color

Hereditary Heart Health Test

PATIENT/CLIENT Charles Warden

DOB: Apr 5, 1985
Sex: Male

ID: 107261908

ORDERING PROVIDER

Carlos Ramos, MD
NPI: 1447451323

SPECIMEN

Type: Saliva
Barcode: 38-7218-0615-3623
Collected: Jan 31, 2019
Received: Feb 4, 2019

Report date: Feb 12, 2019

No mutations were identified.

This means no pathogenic or likely pathogenic variants (also called mutations) associated with an increased risk of hereditary arrhythmia, arteriopathy, cardiomyopathy, or familial hypercholesterolemia were identified in any of the 30 genes analyzed.

This result does not eliminate your risk of developing cardiovascular disorders. Inherited mutations explain some cases of cardiovascular disorders, but many are not inherited and can not be explained by a single cause. Some non-genetic factors that can influence risk include environment and lifestyle, as well as family history without a known genetic link.

NOTES ABOUT YOUR RESULT

- While Color's Hereditary Heart Health Test analyzes 30 genes associated with hereditary cardiovascular disorders that may have actionable treatment plans, factors like lifestyle, environment, and mutations in other genes not covered by the test, may increase your risk. **Especially if you have a personal or family history**, you may want to consider evaluation by a cardiologist and additional genetic testing to analyze more genes related to hereditary cardiovascular disorders. Your healthcare provider can help determine the best management plan for you, which may include additional evaluations.

GENES ANALYZED

The genes below were analyzed, and no pathogenic or likely pathogenic variants associated with an increased risk of hereditary arrhythmia, arteriopathy, cardiomyopathy, or familial hypercholesterolemia were identified. Please see the test methodology and limitations section for additional information.

ACTA2, ACTC1, APOB, COL3A1, DSC2, DSG2, DSP, FBN1, GLA, KCNH2, KCNQ1, LDLR, LMNA, MYBPC3, MYH11, MYH7, MYL2, MYL3, PCSK9, PKP2, PRKAG2, RYR2, SCN5A, SMAD3, TGFBR1, TGFBR2, TMEM43, TNNI3, TNNT2, TPM1

REVIEWED BY

Zheng Tan

Feb 12, 2019

Zheng Tan, Ph.D., FACMG, Medical Geneticist — Date

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Risk and Family Information

FAMILY

Consider sharing your results with relatives who may also benefit from genetic testing. A few key points to remember:

- Your negative result lowers the chance that you have an inherited mutation associated with hereditary cardiovascular disorders.
- It is still possible for your relatives to have a hereditary cardiovascular disorder or a mutation that you did not inherit. They may benefit from their own genetic testing, especially those who have a history of cardiovascular disorders.
- If any of your relatives has a mutation, there is a 50% chance that their siblings and children also have the same mutation.
- A father and mother are equally likely to pass on a mutation. Sons and daughters are equally likely to inherit a mutation if one of their parents has it.
- If you learn that a relative of yours has a mutation, contact a Color genetic counselor to learn how that information may impact your risk assessment and interpretation of results.

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Know your screening guidelines

Below is a summary of guidelines for individuals who have not been diagnosed with a cardiovascular disorder.

HEART HEALTH SCREENING GUIDELINES[1]

Blood pressure

- Blood pressure check at every healthcare visit, or at least once every 2 years. Your provider may discuss screening more often if your blood pressure is higher than average. Untreated high blood pressure can cause damage to the heart and blood vessels, which can lead to heart attacks, heart failure, or stroke.

Cholesterol

- **Starting at age 20**: cholesterol level check every 4-6 years. Your provider may discuss screening more often if you have elevated risk for heart disease and stroke. Untreated high cholesterol can lead to buildup in the arteries, which can lead to heart attack or stroke.

Weight/ Body Mass Index (BMI)

- BMI check at every healthcare visit, or at least once a year. Being obese puts you at risk for health problems such as heart disease, stroke, and more.
- If your BMI is higher than average, a measurement of your waist circumference can help evaluate your cardiovascular risk.

Blood glucose test

- **Starting at age 45**: blood glucose check at least every 3 years. High blood glucose levels put you at a greater risk of developing insulin resistance, prediabetes, and type 2 diabetes. Untreated diabetes can lead to serious problems including heart disease and stroke.

