STROKE GENME

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Welcome

NGUYEN VAN A

Your Hereditary Stroke Screening Report

Date of birth: 27 Apr 1994 Date reported: 27 Jul 2023 Sample number: STROKE_GENME

Referring practitioner: Private

StrokeGENME is designed to help you know the risk of stroke and how to prevent it based on your genetic profile.

The science behind StrokeGENME

Genetics and personalised medicine

Genes are segments of DNA that contain the instructions your body needs to make each of the many thousands of proteins required for life. Each gene is comprised of thousands of combinations of "letters" (called bases) which make up your genetic code. The code gives the instructions to make the proteins required for proper development and function.

Genetic variations can affect the expression of a gene, thereby affecting metabolic processes that are important for maintaining a state of health. Knowledge of these variations offers a powerful advantage, enabling personalised nutritional, lifestyle, and exercise recommendations aimed at optimising health, weight management and performance.

NORMAL GENE
Genotype for baseline performance potential

VARIANT GENE
Genotype for increased performance potential

Testing Methods

Using Oragene og-600 saliva collection kit as transport medium, which can preserve DNA for years at ambient temperature.

DNA sample collection device and nucleic acid stabilization chemistries, are protected by issued & pending patents in numerous countries around the world.

From the collected saliva samples, DNA is extracted using the Chemagic PrimeTM Robot system. This fully automated process utilizes the chemagen M-PVA Magnetic Bead technology for DNA and RNA purification along with liquid handling for high-throughput isolation of ultrapure nucleic acids.

This process is monitored according to the ISO/IEC 17025 Quality Control standards. The extracted DNA is then enriched for target regions using a hybridization-based approach and decoded by the proprietary Genetica® V3 genetic decoding chip. The Genetica® V3 genetic decoding chip includes 800,000 single nucleotide polymorphisms (SNPs), insertions or deletions (Indels), and copy number variants (CNVs).

Genetica employs proprietary artificial intelligence tools to extract SNPs, Indels, and CNVs from over 435,000 published scientific articles. The artificial intelligence tool classifies the variants/mutations based on their significance and extracts the most relevant 800,000 variants/mutations for individuals of Asian descent. All disease-causing and potentially disease-causing variants are determined using the Clinvar and ACMG databases.

Genetica's workflow utilizes the Thermo Fisher GeneTitan and Illumina Hiseq 2000 platforms (600 GB per run). All samples are processed in the RUCDR Infinite Biologics Clinical Genomics laboratory, which is CLIA certified and accredited by CAP (CLIA Number: 31D2077913, CAP Number: 8981166).

Disclaimer

The purpose of this test is provide information about how a tested individual's genes may affect carrier status for some inherited diseases, responses to some drugs, risk for specific common health conditions, and/or selected diet, nutrition and/or exercise responses, depending upon the specific genetic testing that is ordered. Tested individuals should not make any changes to any medical care (including but not limited to changes to dosage or frequency of medications, diet and exercise regimes, or pregnancy planning) based on genetic testing results without consulting a health care professional.

This test does not take into account large genomic abnormalities, chromosomal aneuploidy or complex rearrangements such as translocations.
In addition, there might be rare genetic variations being tested that could not be detected by current technologies. Genetics research is also not at all comprehensive. Only a fraction of DNA variations are known to be related to health and wellness traits. Take cancer as an example, there may be genes related to cancer that clinical relevance has yet to be established with certainty. As a result, the test may not detect all variants associated with the disease being examined.
Neither carrying a harmful mutation or negative genetic results will guarantee that a person might not develop the disease in the future.

The test might not report variants of uncertain significance (VUS). VUS is a genetic variant in which the association with disease risk is not clear. A variant may be classified as VUS at the time of testing and could be benign or disease-causing in the future.

