Pharmacogenomics FAQ

Pharmacogenomics uses information about a person's genetic makeup, or genome, to choose the drugs and drug doses that are likely to work best for that particular person. This new field combines the science of how drugs work, called pharmacology, with the science of the human genome, called genomics.

What is pharmacogenomics?

Pharmacogenomics uses information about a person's genetic makeup, or genome, to choose the drugs and drug doses that are likely to work best for that particular person. This new field combines the science of how drugs work, called pharmacology, with the science of the human genome, called genomics.

What might pharmacogenomics mean for me?

Until recently, drugs have been developed with the idea that each drug works pretty much the same in everybody. But genomic research has changed that "one size fits all" approach and opened the door to more personalized approaches to using and developing drugs.

Depending on your genetic makeup, some drugs may work more or less effectively for you than they do in other people. Likewise, some drugs may produce more or fewer side effects in you than in someone else. In the near future, doctors will be able to routinely use information about your genetic makeup to choose those drugs and drug doses that offer the greatest chance of helping you.

Pharmacogenomics may also help to save you time and money. By using information about your genetic makeup, doctors soon may be able to avoid the trial-and-error approach of giving you various drugs that are not likely to work for you until they find the right one. Using pharmacogenomics, the "best-fit" drug to help you can be chosen from the beginning.

How is pharmacogenomic information being used?

Doctors are starting to use pharmacogenomic information to prescribe drugs, but such tests are routine for only a few health problems. However, given the field's rapid growth, pharmacogenomics is soon expected to lead to better ways of using drugs to manage heart disease, cancer, asthma, depression and many other common diseases.

One current use of pharmacogenomics involves people infected with the human immunodeficiency virus (HIV). Before prescribing the antiviral drug abacavir (Ziagen), doctors now routinely test HIV-infected patients for a genetic variant that makes them more likely to have a bad reaction to the drug.

Another example is the breast cancer drug trastuzumab (Herceptin). This therapy works only for women whose tumors have a particular genetic profile that leads to overproduction of a protein called HER2.

The U.S. Food and Drug Administration (FDA) also recommends genetic testing before giving the chemotherapy drug mercaptopurine (Purinethol) to patients with acute lymphoblastic leukemia. Some people have a genetic variant that interferes with their ability to process the drug. This processing problem can cause severe side effects and increase risk of infection, unless the standard dose is adjusted according to the patient's genetic makeup.

The FDA also advises doctors to test colon cancer patients for certain genetic variants before administering irinotecan (Camptosar), which is part of a combination chemotherapy regimen. The reasoning is that patients with one particular variant may not be able to clear the drug from their bodies as quickly as others, resulting in severe diarrhea and increased infection risk. Such patients may need to receive lower doses of the drug.

What other uses of pharmacogenomics are being studied?

Much research is underway to understand how genomic information can be used to develop more personalized and cost-effective strategies for using drugs to improve human health.

In 2007, the FDA revised the label on the common blood-thinning drug warfarin

(Coumadin) to explain that a person's genetic makeup might influence response to the drug. Some doctors have since begun using genetic information to adjust warfarin dosage. Still, more research is needed to conclusively determine whether warfarin dosing that includes genetic information is better than the current trial-and-error approach.

The FDA also is considering genetic testing for another blood-thinner, clopidogrel bisulfate (Plavix), used to prevent dangerous blood clots. Researchers have found that Plavix may not work well in people with a certain genetic variant.

Cancer is another very active area of pharmacogenomic research. Studies have found that the chemotherapy drugs, gefitinib (Iressa) and erlotinib (Tarceva), work much better in lung cancer patients whose tumors have a certain genetic change. On the other hand, research has shown that the chemotherapy drugs cetuximab (Erbitux) and panitumumab (Vecitibix) do not work very well in the ٤٠ percent of colon cancer patients whose tumors have a particular genetic change.

Pharmacogenomics may also help to quickly identify the best drugs to treat people with certain mental health disorders. For example, while some patients with depression respond to the first drug they are given, many do not, and doctors have to try another drug. Because each drug takes weeks to take its full effect, patients' depression may grow worse during the time spent searching for a drug that helps.

Recently, researchers identified genetic variations that influence the response of depressed people to citalopram (Celexa), which belongs to a widely used class of antidepressant drugs called selective serotonin re-uptake inhibitors (SSRIs). Clinical trials are now underway to learn whether genetic tests that predict SSRI response can improve patients' outcomes.

Can pharmacogenomics be used to develop drugs?

Yes. Besides improving the ways in which existing drugs are used, genome

research will lead to the development of better drugs. The goal is to produce new drugs that are highly effective and do not cause serious side effects.

Until recently, drug developers usually used an approach that involved screening for chemicals with broad action against a disease. Researchers are now using genomic information to find or design drugs aimed at subgroups of patients with specific genetic profiles. In addition, researchers are using pharmacogenomic tools to search for drugs that target specific molecular and cellular pathways involved in disease.

Pharmacogenomics may also breathe new life into some drugs that were abandoned during the development process. For example, development of the beta-blocker drug bucindolol (Gencaro) was stopped after two other beta-blocker drugs won FDA approval to treat heart failure. But interest in Gencaro revived after tests showed that the drug worked well in patients with two genetic variants that regulate heart function. If Gencaro is approved by the FDA, it could become the first new heart drug to require a genetic test before prescription.

Reference:

www.genome.gov/FAQ/Pharmacogenomics