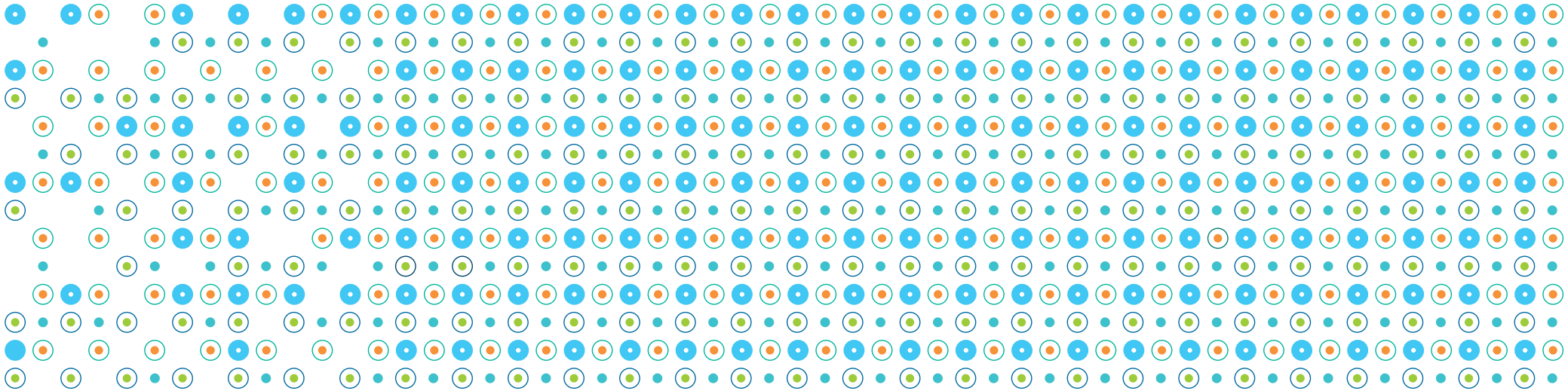
A Consumer's Guide to

GENETIC HEALTH TESTING



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INTRODUCTION

Your Genes Affect Your Health.

Every cell in a person's body contains a set of instructions, called genes, that help determine how your body works and your individual physical characteristics. We each inherit a unique combination of genes from our parents. These genes, together with many other factors, such as our environment and lifestyle choices, are responsible for making us individuals. Genes influence how tall you are, your hair color, aspects of your personality, your risk for developing a variety of diseases, and how you will likely respond to certain medications.

Over the last few decades, our understanding of how genes influence our health has increased significantly. Our ability to determine how an individual's genes may impact a person's health is especially useful, because that information can be used to help guide disease prevention and treatment strategies.

The goal of this guide is to provide basic information about certain types of tests that provide information about a person's genes, called genetic health tests.

WHAT IS GENETIC TESTING?

Tests that determine variations in genes, which are called genetic tests, have multiple applications. They may be used to help guide medical decisions, to identify individuals, or just to provide information about how a person's body works.

PERSONALIZED MEDICINE

Personalized medicine, sometimes referred to as precision medicine, is an evolving field that uses diagnostic tools to identify specific biological markers, often genetic, to help determine which medical treatments and procedures will work best for each patient.

When discussed with a qualified health care professional and combined with an individual's medical records and circumstances, genetic health test results may help inform personalized prevention and treatment plans.

Physician-initiated clinical genetic tests are ordered by physicians in consultation with their patients. Physicians use the result of a genetic test to make a clinical treatment decision. For example, genetic tests are sometimes ordered to help clarify a patient's diagnosis, assess the likelihood that a treatment will be effective, or determine the likelihood that a treatment or dosage will cause a severe side effect.

Forensic genetic tests are usually ordered by law enforcement or a court. The result of a forensic genetic test is used to determine a person's identity, often at a crime scene or the scene of an accident.

Consumer genetic tests can be purchased directly by an individual if permitted under applicable state law. The results of a consumer genetic test are returned directly to the individual who purchased it. There are two categories of consumer genetic tests:

- **Genetic non-health testing** returns results that are not directly relevant to a person's health care. These results may include information about family (how closely you are related to someone), ancestry (the ethnic and regional origins of your family over generations), or wellness (for example, how your genes might impact your nutrition or exercise). Or, the results may simply be for entertainment (for example, how your genes may affect your taste palette).
- **Genetic health testing** returns results that are relevant to a person's health care. These tests may inform disease prevention and treatment strategies. Consumer-initiated genetic health tests can only be ordered if they are cleared for over-the-counter (OTC) use by the U.S. Food and Drug Administration (FDA) or prescribed by a doctor. These results may include information about your comparative risk of getting certain health conditions

(for example, do you have a greater or lesser risk than the average person of developing a condition such as Parkinson's disease or breast cancer?); the way that your body may react to some medications and dosages (for example, how will certain drugs be metabolized in your body? Is a medicine more likely to be effective or ineffective for you? Are you likely to have an adverse side effect?); or about your carrier status for certain diseases (for example, do you have certain genes that can be passed onto your children that impact their risk of getting an inherited disease?).

