



[cancer.org](https://www.cancer.org) | 1.800.227.2345

Thyroid Cancer Causes, Risk Factors, and Prevention

Risk Factors

A risk factor is anything that affects your chance of getting a disease such as cancer. Learn more about the risk factors for thyroid cancer.

- [Thyroid Cancer Risk Factors](#)
- [What Causes Thyroid Cancer?](#)

Prevention

Most people with thyroid cancer have no known risk factors, so it is not possible to prevent most cases of this disease. Learn more here.

- [Can Thyroid Cancer Be Prevented?](#)

Thyroid Cancer Risk Factors

A risk factor is anything that increases a person's chance of getting a disease such as cancer. Different cancers have different risk factors. Some risk factors, like smoking, can be changed. Others, like a person's age or family history, can't be changed.

But risk factors don't tell us everything. Having a risk factor, or even several risk factors,

does not mean that you will get the disease. And many people who get the disease may have few or no known risk factors. Even if a person with thyroid cancer has a risk factor, it is very hard to know how much that risk factor may have contributed to the cancer.

Scientists have found a few risk factors that make a person more likely to develop thyroid cancer.

Risk factors that can't be changed

Gender and age

For unclear reasons thyroid cancers (like almost all diseases of the thyroid) occur about 3 times more often in women than in men.

Thyroid cancer can occur at any age, but the risk peaks earlier for women (who are most often in their 40s or 50s when diagnosed) than for men (who are usually in their 60s or 70s).

Hereditary conditions

Several inherited conditions have been linked to different types of thyroid cancer, as has family history. Still, most people who develop thyroid cancer do not have an inherited condition or a family history of the disease.

Medullary thyroid cancer: About 2 out of 10 medullary thyroid carcinomas (MTCs) result from inheriting an abnormal gene. These cases are known as familial medullary thyroid carcinoma (FMTC). FMTC can occur alone, or it can be seen along with other tumors.

The combination of FMTC and tumors of other endocrine glands is called *multiple endocrine neoplasia type 2* (MEN 2). There are 2 subtypes, MEN 2a and MEN 2b, both of which are caused by mutations (defects) in a gene called *RET*.

- In MEN 2a, MTC occurs along with pheochromocytomas (tumors that make adrenaline) and with parathyroid gland tumors.
- In MEN 2b, MTC is associated with pheochromocytomas and with benign growths of nerve tissue on the tongue and elsewhere called *neuromas*. This subtype is much less common than MEN 2a.

In these inherited forms of MTC, the cancers often develop during childhood or early

adulthood and can spread early. MTC is most aggressive in the MEN 2b syndrome. If MEN 2a, MEN 2b, or isolated FMTC runs in your family, you may be at very high risk of developing MTC. Ask your doctor about having regular blood tests or ultrasound exams to look for problems and the possibility of genetic testing.

Other thyroid cancers: People with certain inherited medical conditions have a higher risk of more common forms of thyroid cancer. Higher rates of thyroid cancer occur among people with uncommon genetic conditions such as:

Familial adenomatous polyposis (FAP): People with this syndrome develop many colon polyps and have a very high risk of [colon cancer](#)¹. They also have an increased risk of some other cancers, including papillary thyroid cancer. *Gardner syndrome* is a subtype of FAP in which patients also get certain benign tumors. Both Gardner syndrome and FAP are caused by defects in the gene *APC*.

Cowden disease: People with this syndrome have an increased risk of thyroid problems and certain benign growths (including some called hamartomas). They also have an increased risk of cancers of the thyroid, [uterus](#)², [breast](#)³, as well as some others. The thyroid cancers tend to be either the papillary or follicular type. This syndrome is most often caused by defects in the gene *PTEN*. It is also known as Multiple Hamartoma Syndrome and PTEN Hamartoma Tumor Syndrome

Carney complex, type I: People with this syndrome may develop a number of benign tumors and hormone problems. They also have an increased risk of papillary and follicular thyroid cancers. This syndrome is caused by defects in the gene *PRKAR1A*.

Familial nonmedullary thyroid carcinoma: Thyroid cancer occurs more often in some families, and is often seen at an earlier age. The papillary type of thyroid cancer most often runs in families. Genes on chromosome 19 and chromosome 1 are suspected of causing these familial cancers.

If you suspect you might have a familial condition, talk with your doctor, who might recommend genetic counseling if your medical history warrants it.

Family history

Having a first-degree relative (parent, brother, sister, or child) with thyroid cancer, even without a known inherited syndrome in the family, increases your risk of thyroid cancer. The genetic basis for these cancers is not totally clear.

Risk factors that may be changed

Iodine in the diet

Follicular thyroid cancers are more common in areas of the world where people's diets are low in iodine. On the other hand, a diet high in iodine may increase the risk of papillary thyroid cancer. In the United States, most people get enough iodine in their diet because it is added to table salt and other foods.

Radiation

Radiation exposure is a proven risk factor for thyroid cancer. Sources of such radiation include certain medical treatments and radiation fallout from power plant accidents or nuclear weapons.

