ADVERTISEMENT FEATURE

HARNESSING AI TO SEE A PATIENT'S UNIQUE PATTERNS

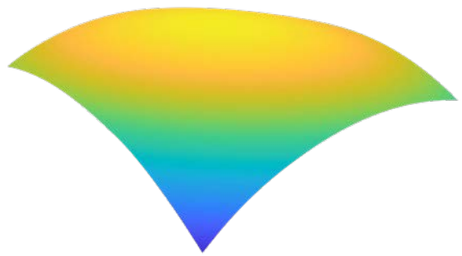
ARTIFICIAL INTELLIGENCE FOCUSED ON DYNAMIC PATIENT CARE is helping to fine-tune drug dosing regimes and reduce hospital wait times, with potentially dramatic benefits.

Personalized medicine, which looks holistically at a patient's unique physiology and how it changes across time, is only just emerging in a practical sense, say scientists — but it promises to revolutionize healthcare, improving treatments and increasing healthy lifespans.

Dean Ho, director of the Institute for Digital Medicine (WisDM) at the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine), has a keen interest in progressing the field.

For example, drug doses could be adjusted across the course of a treatment or even across a day, he says. "Historically, dose optimization was based on reaching toxicity — essentially finding the maximum possible dose a patient could tolerate," says Ho. "Now, we are using artificial intelligence (AI) to try to adjust doses based on efficacy — what works best for a particular patient at a given time."

One of the goals at WisDM is to use a patient's own data to manage their care, adapting to how their physiology changes over time. "In order to do that, we need to stop treating everyone based on a single snapshot in time in their lives and move towards seeing their entire story with the help of AI mapping," Ho says.



▲ **After monitoring several doses, CURATE.AI can produce a parabolic graph that predicts how a patient is likely to respond to a drug over time.**

PATIENT INPUT

To attempt this, Ho and his WisDM team have conducted a series of clinical trials that monitor how a given patient has responded to a drug over several doses. Depending on the disease, the markers used to track the efficacy of a treatment could be studied in anything from the constituents of blood serum, to the results of a body scan.

From this data, the team is able to generate a parabola that predicts how a patient is likely to respond to the drug over time. The parameters of each parabola are developed with the help of an AI neural network called CURATE.AI, explains Ho.

CURATE.AI has already been used in clinical trials to optimize chemotherapy treatments for cancers such as prostate cancer[1] and solid tumours[2]. It has also been used to optimize immunosuppressant drug doses for patients who have had liver transplants[3], who need them to prevent rejection.

Cardiologist, Laureen Wang, is interested in whether the neural network could also help her patients manage their blood pressure. Hypertension — or high blood pressure — is one of the leading causes of preventable heart attacks and strokes in Singapore.

Wang, who works at the National University Heart Centre, Singapore (NUHCS) and also as a clinical principal investigator at WisDM, is leading a feasibility trial investigating whether CURATE.AI's dosing recommendations for anti-hypertension medications could help lower people's blood pressure faster.[4]

To do this, patients will be able to use a remote blood-pressure measurement system to monitor themselves regularly. Clinicians will then have access to this data and CURATE.AI's recommendations, and can use telehealth appointments to adjust patient dosing accordingly. Clinicians don't have to use the AI's recommendations, says Wang, but the hope is that these could speed up the initial process of adjustment and reducing a patient's blood pressure.

"In the long run, if we can use this system, it would mean that my patients can achieve their blood pressure targets faster even though they don't see me in person as often," Wang says.

MINDSET SHIFT

Getting the trial started, however, was more difficult than anticipated, says Wang. Doctors were conservative about adopting the recommendations and patients did not always understand the intervention, making obtaining informed consent challenging.

Furthermore, as CURATE.AI is classified as a medical device (it is not yet approved for use for the general public), the institutional review board at the National University Health System (NUHS) initially asked to see a physical device. "Given the challenges faced by reviewers in understanding the concept of an AI tool, it raised several questions about how patients and doctors are likely to perceive it," she says.

Hesitation is understandable, says Kee Yuan Ngiam, deputy director of WisDM and group chief technology officer of NUHS. "Clinicians will need to be trained to use and interpret the recommendations from these tools," he says.

There are also additional concerns about the security of private patient information when AI systems are involved. To address these issues, NUHS has put robust governance policies in place and only stores de-identified data, Ngiam says.