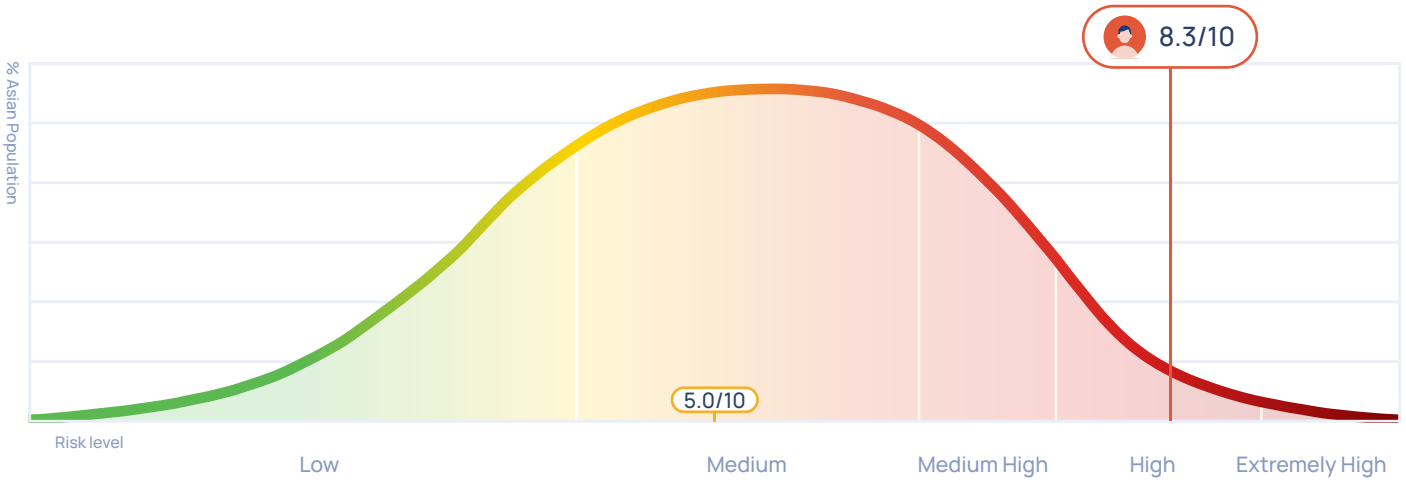
The science behind the significance or interpretation of certain testing results continues to evolve. Although great strides have been made to advance the potential usefulness of genetic testing, there is still much to be discovered. Genetic testing is based upon information, developments and testing technique that are known today. Future research may reveal changes in the interpretation of previously obtained genetic testing results. For example, any genetic test is limited by the variants being tested. The interpretation of the significance of some variants may change as more research is done about them. Some variants that are associated with disease, drug response, or diet, nutrition and exercise response may not be tested; possibly these variants have not yet been identified in genetic studies.

Many of the health conditions that are tested are dependent on genetic factors as well as non-genetic factors such as age, personal health and family health history, diet, and ethnicity. As such, an individual may not exhibit the specific drug response, disease, or diet, nutrition and exercise response consistent with the genetic results. Based on test results and other medical knowledge of the test individual, health care professionals might consider additional independent testing, or consult another health care professional or genetic counsellor.

Contents

G-Stroke Report

Your polygenic risk score is 8.3 | Group: High Risk



Risk Estimate

4.98 times

Your genetic risk of stroke is 4.98 times higher compared to the average Asian population (*)

Clinical Summary

- There is a higher risk of both ischemic stroke and hemorrhagic stroke
- Impacts on the other cardiovascular issues such as coronary heart disease, myocardial infarction, and atrial fibrillation
- Increased risk of stroke associated with diabetes is regulated by the CDKAL1 gene

Recommendation

Should do

- ✓ Diet: Increase potassium intake by eating plenty of fruits and vegetables.
- ✓ Exercise: Dedicate 30-60 minutes to moderate or high-intensity physical activity every day.
- ✓ Consult with a specialist doctor to regularly monitor other stroke risk factors.

