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Smart healthcare is not just Artificial Intelligence (AI), Internet of Things (IoT) or AIoT; it's a comprehensive approach toward the future of medicine.

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Professor Chi-Hung Lin of NCTU discusses the opportunities and hurdles for unveiling smart healthcare in Taiwan. He also assesses Taiwan's position in the global race for smart healthcare, and how supportive the authorities are proving in its embracement.

Please introduce yourself and your field of research to our readers.

I am a medical doctor but gave up the clinical work at an early phase to dig deeper into research. I received my PhD from Yale in 1995 and returned to Taiwan to join National Yang-Ming University. My speciality is genomics and cancer research. I climbed the academic stairs and obtained tenured full professorship in 2003. I served as Director of Research and Education in Taipei City Hospital, which launched several public health programmes, including universal new-born hearing impairment screening, and pit and fissure sealants programme that aimed to prevent tooth decay in children of elementary schools. I was given the opportunity for a secondment to the government. I spent four years in the Taipei City Government as the Commissioner of health and another four years as the Health Commissioner in New Taipei City. After the secondment, I returned to academia; I am currently chair professor of National Yang-Ming University (NCTU) and National Chiao Tung University (NCTU) and served as senior vice president in NCTU.

NCTU is renowned for its endeavours and accomplishments in ICT and Engineering. Many of the top Taiwanese entrepreneurs are alumni of the university. This is quite unique and differentiates it from other major universities in Taiwan. In the next few years, we will integrate the strength of both NYMU and NCTU to facilitate cross-disciplinary education and research. We are now in the process of establishing a “future hospital” in the campus, making that facility a living lab and model for smart healthcare.

What is the work you are doing in regard to smart healthcare?

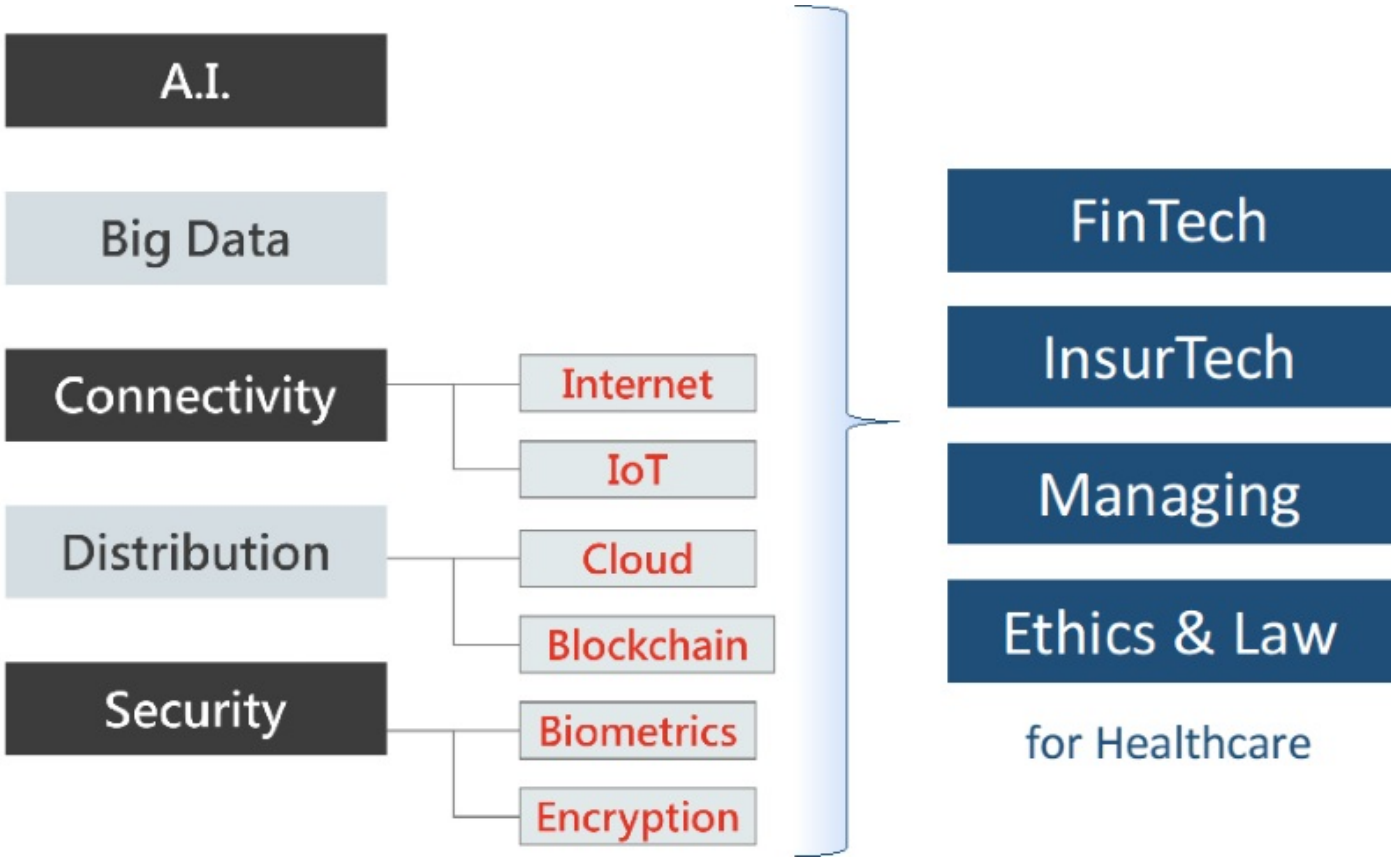
NYMU and NCTU are very ambitious in terms of penetrating and working together with the industry to promote “big health” and “smart healthcare” in Taiwan.

