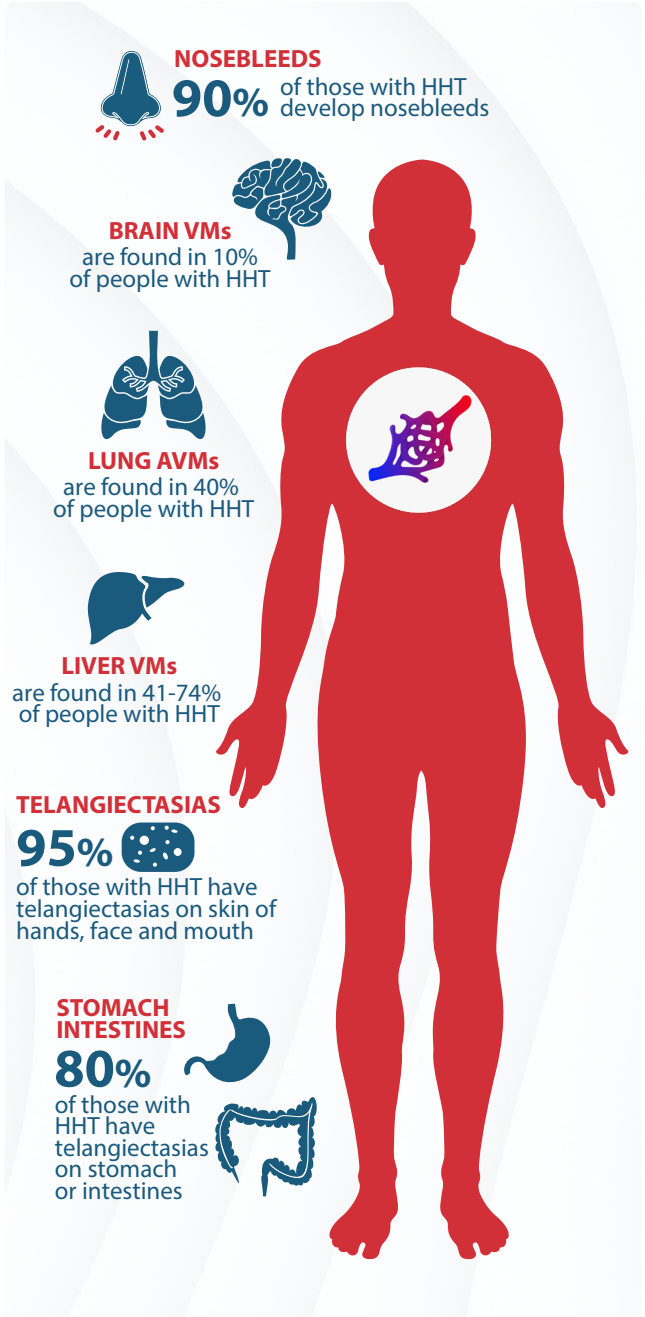
CAUSES & SYMPTOMS OF HHT

HHT is caused by alterations in genes that help maintain normal blood vessel formation. These alterations lead to blood vessel abnormalities in the lungs, brain, liver, gastrointestinal (GI) tract, skin and nose.



ADDITIONAL RESOURCES

www.CureHHT.org

Cure HHT Resource Library
www.curehht.org/patient-topics

Genetics of HHT
www.curehht.org/genetics

Nosebleed Severity Scoring Tool (ESS)
www.hhtess.com

Glossary of Terms
www.curehht.org/glossary

Curacao Criteria
www.curehht.org/diagnostic-criteria

HHT Centers of Excellence
www.curehht.org/hht-treatment-center

International HHT Clinical Guidelines
www.hhtguidelines.org

Rare Genomes Project *(free testing)*
www.raregenomes.org

cure hht

CONNECT WITH US

www.curehht.org | hhtinfo@curehht.org
P.O. Box 329, Monkton, MD 21111
Non-Profit Tax I.D. Number: 223115041

Suffer from nosebleeds?