Should avoid

- ✗ Activities that pose a risk of head injury, such as combat sports.
- ✗ A diet high in salt and saturated fats.

Gene analyzed

73 genes analyzed (**)

ABCC6, ABCC8, ABL1, ACTA2, ADA2, APOB, APP, ATP7B, CACNA1A, CBS, CDKAL1, CDKN2B, COL3A1, COL4A1, COQ2, COQ4, COQ8A, COQ9, DARS2, ERLIN1, FBN1, FBXL4, FLNA, GATA4, GCK, GFER, GFM2, GLA, HNF1A, HTRA1, JAG1, KDR, LDLR, LIPA, LMNA, LOX, MCEE, MMAA, MMUT, MYH11, MYH7, NDUFA6, NDUFS2, NIPBL, NOTCH3, OPA1, OXA1L, PAX4, PCSK9, PDSS2, PDX1, PIK3CA, PMM2, POLG, PRKAR1A, PRKCH, RET, RMND1, RPS6KA3, RRM2B, SATB2, SLC25A4, SLC2A10, SMAD3, SMAD4, SOX17, SPG7, SUOX, TGFBR1, TWNK, WFS1, WRN, YARS2

List of genes related to the risk on the next page ›

Your gene variants that affect stroke risk

0 (***)	13	0	0
Pathogenic Variants	Harmful Variants	Protective Variants	VUS (Variant of Uncertain Significant)

13 harmful variants

Gene	Value	Level impact	Output
CDKN2B-AS1	AG NC_000009.12:g.22115960		Susceptible to coronary heart disease, might lead to increased risk of ischemic stroke
CDKN2A	AG NC_000009.12:g.22124478		Susceptible to loss of neurologic function in a part of the brain, linked to cell aging gene mutation
CDKN2B-AS1	TC NC_000010.11:g.22083405		Increased myocardial infarction risk, possibly caused by "bubble-shaped" blood vessels in the brain
CDKN2B-AS1	AG NC_000009.12:g.22096056		Susceptible to early myocardial infarction (heart attack) that may also be associated to ischemic stroke
EDNRA	AC NC_000004.12:g.147479667		Associated with intracranial aneurysm (IA), which could further progress to subarachnoid hemorrhage
ERLIN1	TG NC_000010.11:g.100186688		At higher risk for a burst blood vessel in the brain given a harmful cholesterol gene mutation in the ERLIN1 gene
CDKAL1	TC NC_000009.12:g.22134		Higher chance of getting diabetes-related stroke, linked to pancreatic cell health gene
PCSK9	TT NC_000006.12:g.44626422		Higher risk for large artery atherosclerosis, a major ischemic stroke subtype
CDKAL1	AG NC_000006.12:g.20679478		Susceptible to diabetes-related stroke, linked to a harmful mutation in an insulin secretion gene
LMNA	TT NC_000004.12:g.11078		Susceptible to atrial fibrillation (irregular and often rapid heart rate), raising the risk of stroke
ADAMTS2	AA NC_000005.10:g.179236407		Susceptible to visual disturbances, linked a collagen gene defect
VEGF	TC NC_000004.12:g.55113		Higher risk of "burst" blood vessels, linked to a harmful blood vessel regulation gene mutation
BOLL	GG NC_000002.12:g.197766990		Elevated risk of blurred vision due to a harmful mutation linked to brain aneurysms

Scientific Details

Variant Classification

Pathogenic Variant	Harmful Variant	Protective Variant	Variant of Uncertain Significance (VUS)
A copy number or sequence variant that is known to cause disease or developmental differences.	A copy number or sequence variant that is known to increase risk of disease or developmental differences.	A copy number or sequence variant is associated with reduced risk of developing a disease or delays onset.	A copy number or sequence variant that does not have enough evidence to say it's the causes disease or developmental differences. Additional information can help inform uncertain results over time.

