurance Administration, Ministry of Health and Welfare, Taiwan (ROC)" 2020). By just opening the NHI APP and click "My Health Bank", users can easily start to make masks reservation using their mobile phone as shown in Figs. 2, 3 and 4 respectively ("National Health Insurance Administration, Ministry of Health and Welfare, Taiwan (ROC)" 2020). Though eMask is not directly based on AI model but this feature or similar could be enhanced in future to control infections by developing AI based smart monitoring and surveillance systems.

## 7    Conclusion

In the age of Big Data and Health Information Technology, Artificial Intelligence has the potential to speed up data gathering using health applications/health data banks and biometric monitoring devices as well as filter and categorize them efficiently. This will increase the efficiency and accuracy of diagnosis, treatment plans, prognosis as well as clinical research and crisis response. Patient's perspective could be better and understood and their involvement in developing health technology software would prove greatly beneficial.

The government of Taiwan had the 2003 SARS outbreak for reference and has established a public health response mechanism, enabling rapid actions for the next crisis. Well-trained and experienced teams of officials were quick to recognize the

**Fig. 3** National health insurance express MobileApp verification steps guidance



**Fig. 4** Guidance steps for individuals not applicable to reserve masks using mobile phones

crisis and activated emergency management structures to address the emerging outbreak. Taiwan's HIT journey from flash drive to Health Cloud showing the achievements of Taiwanese government in taking successful steps for health IT strategies development with time. Taiwan leveraged its national health insurance database and integrated it with its immigration and customs database to begin the creation of big data for analytics and controlled the health crisis COVID19.

The primary purpose of these initiatives is to ensure safety, sustain the continuity of care by providing patients information at the point of care regardless of where they get care, and to improve the quality of care. The meaningful use of Taiwan's MyHealthBank was also seen in the COVID19 Health crisis, where the Taiwanese government introduced the eMask facility that allows citizens to order online Facemasks instead going to the Pharmacy and be in queue for hours.

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