Tackling heart disease and stroke risks with customized treatment

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Two major illnesses in Europe have prompted EU researchers to hunt for cures by grouping affected people.

Professor Rick Grobbee believes the key to better treatment for individual patients with heart disease is to look at large numbers of them. This approach can reveal different subgroups of disease.

Grobbee, a researcher at University Medical Center Utrecht in the Netherlands, was so intrigued by this potential that he made it the focus of his work after studying high blood pressure in the early 1980s.

Patient populations

"That really made me switch my career," Grobbee said. "I found it extremely exciting and rewarding to study patient populations."

More recently, he channeled his expertise into a ground-breaking research project that received EU funding to collect information on patients with heart conditions. Called BigData@Heart, the project ended in February 2023 after six years.

Heart disease is so widespread in Europe that the pool of patients from whom to collect data is large.

In 2015, more than 85 million people in Europe were living with cardiovascular disease, according to the European Heart Network.

People across the continent enter hospitals every day with chest pains, nausea and shortness of breath—a few of the indications of a heart attack. Warning signs can exist for weeks or attacks can be sudden.

No matter why patients turn up, their arrival is often the end stage of an illness in development for some time.

"Heart failure is very disabling," said Grobbee. "It has a major impact on people's quality of life."

Underlying illnesses

Heart disease accounts for 45% of all deaths in Europe.

Behind heart failures and heart attacks lie different illnesses. Treatments work for some and not for others.

"The problem is that, in heart failure and heart disease, we have a lot of medications but we often treat everyone the same way," said Grobbee. "That is probably not the best approach."

Large numbers of people don't respond to treatment, some show little improvement and still others face side effects.

BigData@Heart, which Grobbee led, brought together information from 50 million patients with heart conditions using databases, machine learning and artificial intelligence.

Scale and history

"That's such a big scale that it creates an opportunity to delve much deeper into this diversity," he said. "Combined with computer power, it allows us to look much further away—like how a telescope allows you to look at stars that are otherwise invisible."

This approach has a history. In 1948, the "Framingham Heart Study" began in the US state of Massachusetts and continues to this day. It has revealed that factors such as high blood pressure, elevated cholesterol levels, diet and lifestyles greatly influence the risk of heart attack.

This ushered in a treatment revolution, with targeted drugs for high blood pressure saving millions of lives.

In BigData@Heart, Grobbee and his colleagues sought to repeat this feat by better understanding patient subgroups.

Patients were classified more narrowly according to whether they had other conditions such as diabetes, kidney troubles or heart-rhythm disorders. Doctors could then see which treatments worked best for which subgroups.

The research featured specialist organizations in six EU countries—Belgium, France, Germany, the Netherlands, Spain and Sweden—and in Switzerland, the U.K. and the U.S.

Customized cures

The project made gains.

For beta blockers, which are medications that reduce blood pressure, the statistics revealed that some patients benefit, some don't and a third group suffers side effects.

As a result, doctors will start off better equipped to assess patients, even if the precise medical condition of any one of them is atypical.

"Now physicians can use that information to better customize and tweak treatments," said Grobbee. "We learned from large numbers to give better guidance for individual patients."

BigData@Heart had industry involvement built in. As a part of an EU public-private research partnership called the Innovative Medicines Initiative, the project included the pharmaceutical industry, which contributed funding and its own own studies.

"It was great to work with them because of their ability to look at different types of patients who might benefit from therapies so we can repurpose drugs or design new ones," said Dipak Kotecha, a professor of cardiology at the University of Birmingham in the U.K. and a project participant.

Neck arteries

Another EU-funded research project is taking a broadly similar approach to tackle a different medical challenge: strokes.

Called TAXINOMISIS, the initiative is categorizing patients by using medical imaging, blood-test results and existing health conditions. Due to wrap up in December 2023 after six years, it too harnesses the power of AI and advances the idea of personalized medicine.

The focus has been on a disease affecting two arteries in the neck that supply blood to the brain. They're called carotid arteries.

With carotid artery disease, deposits called plaques build up there. This can narrow the passageway for blood or cause pieces of plaque to break off and flow into the brain.

"If you have problems in your carotid arteries, then you might have problems in your brain," said Dimitrios Fotiadis, who leads TAXINOMISIS and is a professor of biomedical engineering at the University of Ioannina in Greece.

Such brain illnesses include stroke and dementia. An estimated 30% of strokes involve carotid artery disease, underlying the push to discover plaques and intervene.

Dislodged-plaque risks

At present, patients are assessed with medical imaging such as MRI to estimate how much blockage is present.

But this technique is imperfect. There are different types of plaques, some more likely to break off.

TAXINOMISIS developed software that generates a 3D image of the artery and predicts whether the plaque will expand and the risks of it breaking up and damaging the brain.

This lets the doctor decide whether a patient can go home, be prescribed a drug or receive a stent—a thin, hollow tube that is surgically inserted to expand a narrowing artery.

Alternatively, a person's risk assessment could suggest that surgery is needed.

Doctors in Greece, Germany, the Netherlands, Serbia and Spain have been putting the tool through its paces with 300 patients and offering feedback to the developers.

Better test

Another part of the project designed a "lab on a chip"—a technology that with a drop of blood tests for a handful of genes implicated in carotid artery disease. This technique can give results in minutes rather than hours, significantly reducing costs.

Fotiadis estimates it takes four to six years to bring a completed prototype to the market.

In any case, he said the ultimate benefit of research such as TAXINOMISIS is that it will give doctors a better perspective about the particular needs of an individual patient.

"The doctor ultimately decides about the treatment," said Fotiadis.

Grobbee in Utrecht echoed the point.

"For doctors, this all helps make sense of some of the confusion as to why our patients sometimes respond so differently," he said.

More information:

- BigData@Heart
- TAXINOMISIS

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