When consumer genetic tests return health care-related results, they are more tightly regulated.

Genetic health tests may have been reviewed by FDA, allowing them to be sold directly to consumers without a prescription (OTC genetic tests). For all OTC genetic tests, FDA reviews the accuracy of the test results and assesses whether consumers can safely use and understand the test reports.

Genetic health tests that have not been cleared or approved by FDA for OTC use are provided to consumers through a prescription by a doctor, but only in states where local laws permit. Some of the companies offering these tests make a licensed medical professional, such as a physician or other genetics expert, available to verify the laboratory's results and discuss the test reports.

INFORMATION COMMONLY INCLUDED IN GENETIC HEALTH TESTS

Disease risk indicators that may provide insight into your comparative risk of developing a disease or health condition, such as:

- Certain kinds of cancer (such as breast, ovarian, and colorectal cancer)
- Certain kinds of heart diseases
- Parkinson's disease, a nervous system disorder impacting movement
- Late-onset Alzheimer's disease, a progressive brain disorder that destroys memory and thinking skills
- Celiac disease, a disorder resulting in the inability to digest gluten, which is found in many common foods
- Alpha-1 antitrypsin deficiency, a disorder that raises the risk of lung and liver disease
- Early-onset primary dystonia, a movement disorder involving involuntary muscle contractions and other uncontrolled movements
- Factor XI deficiency, a blood clotting disorder that can cause bleeding
- Gaucher disease type 1, an organ and tissue disorder
- Glucose-6-phosphate dehydrogenase deficiency, also known as G6PD, a red blood cell condition
- Certain kinds of hemochromatosis, an iron overload disorder
- Certain kinds of thrombophilia, a predisposition to developing blood clots

Pharmacogenetic (drug metabolism) indicators that may provide insight into how you may react to certain drugs

Carrier status indicators that may provide insight into the potential for you to pass a gene to your children that can impact their chances of developing a genetic disease, such as:

- Cystic fibrosis
- Tay-Sachs disease
- Sickle cell anemia

WHY WOULD I ORDER GENETIC HEALTH TESTING?

Genetic test results may encourage you to be proactive about lifestyle changes that may help manage health risks.

Your doctor may recommend a genetic test for you if certain health conditions run in your family or if you or a family member has been diagnosed with a condition known to have a genetic marker that may impact treatment decisions. But regardless of whether you have a personal or family history of a health condition, consumer genetic health testing is available if you are interested in learning about your comparative risk of disease or how you may respond to specific medicines. The test results may encourage you to be proactive about lifestyle changes that may help you manage health risks.

For example: If you have an increased genetic risk of developing celiac disease, you might choose to make changes to your diet and exercise habits and ask your health care provider to help you develop a plan to watch for early symptoms of disease.

Before acting on test results, repeat testing or confirmation through another method should be considered.

Some genetic health-related information is "medically actionable," meaning medical interventions are available that could reduce the risk of getting a disease or that using this information could influence treatment decisions and how the disease advances. In this case, you should make a doctor aware of the results, to initiate potentially important medical management strategies. Before acting on these results, repeat testing or confirmation through another method should be considered.

For example: If a consumer genetic health test indicates that you have an increased risk of getting breast cancer, you should consult your doctor. Together, you may decide to undergo more frequent screening and/or engage in other preventive strategies.

You may find that you are at equal or lower risk of developing a specific illness than the general population. This does not mean, however, that you should forgo recommended health screenings such as mammograms and blood tests. Your environment and other lifestyle factors also affect your health. Regular checkups and a healthy lifestyle are very important, regardless of your genetic risk factors. As with any health-related decision, you should work with your health care provider to develop a health management strategy that suits your needs.

WHAT SHOULD I CONSIDER BEFORE ORDERING GENETIC HEALTH TESTING?

Genetic health testing information can have significant implications for your well-being, so it is important that you understand what the results can and cannot tell you before ordering the tests.