HEREDITARY HEMORRHAGIC TELANGIECTASIA (HHT)

Osler-Weber-Rendu Syndrome

The Role of Genetics in HHT

HEREDITARY HEMORRHAGIC TELANGIECTASIA (HHT)

Hereditary Hemorrhagic Telangiectasia is a hereditary bleeding disorder characterized by abnormal blood vessel formation resulting in **telangiectasia** and **arteriovenous malformations (AVMs)**. These alterations lead to blood vessel abnormalities in the lung, brain, liver, gastrointestinal (GI) tract, uterus, skin, and nose.

GENETICS OF HHT

HHT is caused by a pathogenic variant in one of several HHT-associated genes. HHT follows an *autosomal dominant* inheritance pattern. Approximately 90% of HHT cases are caused by alterations in the **ENG (HHT1)** or **ACVRL1 / ALK1 (HHT2)** gene.

Alterations in a third gene, **SMAD4**, can lead to a condition called **Juvenile Polyposis HHT Syndrome (JP-HHT)**. Individuals with this condition have HHT symptoms as well as specific GI polyps called juvenile polyps, and are at an increased risk for stomach and intestinal cancer. Other cases of HHT can arise from variants in genes **GDF2**, **RASA1** and **EPHB4**. In some cases, the variant is called an unknown significance which means it is not known to cause HHT but does need to be investigated further.

A parent has a 50% chance of passing HHT to their child. You only need one HHT-causing DNA to develop HHT. The HHT Clinical Guidelines emphasize the risk of missing diagnoses in children and young adults who may be asymptomatic; clinical and genetic screening are required to rule out an HHT diagnosis.

Why should patients get genetic testing?

HHT can be clinically diagnosed according to the established **Curaçao Criteria**, however, often times, clinical criteria alone are not enough to definitively diagnose HHT patients. *Genetic testing can:*

Identify at-risk family members

Determine the presence or absence of a familial variant to identify at-risk family members, especially asymptomatic children. HHT does not skip a generation.

Improve medical management

Some HHT symptoms are more common with variants in certain genes. Variants in the SMAD4 gene are associated with conditions other than HHT and require additional, non-HHT screening.

Improve drug therapy outcomes

Advances in precision medicine could mean that knowing your HHT-causing gene affects medicine and treatment recommendations.

Assist in family planning decisions

Options to reduce HHT risk in future children are also available to those who have a known HHT variant.

Confirm an HHT diagnosis

This may lead to earlier screening, provide additional screening needed (SMAD4), improved treatment, changes in insurance plans, school and work accommodations, and increased awareness for the family.

Rule out an HHT diagnosis*

This may alleviate concern and prevent unnecessary medical screenings and financial strain.

**Genetic testing can be done using blood, saliva, cheek swabs, or prenatal samples. For patients with variants of unknown significance, further clinical testing is required. HHT can only be ruled out by genetic testing if a family's HHT-causing variant is known.*

How do I arrange for a genetic test?

Genetic testing is typically ordered by a genetic counselor, medical geneticist or a health professional with specific expertise regarding HHT, hereditary conditions, and/or genetic testing.

These specialists will know the most appropriate test to order, and which lab to use based on insurance and other factors. Most HHT Centers of Excellence and major medical centers have genetic counselors.

- **Visit an HHT Center of Excellence.**
- **Ask your primary care provider.**
- **Find a genetic counselor near you** https://findageneticcounselor.nsgc.org
- **Look for an online tele-genetics service** www.genomemedical.com/individuals
- **Sign up for the Rare Genomes Project research study for free testing** www.curehht.org/rare-genomes-project

Statistics

- An estimated 1 in 5,000 people have HHT.
- Men, women, and children of all ethnicities are equally affected.
- 9 out of 10 people with HHT are undiagnosed.
- 20% of undiagnosed patients experience sudden disability or death.
- Brain and lung malformations can be life threatening at any age.
- When diagnosed and treated, HHT patients have a normal life expectancy.