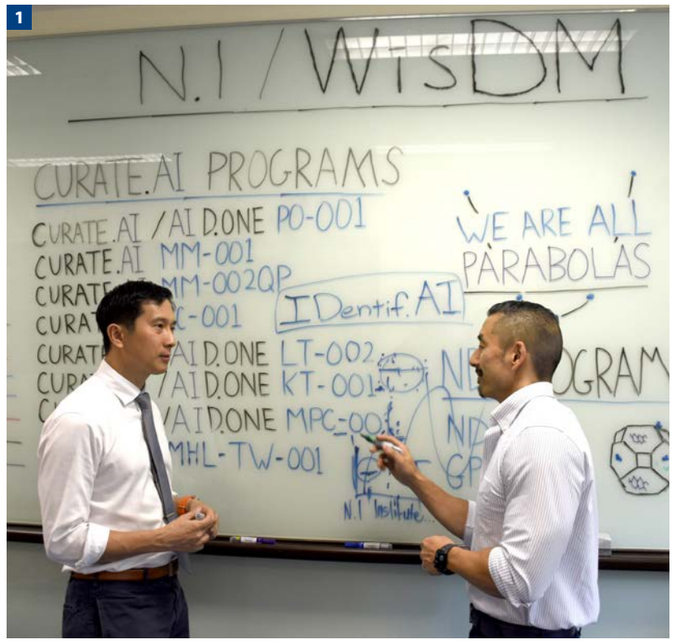
NUHS also developed the DISCOVERY AI platform where large multi-institution medical data sets can be efficiently shared and used to train AI models. It is additionally protected by a technology they developed that uses a very secure data verification method known as blockchain. Once developed, AI models can then be deployed via NUS Medicine's ENDEAVOUR AI platform, which can then present live AI predictions to clinicians at scale (see box).

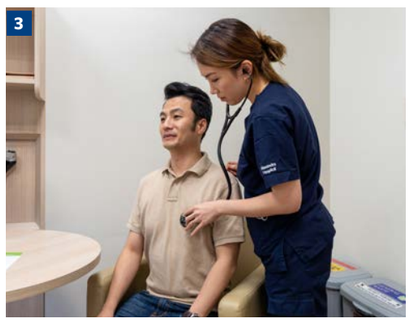
TAKING IT PERSONALLY

These models are just the beginning, Ngiam says. "Having longitudinal access to patient data, ranging from lab test results and data on vital signs, to even nursing notes is incredibly powerful."[5]

Researchers like Ho are taking this concept to heart. Using a combination of finger prick tests and continuous glucose monitoring, he has been given ethics approval by the university to test the impact of diet and exercise on his ability to remain in a state of ketosis. He plans to publish on this data.

"When I talk about our research, people might find it interesting, but not very relatable. But when I present my personal data, there is a startling recognition that the dynamic approach will play a pivotal role in how we care for patients in the future," he says. ■





▲ **1. Kee Yuan Ngiam (left), deputy director of the Institute for Digital Medicine (WisDM) at NUS Medicine, and Dean Ho, director of WisDM, map out their plans for CURATE.AI, an AI platform that predicts how a patient is likely to respond to a drug over time.**
2. One project at WisDM is looking at if CURATE.AI aided recommendations can speed up medication adjustments and reduce patients' blood pressure.
3. Laureen Wang (at right) works at both WisDM and as cardiologist at the National University Heart Centre, Singapore.

HOW AI MIGHT HELP SLASH HOSPITAL WAIT TIMES

High occupancy rates and manpower shortages mean that wait times have been getting longer at hospitals across the world. ENDEAVOUR AI — a tool to help predict the length of hospital stays developed at the Yong Loo Lin School of Medicine at the National University of Singapore — helps address this problem by integrating real-time data from electronic health records with clinical observations.

The results are presented in a dashboard that alerts doctors to increasing wait times, enabling proactive deployment of hospital resources. The system, which has been validated by data from more than 260,000 patients, can predict bed capacity up to two weeks ahead of time.

It is also able to predict how many patients might turn up each hour to the emergency department and even to which part of the emergency department. Overall, the system has reduced waiting times by between approximately 30 minutes and a few hours at the three tertiary hospitals under Singapore's National University Health System since its implementation in 2022.

REFERENCES

1. Pantuck, A. *et al. Adv. Ther.* **1**, 1800104 (2018).
2. Blasiak, A. *et al. J. Clin. Onc.* **40**, (2022).
3. Zarrinpar, A. *et al. Sci. Transl. Med.* **8**, 333ra49 (2016).
4. Truong, A.T.L. *et al. Euro. Heart. J. Digi. Heal.* ztad063 (2023).
5. Ngiam, Y-K. *et al. Digi. Onco.* **20**, E262-E273 (2019).

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