Most genetic health tests tell you whether you possess a genetic marker or variation of a gene associated with a particular health condition. In some instances, the test will include information on the estimated increased risk of developing the disease. This does not necessarily mean that you will develop the disease. It means only that your risk of developing that disease is higher than the average person's risk. You may also learn that you carry a genetic variant that can be passed on to your children, which would increase their risk of having an inherited disease.

While consumer genetic health tests may provide information about whether you are relatively more susceptible to some conditions or diseases, they do not provide a diagnosis of the disease or condition. Different genetic variations carry different levels of risk for the health condition they are associated with. It is possible for you to be at risk for a condition even though you do not have a genetic marker associated with it. It is also possible that you may have a higher risk because of your genetics but may never develop a condition. Thus, it is important that you understand the level of risk associated with different genetic markers included within your genetic health test results, so that you can involve a physician when appropriate and respond accordingly.

In some instances, the test will include information about how you may respond to different medicines (i.e., whether a drug will be effective or ineffective for you and at what dose) or whether you are more likely to experience side effects from a certain drug. Rather than acting independently in response to such test results, you should consult your physician to determine whether any changes to your medication regimen would be appropriate.

Some information might be especially sensitive, and you may wish to consider "opting out" of receiving results for certain diseases. For example, you may choose not to receive test results that are associated with a risk for Alzheimer's or other diseases for which there are limited treatments or preventive interventions available.

It is important to understand the accuracy, reliability and usefulness of genetic tests.

All medical tests can have errors. Genetic testing regulations require that certain standards for quality control are met to ensure that the test results are accurate and reliable. The testing limitations, along with the accuracy and validity of any OTC tests, should be detailed in the information provided in the package of the test. For tests that have not been reviewed by FDA, the laboratory often makes such information available on its website. The laboratory may have also published information on its internal validation studies. Nevertheless, it is important to know that despite high standards for quality control, there is always a small risk that the reported test result is not accurate. Therefore, it is important to consider repeating such tests if the result is used for medical decision-making.

IMPORTANT QUESTIONS & CONSIDERATIONS

Before You Decide to Order a Genetic Test, Ask:

- What is my motivation for testing?
- What information do I hope to get and how would I use this information?
- Are the conditions being tested for important to me?
- Will the test results offer peace of mind or increase stress and anxiety?
- Will the test results help me make better health choices?
- Are there actions I can take to improve my health based on the test results?
- Does the vendor provide information I can use to help prevent disease after testing?
- Will I have access to updates on discoveries and new information?
- Will my results be kept private?
- What are the implications of the results to my family and/or for family planning?
- Is the test covered by my insurance policy?

Once You Decide to Order a Test, Ask:

- Are the genetic health tests offered by the vendor authorized by the FDA for over-the-counter use, or do they need to be prescribed by an authorized physician?
- If the test is not cleared by FDA for over-the-counter use, does the vendor provide access to appropriately trained health care professionals, such as the prescribing physician, a certified genetic counselor, a clinical pathologist, or a clinical geneticist?
- Does the vendor provide information about the test's accuracy, the laboratory's methods, and how it develops its test results?
- Do the vendor's methods for performing genetic testing and generating results ensure high-quality and clinically relevant information?
- Does the vendor take steps to confirm the accuracy of medically actionable results prior to adding them to your report?

If the information from a consumer genetic test may be used to influence your health care decisions, it is also very important to be sure that it is clinically relevant (i.e., that the gene variant impacts health in the way that has been described, and that this is supported by scientific evidence). In some cases, FDA has issued a warning about test results that have not been reviewed by the agency and may not have the scientific or clinical evidence to support the test's use in health care decision-making. For example, FDA has recently issued a safety communication that warns patients and physicians against the use of genetic tests with unapproved claims to predict patient response to specific medications.

While there are cases for which some evidence supports a correlation between a genetic variant and drug response, there are other cases where the relationship between reported genetic variations and a medication's effects has not been determined. For OTC consumer genetic tests, this is described in the FDA-authorized label, and general information about how reported genetic variations may impact the levels of a medication in the body is provided. For consumer genetic tests that have been prescribed by a physician, the laboratory should validate the clinical relevance of reported variants.

The Clinical Laboratory Improvement Amendments (CLIA) passed by the U.S. Congress in 1988 require inspections of all clinical laboratories to ensure they meet certain licensure and quality standards. While not all genetic testing is conducted in CLIA-certified laboratories (non-health care-related genetic testing, for example, is not subject to CLIA regulations), federal regulations for genetic health testing require that these tests be performed in CLIA-certified laboratories. CLIA-certified laboratories have internal processes to assess and confirm the clinical validity of their tests. Prescribed genetic health tests developed and conducted in CLIA-certified laboratories are not required to be independently reviewed by a governmental agency prior to their use unless they are offered to residents in New York state, in which case they are subject to review by the New York State Department of Health. OTC tests have additional regulatory standards that allow them to be sold without a doctor's prescription.

