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The 449th International Symposium on Therapy

The 449th International Symposium on Therapy was held by the Zoom Webinar on May 27, 2021. Dr. Taro Kondo, Managing Director of the International Medical Society of Japan (IMSJ), presided over the meeting.

Utilization of ICT and AI in healthcare

Introductory Message from the Chair

Taro Kondo, MD, PhD
Managing Director, IMSJ

This time, the theme of the meeting is the "Utilization of ICT and AI in healthcare". We would like to think about the future of healthcare.

In the first part, each person from London and Tokyo will give a lecture. Since this is an online meeting, the audience can participate and view the lectures from anywhere, and even those who are currently active overseas can participate as presenters.

In Lecture I, Yosuke Takasaki, who is a medical doctor and President of the Institute for Sustainable Society (ISS), will give a talk titled "Health-tech innovation for making our healthcare and society sustainable".

In Lecture II, Yuji Yamamoto, who is a medical doctor and CEO of MinaCare Co., Ltd. will give a talk titled " Value-based healthcare and its strategies ". Dr. Takasaki has been actively involved in building systems and infrastructure, and Dr. Yamamoto has been involved in developing human resources related to medical care and management for the past 10 years.

I had them in mind while planning this meeting, and I wanted to hear about their recent activities, so I invited them. I am happy and excited for the opportunity to listen their lectures together with all of you.

Lecture I

Health-tech innovation for making our healthcare and society sustainable

Yohsuke Takasaki, MD, PhD, ScM, MPA
President
Institute for Sustainable Society (ISS)

Institute for Sustainable Society (ISS) connects the passion and wisdom of front-runners in wide-ranged areas related to sustainability and translates them into concrete innovative actions to make our society inclusive, resilient, and sustainable for everyone without boundaries. Based on those missions, the ISS engages in projects for creating a sustainable society with a particular focus on the SDGs. The ISS's value proposition is "Life," a time to spend with loved ones, a time to be moved by beautiful scenery, and a time to enjoy with your friends.

The achievement of the SDGs has been jeopardized due to the COVID-19 pandemic. To overcome this formidable challenge, we need non-linear and non-contiguous evolution to accelerate our efforts in a back-casting manner. We should not let COVID-19 be just a tragedy; instead, we should translate this pandemic into an opportunity to upgrade our society.

Meanwhile, population aging leads to increased non-communicable diseases, or NCDs (e.g., diabetes, hypertension, cancer, etc.) and subsequent tremendous financial burdens. It is expected that Japanese total medical and long-term care expenditure would be doubled from 50T JPY in 2018 to 100T JPY in 2040. Under such situation, we cannot hand over our society to the next generation.

Innovation has helped our society be a better place. The ISS's most important mission is R&D, including creating intellectual properties named "Formula of Life"; personalized AI is trained by individual data and can propose individually best-suited treatment empowered by behavioral economics technique, nowadays so-called a "deep tech."

Many social networking services, or SNSs, provide highly addictive contents to stick users with personalized services based on their needs and preferences. Likewise, if we could collect individual health/medical data and customize health-related advice to maximize the effects, we can change users' behaviors toward healthier ways. Thus, we are developing personalized AI modeling technology with individual data generated from smartphones, smartwatches, etc. For instance, the root causes of NCDs are lifestyle, such as unhealthy diet, excess alcohol consumption, smoking, etc., which cannot be directly modified by contemporary medicine or surgery. These unhealthy habits come from our cognitive biases and tendencies. The latest evidence shows that some cutting-edge behavioral economics techniques, like "nudge," can alter these habits unknowingly and effortlessly. We believe that personalized AI tailored by own individual data can effectively modify users' behaviors into a healthier way.

Moreover, we are confident that our personalized AI has the potential to transform current medical science and practice completely. Conventional medical science, i.e., randomized control trials, cohort studies, etc., needs to rely on mass data consisting of anonymized individual data. Handling personal data in such science is technically tricky, such as data gathering and analytics. Moreover, researches using mass data have a theoretical limitation: mass data cannot give us an individual effect specifically, which is called ATE: Average Treatment Effect of Rubin Causal Model (RCM). However, analysis of time-series personal data can demonstrate causal inference, namely ITE (Individual Treatment Effect). The individual causal inference will tell us about the most suitable treatment and the best health advice. In fact, a similar concept is already available in cancer treatment, which is individual cancer genome sequence is used to determine the corresponding anticancer drug, a.k.a. "Precision Medicine." Our approach is to 'nudge' people toward a healthier way and propose the most effective and suitable treatment depending on the patients' condition by AI-maximized personalized information. We name them "Precision Health," "Super Precision Medicine," and "Information as a Medicine (IaaM)," respectively.

This new AI modeling with individual cognitive and physical reactions will be a game-changer. Röntgen, who invented X-ray imaging, refused to take out its patents, as he wanted society as a whole to benefit from it. Our "Formula of Life (Personalized AI)" could be used as a fundamental methodology to promote open innovation and achieve the SDGs. "Formula of Life" is, so to speak, 21 century's X-ray. The world will become older and older without exception, which means the world will suffer from more NCDs. We hope to safeguard the future by "Formula of Life," believing it is "our responsibility" that we keep our society sustainable and resilient for the next generation.

Lecture II

Value-based healthcare and its strategies

Yuji Yamamoto, MD, MBA
Founder and CEO
MinaCare Co., Ltd.