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ADDITIONAL RECOMMENDATIONS[1]

Diet

- Eat an overall healthy dietary pattern that emphasizes a variety of fruits and vegetables, whole grains, low-fat dairy products, skinless poultry and fish, nuts, and legumes.
- Limit saturated fat, trans fat, sodium, red meat, sweets and sugar-sweetened beverages.
- If you choose to eat red meat, compare labels and select the leanest cuts available.
- For more dietary recommendations, visit the American Heart Association's website.

Exercise

- **For overall cardiovascular health**: Exercise for a total of 150 minutes a week, such as walking, running, or swimming. Alternately, exercise vigorously for 75 minutes a week. Include moderate- to high-intensity muscle strengthening activity, such as lifting weights, yoga, push ups, or sit ups, at least 2 days per week.
- **For managing blood pressure and cholesterol**: Exercise for a total of 120-160 minutes a week with moderate to vigorous activity.

Smoking

- Don't smoke and avoid secondhand smoke. Quitting smoking can decrease your risk of heart attack and stroke.

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Common Questions

GENERAL QUESTIONS

What does a negative result mean?
A negative result means that no mutations, or genetic changes associated with an increased risk of hereditary cardiovascular disorders were identified in the genes that were analyzed. This result does not eliminate your risk of developing cardiovascular disorders. You may still be at increased risk of cardiovascular disorders due to other factors, mutations not detected by current technology, or mutations in other genes.

Does this result mean I'm not at risk for a cardiovascular disorder?
No, the absence of mutations does not mean that you will not develop a cardiovascular disorder. Your risk is also influenced by factors such as family history, environment, lifestyle, and random chance. In addition, not all of the genes related to hereditary cardiovascular disorders are known or included on the Color test. You should continue to follow the screening and prevention advice of your healthcare team, or schedule an appointment with a Color genetic counselor if you have questions.

Who will see these test results?
Your results are available to you and the healthcare provider who ordered your test, as well as any additional providers you designated. Your results will not be sent by Color to your insurance company, employer, or any other healthcare provider without consent.

Should I share my results with my healthcare provider?
Color recommends you share your results with your healthcare provider. Sharing your results allows your provider to guide you to appropriate resources and discuss tailored options for screening, prevention, and management.

Are there any protections against discrimination based on these results?
In 2008, a federal law called the Genetic Information Nondiscrimination Act (GINA) was passed to prohibit medical insurance companies and employers from discriminating against individuals on the basis of genetic information, including genetic test results, family cancer history, and even the fact that genetic testing occurred. GINA does not extend to life, disability, or long-term care insurance, which may be governed under state law. Protection against these and other types of discrimination may vary by state. Individuals may consider purchasing these policies prior to undergoing genetic testing. Federal and state laws regarding genetic discrimination change from time to time. We encourage you to keep informed of these important laws and regulations.*

*The statements made herein are for informational purposes only and do not constitute legal advice.

FAMILY IMPACT

What do my results mean to my relatives and do any of them need to consider genetic testing?
Though you do not carry a mutation in any of the genes analyzed, it is possible that your relatives have one that you did not inherit. The only way for them to know whether or not they have such a mutation is for them to undergo genetic testing. Genetic testing can be particularly informative for individuals in the family who have been diagnosed with a cardiovascular disorder.

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Please schedule an appointment with a Color genetic counselor for general recommendations about testing tailored to your family.

Should I talk with my relatives about my result?
You are encouraged to share these results with your relatives. Knowing this information may help them decide whether genetic testing is right for them. Relatives who have had a history of cardiovascular problems may especially find this information useful. However, keep in mind that not everyone wants to know their genetic status and genetic testing is a personal decision.

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TEST METHODOLOGY AND LIMITATIONS

Methodology

Genomic DNA is extracted from the submitted sample, enriched for select regions using a hybridization protocol, and sequenced using Illumina Next Generation Sequencing. Sequence data is aligned to a reference genome, and variants are identified using a suite of bioinformatic tools designed to detect single nucleotide variants, small insertions/deletions, and structural variants such as copy number variants, insertions and inversions. Reported variants may be confirmed by alternate technologies, including Sanger sequencing, MLPA or aCGH. Analysis, variant calling and reporting focus on the complete coding sequence and adjacent intronic sequence of the primary transcript(s), unless otherwise indicated.