Associated Variants

Gene	Value	Interpretation	References
CDKN2B-AS1	AG NC_000009.12:g.22115960	The CDKN2B-AS1 gene is located within the CDKN2B-CDKN2A gene cluster at chromosome 9p21. The gene product is a functional RNA molecule that interacts with polycomb repressive complex-1 (PRC1) and -2 (PRC2), leading to epigenetic silencing of other genes in this cluster. The significant genetic susceptibility locus is shown that ischemic stroke shares pathophysiological determinants with coronary heart disease.	(1) J Gustav Smith et al
CDKN2A	AG NC_000009.12:g.22124478	The CDKN2A gene provides instructions for making several proteins. The most well-studied are the p16(INK4A) and the p14(ARF) proteins. Both proteins are also involved in stopping cell division in older cells (senescence). Therefore, the CDKN2A gene is presumed to affect the way your cells age and regenerate. You carry a genetic mutation is linked to a higher risk of ischemic stroke and a higher risk of having a brain aneurysm—which could result in hemorrhagic stroke.	(2) Anna Helgadottir et al
CDKN2B-AS1	TC NC_000010.11:g.22083405	The CDKN2B-AS1 gene plays a part in the way your blood vessels age. With age, your blood vessels may weaken. When this happens, they may take on a bubble-like shape in some spots. A bulging area of a blood vessel is called an aneurysm. An aneurysm in the brain is called an intracranial aneurysm. You have a mutation in the CDKN2B-AS1 gene that is associated with a higher risk of developing “bubble-shaped” blood vessels in the brain.	(3) Hirokuni Hashikata et al
CDKN2B-AS1	AG NC_000009.12:g.22096056	Scientific research posits that the CDKN2B-AS1 gene may affect the formation of plaque (fatty buildup) in your arteries. Plaque is a key component of a disorder called atherosclerosis, which raises a person’s risk of heart attack and stroke. Your version of this gene contains a significant mutation that is associated with a higher risk of heart attack (early in life) and ischemic stroke.	(1) J Gustav Smith et al

Scientific Details

Gene	Value	Interpretation	References
EDNRA	AC NC_000004.12:g.147479667	The EDNRA gene encodes the receptor for endothelin-1, a peptide that plays a role in potent and long-lasting vasoconstriction. EDNRA is located predominantly on vascular smooth muscle cells of the cerebrovascular system and mediates vasoconstriction and proliferation. You have a mutation near this gene that's associated with a greater risk of developing intracranial aneurysms, and subarachnoid hemorrhage. Common symtoms include stiff neck, and severe headaches. Asian individuals, particularly those in Japan, who carry this mutation are at significant risk of a subarachnoid hemorrhage when compared to the rest of the world.	(4) Siew-Kee Low et al
ERLIN1	TG NC_000010.11:g.100186688	The ERLIN1 gene encodes the protein that mediates degradation of inositol 1,4,5-trisphosphate receptors in the endoplasmic reticulum. The encoded protein also binds cholesterol and regulates the SREBP signaling pathway, which promotes cellular cholesterol homeostasis. Defects in this gene have been associated with hemorrhagic stroke.	(5) Tetsuro Yoshida et al
CDKAL1	TC NC_000009.12:g.22134	The CDKAL1 shows a nominal association with type 2 diabetes in Japanese & Han Chinese population. Because type 2 diabetes in Asians is characterized primarily by cell dysfunction, the CDKAL1 gene might well be involved in transduction of glucose toxicity or regenerative capacity of pancreatic cells and, thus, is possible susceptibility gene for type 2 diabetes. The effects of high blood sugar damage a person's blood vessels and raise the chances of having a stroke.	(6) Yukio Horikawa et al
PCSK9	TT NC_000006.12:g.44626422	The PCSK9 gene provides instructions for making a PCSK9 protein, which controls the number of low-density lipoprotein (LDL) receptors. The PCSK9 protein breaks down LDL receptors before they reach the cell surface, so more cholesterol can remain in the bloodstream. You carry a genetic mutation that is linked to a higher risk of large artery atherosclerotic (LAA) stroke in which plaque builds up inside your arteries. Plaque is made up of fat, cholesterol, calcium, and other substances found in the blood. Over time, plaque hardens and narrows your arteries. Large artery atherosclerotic accounts for about 15% of all ischemic strokes.	(7) Elizabeth G Holliday et al
CDKAL1	AG NC_000006.12:g.20679478	Recent research studies suggest that the CDKAL1 gene affects the secretion of insulin. Insulin is a hormone that regulates your blood sugar and high blood sugar is a hallmark sign of diabetes. Diabetes is a well-established risk factor for stroke. We have detected a mutation in your CDKAL1 gene. This mutation is associated with a higher risk of having or developing type 2 diabetes and its consequences, such as stroke.	(6) Yukio Horikawa et al

