

Beyond trial and error: Tailoring drug therapies to patients' DNA

IT professional Gan Chee Hiong, 55, was on his weekly run up Bukit Timah Hill when he had a mild heart attack.

The date was Aug 13, 2024 – a day before his 53rd birthday.

Gan took himself to the emergency department of the National University Hospital (NUH), but it was not until his third day there that doctors ascertained he had suffered a heart attack.

He underwent an angioplasty to address the three blockages in his heart and was prescribed ticagrelor, a blood thinner that prevents blood platelets from clumping together, lowering the risk of blood clots, heart attacks, and strokes.

Instead of providing peace of mind, the medication became a source of anxiety for Gan, who developed frequent episodes of breathlessness.

Suspecting that ticagrelor could be the cause, Gan brought his concerns to Doreen Tan, a cardiology specialist pharmacist at the National University Heart Centre, Singapore, to ask if he could switch to an alternative medication.

Since Gan was not reacting positively to ticagrelor, Tan encouraged him to enrol in the pre-emptive pharmacogenomics (PPGx) clinical implementation pilot to assess his suitability for the older drug clopidogrel.



The pilot is part of a broader effort by the National University Health System to integrate pharmacogenomics into routine care. Conducted as an implementation research programme, it analyses genetic variations across 16 genes known to influence patients' responses to commonly prescribed medications.

Tan initially tested Gan's platelets

for their response to the different blood thinners.

"We also collected genes from the blood samples, and that was when we chanced upon the prevalence of gene mutations, specifically for the antiplatelet (medication). More than 60% of locals have the mutations," she said.

In 2022, scientists found that most Singaporeans have at least

one genetic variant that could react poorly with a drug. The finding was made after the Republic mapped the DNA of 10,000 Singaporeans.

Scientists also found that one in four carries a variant that raises the risk of life-threatening side effects from at least one medication.

Together with Elaine Lo, a principal clinical pharmacist at NUH who was looking into precision medi-

IT professional Gan Chee Hiong (centre) with principal clinical pharmacist Elaine Lo (right) and cardiology specialist pharmacist Doreen Tan. Gan switched blood thinner medication to clopidogrel after undergoing genetic testing to assess his suitability for the drug. ST PHOTO: BRIAN TEO

cine, Tan conceptualised and rolled out the first PGx clinical pilot.

Tan said Gan underwent genetic testing as well as platelet function testing "because the turnaround time for (the latter) test was faster, and he was breathless when he came to the clinic".

Tan said that in cardiology, it is not just antiplatelet medication, but also two other classes of drugs – anticoagulants and beta-blockers – whose effects are influenced by genes and how people respond to medication.

She added that people with very poor gene function are 10 times more likely to have a recurrent cardiac event than those without the variant.

Lo, who is also the lead pharmacist for the pilot, said the team started recruiting patients in 2023.

"At that point in time, the target was 1,000 patients. By Phase 2, there was funding from PRECISE (Precision Health Research, Singapore), a body that coordinates Singapore's multi-phase National Precision Medicine programme," she said.

To date, more than 4,000 patients have undergone pharmacogenomics testing under the programme.

Findings from the pilot have shown that every patient tested carried at least one genetic variant,

while one in five had a variant that could predict an atypical response to one of their prescribed medications.

Lo felt that there should be a subsidy to help people afford the test.

"When you need the drug, your information would (already be) in the system, which would prompt doctors to give the right medication without ordering (separate genetic) tests for each drug needed to treat the condition," she said.

In recent years, Tan has also advocated the reverse approach – giving heart patients without the mutation clopidogrel instead.

"If we could use precision medicine to choose the right people for ticagrelor or for clopidogrel, that would make the most sense," she added.

Gan's life has largely returned to normal, and he has been able to resume moderate exercise.

He told The Straits Times that, having benefited from PPGx, he is now "a strong believer in genetic testing and precision medicine and have encouraged many family members and friends to sign up for it".

"I was even able to fly to Japan to witness the birth of my grandson. He was born on Aug 13, 2025 – exactly a year after I suffered my heart attack," he said.

Judith Tan