Summary for patients and the public

Introduction

People are living longer today than ever before. But an ageing population means more and more of us are likely to live with long-term health conditions that require medication. This means the number of medicines we are taking is increasing.

Many currently available medicines are 'one size fits all'. This means that people are prescribed a medicine for a particular health problem at a set dose. But medicines don't always work in the same way for different people; some people might respond very well to treatment, some might not show any response at all, and for some their medication may also give them unwanted side effects. We cannot completely predict how someone will respond to the medicine they are prescribed, but there is now good evidence that their genetic information – the information stored in their DNA – plays a key part.

What is pharmacogenomics?

Everyone has different genetic information, stored in the genes they inherited from their parents. Pharmacogenomics is the study of how genes affect a person's response to drugs. It brings together the science of drugs (pharmacology) and the study of genes and their functions (genomics) to develop and prescribe medications that are tailored to a person's genetic makeup.

Scientists have learned a great deal about how inherited differences in your genes can affect your body's response to medications. Pharmacogenomic testing can be used to discover which variants of genes you carry, and how they are likely to influence the way your body responds to medicines you might be given. Because your genes hardly change throughout your lifetime, a pharmacogenomic blood test needs to be done once. The test results could then be used throughout your life to guide the choice and the dose of medicine, making it more likely that you receive the most effective medicine for you the first time you are treated, and with the fewest potential side effects (see the graphic on page 10).

What do we know so far?

Using a person's genetic makeup to guide treatment is already a reality for some. The UK is a world leader in mapping individual genomes (all of a person's genetic information), and the expertise and technology needed to roll out this approach to treatment more broadly is already well established.

In fact, pharmacogenomic testing is already benefiting NHS patients in some cases. For example, in breast and colon cancer, pharmacogenomics is used to understand whether a person can safely be prescribed the chemotherapy drug 5-fluorouracil. Research has also shown that there are genetic differences in the way people respond to the painkiller codeine. Codeine works better for some people than others, while in some it can have more side effects, but we do not routinely test before prescribing codeine.

Using pharmacogenomic testing more widely has the potential to keep people healthier for longer, improving their NHS care and outcomes. Unwanted side effects from prescription drugs cost the NHS £530 million annually in hospital admissions. Getting it right the first time could help save the NHS money and resources.

Patient requiring medication

Standard approach

The patient is **prescribed a medicine** for their health problem often at a set dose – a one-size-fits-all approach

The patient's genes affect how they **respond to the medicine** and whether they have side effects

The **prescription is changed or adjusted** to suit the person

Medication stopped | **Dose lowered** | **Dose increased**

Pharmacogenomic approach

The patient has a **pharmacogenomic test** – a blood test carried out once in a person's lifetime

The patient is given **the right medicine at the right dose** for them