Scientific Details

Gene	Value	Interpretation	References
LMNA	TT NC_000004.12:g.11078	The LMNA gene provides instructions for making several slightly different proteins called lamins. The two major proteins produced from this gene, lamin A and lamin C, which provide stability and strength to cells. Lamins A and C are supporting (scaffolding) components of the nuclear envelope. Lamins A and C are also found inside the nucleus, and researchers believe the proteins may play a role in regulating the activity (expression) of certain genes. You carry a genetic mutation in LMNA gene that raises your risk of AF and ischemic stroke.	(8) Solveig Gretarsdottir et al
ADAMTS2	AA NC_000005.10:g.179236407	The ADAMTS2 gene provides instructions for making an enzyme that processes several types of procollagen molecules. The ADAMTS2 enzyme cuts a short chain of protein building blocks (amino acids) off one end of procollagens. This clipping step is necessary for the resulting collagen. Collagen is a protein molecule that adds strength, support, and a bit of elasticity (“stretchiness”) to many of the tissues in your body, including the arteries. All sorts of dysfunctions in the arteries, from high blood pressure to fatty plaque formation to the ballooning of arterial walls can contribute to the risk of stroke.	(9) Astrid Arning et al
VEGF	TC NC_000004.12:g.55113	Vascular endothelial growth factor (VEGF) is a major growth factor for endothelial cells. This gene encodes one of the two receptors of the VEGF. This receptor, known as kinase insert domain receptor, is a type III receptor tyrosine kinase. It functions as the main mediator of VEGF-induced endothelial proliferation, survival, migration, tubular morphogenesis and sprouting. The VEGF gene may regulate the formation of our blood vessels as well as their overall health. You have a mutation in this gene that is associated with a higher risk of hemorrhagic stroke. A hemorrhagic stroke is when a blood vessel in the brain “pops” or bursts open	(10) Wei-Li Zhang et al
BOLL	GG NC_000002.12:g.197766990	The BOLL gene is involved in the development of reproductive cells. Our analysis shows that you carry a harmful mutation in this gene, which is associated with an increased risk of intracranial aneurysms. An intracranial aneurysm is a weakened part of an artery in the brain that forms a balloon-like bulge. The aneurysm may break open or burst, consequently bleeding into the brain. A burst aneurysm can result in a life-threatening hemorrhagic stroke, or double vision.	(11) Kaya Bilguvar et al

Non-genetic factors for stroke

High blood pressure

A major cause of stroke, occurs when blood pressure is too high. Regular check-ups, lifestyle changes, or medication can reduce stroke risk.

Diabetes

Raises stroke risk by hindering oxygen and nutrient delivery due to blood sugar buildup. Commonly accompanied by high blood pressure, a leading cause of stroke.

Obesity

Excess body fat linked to higher "bad" cholesterol, lower "good" cholesterol, high blood pressure, and diabetes, increasing stroke risk.

Excercise

Insufficient physical activity raises stroke risk by contributing to obesity, high blood pressure, high cholesterol, and diabetes. Regular exercise lowers stroke chances.