YOU CAN SPEAK WITH A GENETIC COUNSELOR BEFORE ORDERING A GENETIC TEST

Genetic counselors are health professionals specially trained to explain genetic information and discuss its significance with you and your family. They can work with you to understand the risks and benefits of genetic testing, discuss options for genetic testing, discuss implications of test results, and review actions you may want to take based on the test result. If you are uncertain of whether a genetic test is appropriate for you, seeking the advice of a certified genetic counselor is recommended. You may also want to speak with a genetic counselor if you are unsure about whether the laboratory conducting the test meets appropriate quality standards.

You can find information on genetic counseling through the National Society of Genetic Counselors at **www.nsgc.org**.

It is important to review all relevant privacy policies before ordering a genetic test.

Your genetic information is unique to you, and it may be able to identify you and your relatives. For this reason, you should only disclose your genetic information to people who have

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your best interests in mind. If your health care provider orders a clinical genetic test or your insurance company pays for a genetic test, the results usually become part of your personal medical record. You can ask your health care provider about the federal, state, and local policies that are in place to protect the privacy of your medical record and genetic testing results.

If you decide to purchase consumer genetic health testing, it is important to carefully review the testing company's privacy and consent policy. Typically, the policy will state that the testing company will not share any of your personal data or results with any third parties unless you specifically allow it. This policy should be described in a document you typically need to sign called "informed consent." Third parties may include insurance companies, health management organizations, hospitals, doctors, businesses, and government agencies, among others. You may decide to share your consumer genetic test results with your health care providers. Any genetic test result or other information you share with your health care provider may become part of your medical record.

Consumer genetic testing is a young field, and privacy practices are still evolving. For this reason, the genetic testing company's situation or privacy statement is subject to change. You should make sure the genetic testing company complies with the existing federal and state requirements, and that it adheres to professional best practices. Currently, results of genetic tests performed outside of regular medical practice, including consumer genetic tests where a physician prescription is provided by the vendor, may not be protected by federal privacy protections for medical information, such as the Health Insurance Portability and Accountability Act of 1996 (HIPAA).

The Genetic Information Nondiscrimination Act of 2008 (GINA) protects consumers from discrimination by health insurers and employers on the basis of genetic information. GINA protections do not extend to life insurance and long-term disability insurance.

Law enforcement officials and courts may also request genetic information, and this can be done under subpoena. Requests may also come from the federal government, including the State Department or the U.S. military. Genetic testing companies often consider this when developing their privacy statements, and many make clear that they stand on the side of consumers by providing a transparency report on all requests made by law enforcement and government to date. Nonetheless, your genetic information may be retrieved in this way without your direct consent. Some legal and health professionals are concerned that the collection of information in this way may raise civil liberty issues or could be collected disproportionately from specific racial or ethnic groups.

HOW CAN I ORDER A GENETIC HEALTH TEST?

Over-the-counter or prescription consumer genetic health tests are available from a variety of companies, and can usually be purchased online or over the phone.

It is important to carefully review the available information about the test before you purchase a kit. Upon review of the testing information, you should be confident that the genetic testing company's processes and procedures translate to results that are accurate and reliable. If you have any questions or are concerned about the implications of learning this information about yourself, you should meet with a health professional such as a genetic counselor to discuss your decision to purchase a consumer genetic test.

You will likely submit a "sample" of DNA, often obtained from saliva.

Most genetic tests require a "sample" of your DNA, usually obtained from saliva, which is easily shipped to the genetic testing company. Some tests may require a blood sample.

"If you have any questions or are concerned about the implications of learning this information about yourself, you should meet with a health professional such as a genetic counselor to discuss your decision to purchase a consumer genetic test."

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- Access Solutions Consulting
- American Clinical Laboratory Association
- Alzheimer's Foundation of America
- American Society of Human Genetics
- Association for Molecular Pathology
- Biotechnology Innovation Organization
- Cavarocchi, Ruscio, Dennis Associates
- Color Genomics
- Coriell Institute for Medical Research
- Food Allergy Research and Education (FARE)
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ABOUT US

The Personalized Medicine Coalition (PMC), representing innovators, scientists, patients, providers and payers, promotes the understanding and adoption of personalized medicine concepts, services and products to benefit patients and the health system.

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MEDICINE COALITION

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