The knowledge and technology of health care are evolving day by day, and now that we are in the age of 100 years, the expectations and demands of society for health care are diversifying. Under such pressure, medical care continues to change accordingly. For example, the place of medical care has expanded from advanced medical institutions to clinics, homes, and even into daily life. In addition, the medical evidence has increased from being based on clinical experience to being able to grasp the etiology more accurately. Furthermore, the medical care model has changed from a paternistic one-to-one relationship between professionals and patients at medical institutions to medical care that is tackled by the community, regardless of whether or not care givers have professional license. Health and productivity management promoted by the government is also supporting this transition.

In this way, clinical practice is being pulled by the seemingly contradictory forces of technological sophistication and complexity and the fusion of services into daily life. However, it has been pointed out that the evolution of the health care system and the organization of the provider has not caught up with these changes on the field side. It is pointed out that the already complex medical field makes it even more difficult to solve the problem because the medical care provision system and the medical fee framework are not evolving at a sufficient pace.

In business administration theory, the realization of innovation involves three elements: technology for simplifying things, a business model that makes services affordable and accessible, and the industrial infrastructure on which that business model is established. The theory requires them to be consistent. Based on this, it can be said that in order to connect new knowledge and technology to health care innovation, it is necessary to evolve the health care business model and industrial base as well. The business model of health care is, for example, the ideal way of medical institutions (arrangement of clinical departments, design of care services, etc.), and the industrial base is, for example, health insurance and medical fee system.

In the current health care system in Japan, in principle, insured medical care, which occupies the main part, is provided by a professional at a medical institution after the onset of illness. And the fee is to be paid accordingly. However, in view of the evolution of health care knowledge and technology, and the expectations and demands of society, I think that health care can play its role even before it becomes a disease and in an environment not limited to medical institutions. We have named this concept of health care as "investment-type medical care" because it aims to invest in health rather than dealing with illness, and have promoted this concept as a widespread business. This business is now expanding health care to become more "care-giving" one by utilizing data and ICT.

In this lecture, I will introduce the theoretical background of "investment-type medical care", its examples, and our achievements.

Discourse

Introduction of the speaker of discourse

Taro Kondo, MD, PhD
Managing Director, IMSJ

Norishige Morimoto, IBM Japan Vice President and Chief Technology Officer, IBM Research & Development - Japan, will give a lecture titled "The Future of Computing". He will talk about the future aspects of quantum computers.

Discourse: The future of computing

Norishige Morimoto
Vice President and Chief Technology Officer
IBM Research & Development − Japan

Technology often evolves by reflecting the world's expectation and excitement. When people witness the new technology, they will be inspired and start to think of its possibility and its potential. Such a positive reaction will become the driving force for the advancement of the technology.

In February 2011, IBM "Watson" played at the quiz show "Jeopardy!" and dramatically overperformed two human quiz champions to surprise the world. The event became a wakeup call to scientists who were working on the Artificial Intelligent. It showed the world what machine-based AI could do and now it is "ready to play". But AI has been studied since early '60s, and what make it so special this time? There were several key technology elements which became available in the right place, at the right time.

The first is the computer systems. IBM has been leading the development of semi-conductor based CPU chip for several decades, which the pace of the performance to price growth twice in every 18 months. The performance improvement of the chip was mainly driven by the shrinkage of the transistor and circuits on the chip. In 2011, we could have a fully dedicated high-performance computer server called Power7, with equipped with 2880cores of CPU that was approximately 1million times more powerful than what it was available in the '80s.

The second is the availability of high-quality digital data. By the time the "Watson" plays Jeopardy!, the collected human knowledge saved in the online encyclopedia "Wikipedia" had reached to 5million articles. This easily exceeds what human's biological brain could possibly take. In addition, we could add all kinds of record book such as sports almanac, song lyrics, news articles, novels and more text base information to the database to train "Watson" system. This kind of high-quality digital data were not available before we have internet since 1994.

As this trend grows, we are now aiming to build even more complex and smarter AI systems, with peta bytes of data and exponentially growing complex knowledge network connected to each other. That means, it will take exponential scale of computing power to do all the required work, which we know we could not achieve with the current pace of growth in the traditional semi-conductor base system.

Quantum computer is a totally new concept of computer based on quantum mechanics and quantum effects such as superposition and entanglement. Instead of classical mean of bit, it employs a special computing unit called quantum bit or qubit. The combination of qubits makes quantum gates, to formulate quantum algorithms. This new concept of computer will enable extraordinary scale of computing that were not possible on its classical counterpart, and provide a new way of mathematical expression for the computing that was not easy or even possible until now.

IBM started the research of quantum computer since early 70s, and started to build quantum computer since mid 2010s. The first quantum computer from IBM was released on the cloud in 2016, to encourage scientists from the world to use it and provide feedback to make it even better. Since then, IBM built more than 30 quantum computers and gathered more than 140 company and university research partners to drive this new field of technology.

In Japan, we started an industry-academia collaboration in 2018 called IBM Q Hub at Keio. It started with collaboration between IBM, Keio University and four industry member companies with half dozen of scientists. Today, it grew into seven industry member companies with more than 30 scientists, which became one of the most successful quantum application research groups within IBM Quantum Network. In 2020, with University of Tokyo leading the pack, we established Quantum Innovation Initiative Consortium (QIIC) with over ten industry partners, and planning to open the first commercial quantum computer data center (IBM Q System One) in Asia Pacific (Shin-Kawasaki city) later this year.

In this talk, I will introduce the foundation of quantum computer and its structure, as well as the latest update of our research activity and its future direction.