High cholesterol levels

Excess cholesterol from food or liver buildup can clog arteries, including in the brain, increasing stroke risk. Blood tests detect high cholesterol and triglyceride levels.

Atrial Fibrillation

Heart disorders like coronary artery disease block oxygen-rich blood flow to the brain, increasing stroke risk. Other heart conditions can cause blood clots leading to stroke.

Smoking

Damages heart and blood vessels, raises blood pressure, reduces blood's oxygen-carrying capacity. Secondhand smoke exposure also raises stroke risk.

Reference

Self-evaluation tool used to assess the likelihood of developing a stroke based on non-genetic factors

Stroke Risk Score Card

Check each box that applies to you. Each check equals 1 point. Total your points at the bottom of each column and compare your results to the answer key.

Risk Factor	High Risk	Caution	Low Risk
Blood Pressure	☐ > 140/90mmHg or don't know	☐ 120-139/80-89mmHg	☐ <120/80mmHg
Cholesterol	☐ >240 mg/dL (>6.18 mmol/L) or don't know	☐ 200–240 mg/dL (5.18–6.18 mmol/L)	☐ < 200 mg/dL (<5.18 mmol/L)
Diabetes	☐ Yes	☐ Borderline	☐ No
Smoking	☐ Smoker	☐ Trying to quit	☐ Non-smoker
Atrial Fibrillation	☐ Irregular Heartbeat	☐ I don't know	☐ Normal Heartbeat
Diet	☐ Overweight	☐ Slightly Overweight	☐ Healthy Weight
Exercise	☐ Rarely Exercise	☐ Sometimes Exercises	☐ Exercise Regularly
History of Stroke in your family	☐ Yes	☐ Not Sure	☐ No
ADD UP YOUR SCORE	☐ HIGH RISK	☐ CAUTION	☐ LOW RISK

Information Source:

NATIONAL STROKE ASSOCIATION®

- If your RED score is 3 or more, please ask your doctor about stroke prevention right away
- If your YELLOW score is 4 to 6, keep you are off to a good start. Keep working on it.
- If your GREEN score is 6 to 8, congratulations! You are doing very well at controlling risk for stroke.

Information about Stroke

What is a stroke

According to the World Health Organization, stroke is one of the leading causes of death and disability worldwide. In the United States alone, over 795,000 people suffer from a stroke each year.

Generally, a stroke occurs when blood supply to the brain is blocked or interrupted, depriving the brain of oxygen. The brain needs oxygen to function, and without it, brain cells can die within minutes. Stroke can also occur when there is sudden bleeding in the brain due to a ruptured blood vessel, causing damage to the surrounding brain tissues.

Individuals who have experienced a stroke can suffer permanent brain damage, disabilities, or even death.

Stroke is a medical emergency that requires prompt treatment.

Signs of stroke

It is important to recognize the most common symptoms of a stroke. Remember B.E. F.A.S.T:

B = Balance: Sudden loss of balance, coordination or footing
E = Eyesight: Sudden loss of vision in one or both eyes? Or double vision?
F = Face drooping. Is one side of the face drooping when smiling?
A = Arm weakness. Is one arm weak or numb when raising both arms?
S = Speech difficulty. Is speech slurred or hard to understand?
T = Time to call emergency services immediately if you experience any of the above symptoms

Other symptoms of stroke include:

Sudden severe headache.
Numbness, particularly on one side of the face, arm, or leg.
Confusion or difficulty understanding what others are saying.

Types of stroke

There are two main types of stroke:

Ischemic stroke: Ischemic stroke is typically caused by a combination of plaque (fatty deposits) and/or blood clots that block the blood vessels, leading to reduced blood flow to the brain. These cases account for about 80% of all strokes.

Hemorrhagic stroke: Hemorrhagic stroke occurs when a blood vessel ruptures and bleeds into the brain. These cases are less common, accounting for about 20% of all strokes.

Genetics and the impact on stroke

Studies have identified specific genes that are associated with an increased risk of stroke. These genes may play a role in the development of the disease or be risk factors that contribute to stroke.