Variants are classified according to the standards and guidelines for sequence variant interpretation of the American College of Medical Genetics and Genomics (ACMG). Variant classification categories include pathogenic, likely pathogenic, variant of uncertain significance (VUS), likely benign, and benign. All variants are evaluated by a board certified medical geneticist or pathologist. Identified likely benign and benign variants are not reported. The presence of a VUS is always reported, and the details are available upon request. All VUS and likely pathogenic variants are reviewed bi-annually for updates in the scientific literature. As part of the Color service, we will attempt to recontact the provider and/or the person that was tested if any reported variant's classification changes.

This test was developed and its performance characteristics determined by Color Genomics, a clinical laboratory accredited by the College of American Pathologists (CAP) and certified under the Clinical Laboratory Improvement Amendments (CLIA) to perform high-complexity testing (CAP #8975161 - CLIA #05D2081492). This test has not been cleared or approved by the United States Food and Drug Administration (FDA). The FDA does not require this test to go through premarket FDA review. This test is used for clinical purposes. It should not be regarded as investigational or for research.

Genes

ACTA2, ACTC1, APOB, COL3A1, SC2, DSC2, DSP, FBN1, GLA, KCNH2*, KCNQ1*, LDLR, LMNA, MYBPC3, MYH7*, MYH11, MYL2, MYL3, PCSK9, PKP2, PRKAG2, RYR2, SCN5A, SMAD3, TGFBR1*, TGFBR2, TMEM43, TNNI3, TNNT2, TPM1*

* Please see the Limitations section for more information.

Limitations

This test aims to detect all clinically relevant variants within the genes analyzed (defined above). The majority of these genes are assessed for variants within all coding exons (and adjacent intronic sequence). Several regions that cannot be reliably assessed with standard target enrichment protocols are not analyzed: *APOB* exon 1, *KCNH2* exon 4, *KCNQ1* exon 1 and *TGFBR1* exon 1. Variants of uncertain significance are not reported in regions of high homology: *MYH7* exon 27. For the *LDLR* promoter region, the detection of deletions, duplications, and complex structural rearrangements may be limited.

This test is not designed to detect chromosomal aneuploidy or complex rearrangements such as translocations. It also does not reliably detect mosaicism. The sensitivity to detect deletions and duplications in the range of 40-250bp, as well as those which deletion/duplication do not overlap more than 250bp of contiguous coding sequence, may be reduced. The presence of a large insertion may interfere with the chemistry used to target the genes of interest, which could decrease the detection sensitivity. In addition, the sequence and identity of a large insertion may not be completely resolved. Inversions including at least one coding exon will be detected only if the breakpoints are covered by the Color test. The sensitivity to detect variants may be reduced in regions of low/high GC content, and in the vicinity of homopolymers and simple sequence repeats.

Color only reports findings within the genes that are on the panel. It is important to understand that there may be variants in those genes that current technology is not able to detect. Additionally, there may be genes associated with hereditary cardiovascular disorders whose clinical association has not yet been definitively established. The test may therefore not detect all variants associated with hereditary cardiovascular disorders. Additionally, in the unlikely event a variant is detected that is associated with a disorder other than hereditary cardiovascular disorders, this information will not be included in the report. Genetic counseling and/or physician consultation may be warranted to ensure complete understanding of your test results.

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In very rare cases, such as allogeneic bone marrow transplant, or recent blood transfusion (within 7 days of testing), the results of germline DNA analysis may be complicated by donor mutations. DNA quality may be affected if a participant has received chemotherapy within the last 120 days.

Disclaimers

Color implements several safeguards to avoid technical errors, such as 2-dimensional barcoding and barcode scanning at several steps throughout the sequencing process. Color is not responsible for errors in specimen collection, transportation, and activation or other errors made prior to receipt at our laboratory. Due to the complexity of genetic testing, diagnostic errors, although rare, may occur due to sample mix-up, DNA contamination, or other laboratory operational errors. In addition, poor sample DNA quality and certain characteristics inherent to specific regions of an individual's genomic DNA may limit the accuracy of results in those regions.

In the absence of an identified pathogenic or likely pathogenic mutation, standard risk models may be employed to determine potential risk of hereditary cardiovascular disorders and guidelines displayed on this report. All risk estimation is approximate, sometimes cannot be specifically calculated, and is based on previously analyzed cohorts. Additionally, risk estimation may be incorrect if inaccurate personal or family history is provided. An elevated risk for hereditary cardiovascular disorders is not a diagnosis and does not guarantee that a person will develop the disease.

Contact us free of charge at (844) 352-6567 with any questions.

1 Eckel RH, Jakicic JM, Ard JD, et al. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation. 2014;129(25 Suppl 2):S76-99.*