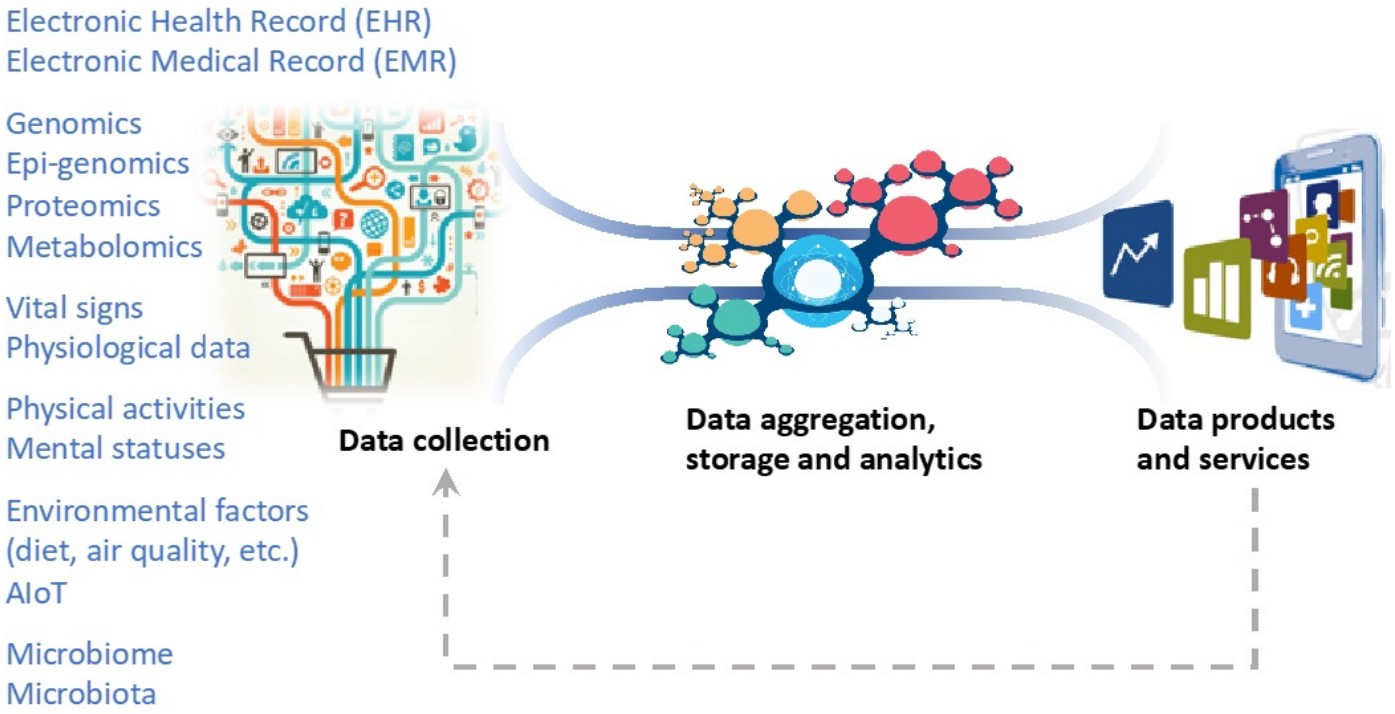
The minimal definition of smart healthcare is the organizations and practices that utilize Smart Health Technologies (SHT) to support health management and healthcare. There are big expectations for the potential of SHT, but such technology is still in its infancy. Further research and developments is needed, e.g. to ensure privacy protection and the security and accuracy of data. There are also issues related to financial support, regulations, service deliveries, ethics and law, to name just a few. So, smart healthcare is not just Artificial Intelligence (AI), Internet of Things (IoT) or AIoT; it’s a comprehensive approach toward the future of medicine.