Risk factors may include diabetes, high blood pressure, abnormal heart rhythms, and more. Understanding the impact and role of specific genes in increasing the risk of stroke can be crucial.

For example, if you carry a gene that predisposes you to high blood pressure, being aware of this can help you make appropriate lifestyle changes to reduce the risk of stroke.

References

1. J Gustav Smith et al. Common genetic variants on chromosome 9p21 confers risk of ischemic stroke: a large-scale genetic association study. Available at: https://pubmed.ncbi.nlm.nih.gov/20031580/

2. Anna Helgadottir et al. The same sequence variant on 9p21 associates with myocardial infarction, abdominal aortic aneurysm and intracranial aneurysm. Available at: https://pubmed.ncbi.nlm.nih.gov/18176561/

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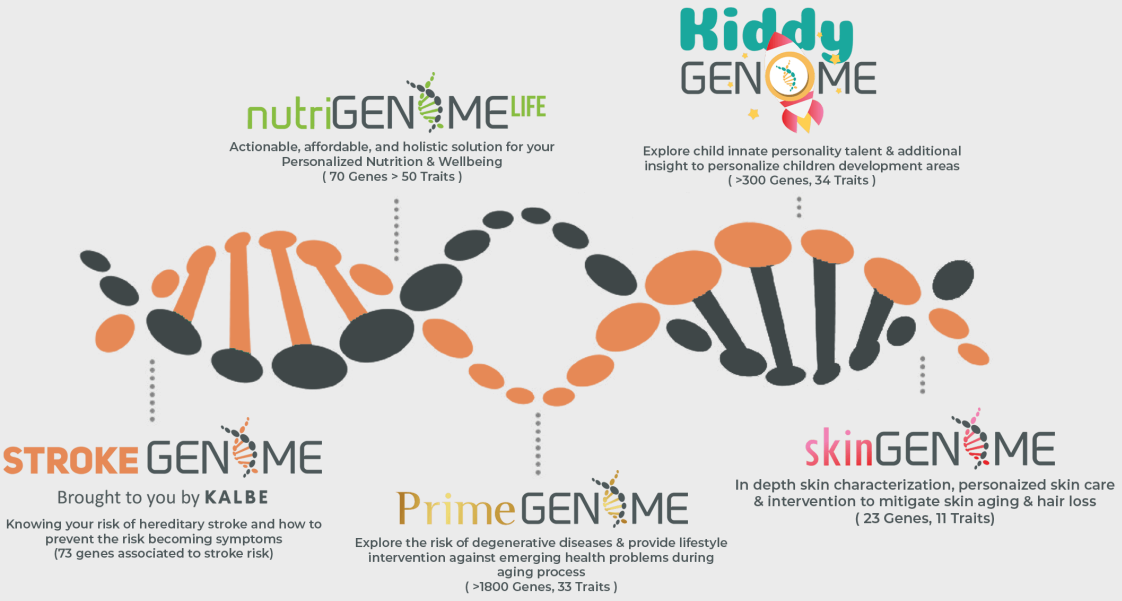
10. Wei-Li Zhang et al. Association of variants in the vascular endothelial growth factor receptor 2 gene and the risk of hemorrhagic stroke. Available at: https://pubmed.ncbi.nlm.nih.gov/19953880/

11. Kaya Bilguvar et al. Susceptibility loci for intracranial aneurysm in European and Japanese populations. Available at: https://pubmed.ncbi.nlm.nih.gov/18997786/

a GENEius Way to know your risk of stroke

Everyone is unique. Knowing your genomic profile unlocks insight about the predisposition of hereditary stroke risks, including the causes, the genes that associated the most with the risk, providing recommendations to help you prevent the risk becoming disease. Discover your holistic & personalized health journey through a GENEius way, **BE** the best version of ME with GENME, **NOW.**



JOURNEY TO A BETTER ME

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