Recently, IBM announced that they were withdrawing from the health sector, which is a big failure for an IT company in healthcare industry. So, what lessons does IBM Watson tell us? I believe that the major setback of the blue giant lies in the fact that they failed to incorporate their products and protocols into the routine healthcare delivery system, neither have they integrated their services with payment and insurance. Issues related to privacy protection, data security and authorization still remain unsolved. With this consideration in mind, we will spend the next couple of years testing whether blockchain technology can offer some hope to cross these hurdles. Other encryption technologies will also be tested.

If all of the data security, and the data connectivity and distributions issues can be properly solved, we can then aggregate electronic health records (EHR), electronic medical records (EMR) with genomics data, with IoT measurements on vital signs, physical activities or mental statuses, and even with other environmental factors or microbiota – the interaction of human beings with micro-organisms. Such “big data” can then be subjected to innovative analyses or AI to create solutions. Nevertheless, data collection and aggregation remain the most important aspect. This has already been achieved to varying degrees in other areas, for example in FinTech. Perhaps we can utilize

their experience to advance solutions in healthcare.





Is it that there is not the technology that can be integrated, or is it that the stakeholders remain resistant?

I think both exist. Healthcare professionals including doctors tend to be very conservative and are very protective over their patients' data. They also need solid evidence to show that the new methods are "better" than the conventional ones, both from the value or outcome point of view. Thus, there is a hurdle to overcome. The good news is that the healthcare profession embraces innovation, and the "big data mindset" is gradually being accepted by the mainstream.

Successful deliveries of future healthcare services rely not only on the capability of service providers, but also on the service receivers. Along with knowledge and awareness, the patients will need a greater than before input in the decision making which affects them. We are now promoting this on a greater scale in Taiwan, elevating people's knowledge levels. This could even tie into the insurance side of healthcare; with those who take more active roles in their health, e.g., exercise or regular physical check-up, they are able to reduce their premiums.

Where does Taiwan stand in the global race to lead in smart healthcare?

The advantage of Taiwan is that we have a relatively small society, with healthcare data integrated into one under the national database. We have begun with a strong base. While I would not call Taiwan a current leader, we are definitely in a good position to try something new, functioning as a living lab.

Taiwan in the past would credit themselves for the quality of their national health insurance system. However, my criticism is that if the system is so good, why is it not emulated by other countries? The NHI is now facing a huge barrier in terms of wastage, discontinuity of services, ageing population, and an increase in chronic disease and surging demand for long-term care.

I separate smart healthcare of the future into three segments: the service providers, the service receivers, and of course, the tech/service developers. Previously, the service provider offered an insight to the developer and come up with new product or protocols. Nowadays, through big data and AI, novel solutions can directly target at the clinical issues (without hypothesis-driven reasoning, for example). Leveraging conventional ways of healthcare with data-driven approaches will surely add further value to health and medicine in the future.

What we are trying to do is to start with the data collection and aggregation and provide such data consortium for analyses and clinical trials. We welcome global pharmaceutical companies and

health product manufacturers to try on this unique resource.

How well prioritised is smart healthcare by the current administration?

I have experience in bureaucratic systems (from my 8-year secondment in the government), so I understand the hesitation to adopt new systems and ways of working. However, Execution is Everything. Unless we come up with something that is doable, we cannot progress in this area.

My advice to the ministry of the central government would be for them to embark on small scale trials to find the best system of working. No one has a comprehensive solution in future medicine and care. What works in the USA probably will not work in Taiwan, and vice-versa. Consequently, we must test the waters for the bespoke Taiwanese solution first through implementation trials.

Given the university's history of entrepreneurship, what success stories can you provide as an example?

I recently visited a company called Horoscope that went through our incubation centre. Now it is a start-up of 120 people and is making use of big data. They design medical equipment, which is less specialised, targeting general physicians, or even nurses and technicians for community screening. Today's regulations prohibit the practices of these specialist equipment from non-specialist medical professionals. However, for the future of healthcare to be sustainable, these former hospital specialities must diffuse into the community and even to the home. Together with AI and its interpretation of data, this should not pose too much difficulty. However, one must contemplate what happens when the machine gives you the diagnosis. This is where their solutions come in, providing these examinations that are more simplified, overcoming the diagnostic hurdles. These solutions will be marketed internationally, particularly in emerging countries.

What is your final message for our international audience?

For smart healthcare, it is critical that we make advancements in technology, practices, management, regulation, finance, and ethics and law at the same time, so that healthcare can move to the right direction, and our customers- the patients take centre stage.

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