Having had [head or neck radiation treatments in childhood](#)⁴ is a risk factor for thyroid cancer. Risk depends on how much radiation is given and the age of the child. In general, the risk increases with larger doses and with younger age at treatment.

Before the 1960s, children were sometimes treated with low doses of radiation for things we wouldn't use radiation for now, like acne, fungus infections of the scalp (ringworm), or enlarged tonsils or adenoids. Years later, the people who had these treatments were found to have a higher risk of thyroid cancer. Radiation therapy in childhood for some cancers such as [lymphoma](#)⁵, [Wilms tumor](#)⁶, and [neuroblastoma](#)⁷ also increases risk. Thyroid cancers that develop after radiation therapy are not more serious than other thyroid cancers.

[Imaging tests](#)⁸ such as x-rays and CT scans also expose children to radiation, but at much lower doses, so it's not clear how much those tests might raise the risk of thyroid cancer (or other cancers). If there is an increased risk it is likely to be small, but to be safe, children should not have these tests unless they are absolutely needed. When they are needed, they should be done using the lowest dose of radiation that still provides a clear picture.

Several studies have pointed to an increased risk of thyroid cancer in children because of radioactive fallout from nuclear weapons or power plant accidents. For instance, thyroid cancer was many times more common than normal in children who lived near Chernobyl, the site of a 1986 nuclear plant accident that exposed millions of people to radioactivity. Adults involved with the cleanup after the accident and those who lived near the plant have also had higher rates of thyroid cancer. Children who had more iodine in their diet appeared to have a lower risk.

Some radioactive fallout occurred over certain regions of the United States after nuclear weapons were tested in western states during the 1950s. This exposure was much,

much lower than that around Chernobyl. A higher risk of thyroid cancer has not been proven at these low exposure levels. If you are concerned about possible exposure to radioactive fallout, discuss this with your doctor.

Being exposed to radiation when you are an adult carries much less risk of thyroid cancer.

Hyperlinks

1. www.cancer.org/cancer/colon-rectal-cancer.html
2. www.cancer.org/cancer/uterine-sarcoma.html
3. www.cancer.org/cancer/breast-cancer.html
4. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/second-cancers-in-adults.html
5. www.cancer.org/cancer/lymphoma.html
6. www.cancer.org/cancer/wilms-tumor.html
7. www.cancer.org/cancer/neuroblastoma.html
8. www.cancer.org/treatment/understanding-your-diagnosis/tests/imaging-radiology-tests-for-cancer.html

References

Davidge-Pitts CJ and Thompson GB. Chapter 82: Thyroid Tumors. In: DeVita VT, Lawrence TS, Rosenberg SA, eds. *DeVita, Hellman, and Rosenberg's Cancer: Principles and Practice of Oncology*. 10th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2015.

National Cancer Institute. Physician Data Query (PDQ). Thyroid Cancer Treatment. 02/06/2019. Accessed at https://www.cancer.gov/types/thyroid/hp/thyroid-treatment-pdq#_313_toc. on February 20, 2019.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology: Thyroid Carcinoma. V.3.2018. Accessed at https://www.nccn.org/professionals/physician_gls/pdf/thyroid.pdf on February 20, 2019.

Schneider DF, Mazeh H, Lubner SJ, Jaume JC, and Chen H. Chapter 71: Cancer of the Endocrine System. In: Niederhuber JE, Armitage JO, Dorshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 5th ed. Philadelphia, Pa. Elsevier: 2014.

See all references for Thyroid Cancer (www.cancer.org/cancer/thyroid-cancer/references.html)

Last Medical Review: March 14, 2019 Last Revised: March 14, 2019

What Causes Thyroid Cancer?

Thyroid cancer is linked with a number of inherited conditions (described in [Thyroid cancer risk factors](#)¹), but the exact cause of most thyroid cancers is not yet known.

Certain changes in a person's DNA can cause thyroid cells to become cancerous. DNA is the chemical in each of our cells that makes up our genes – the instructions for how our cells function. We usually look like our parents because they are the source of our DNA. But DNA affects more than just how we look. It also can influence our risk for developing certain diseases, including some kinds of cancer.

Some genes contain instructions for controlling when our cells grow and divide into new cells or when they die.

- Certain genes that help cells grow and divide or make them live longer than they should are called *oncogenes*.
- Genes that slow down cell division or make cells die at the right time are called *tumor suppressor genes*.

Cancers can be caused by DNA changes that turn on oncogenes or turn off tumor suppressor genes.

People get 2 copies of each gene – one from each parent. We can inherit damaged DNA from one or both parents. Most cancers, though, are not caused by inherited gene changes. In these cases, the genes change during a person's life. They may occur when a cell's DNA is damaged by something in the environment, like radiation, or they may just be random events that sometime happen inside a cell, without an outside cause.

Papillary thyroid cancer

Several DNA mutations (changes) have been found in papillary thyroid cancer. Many of these cancers have changes in specific parts of the *RET* gene. The altered form of this gene, known as the *PTC* oncogene, is found in about 10% to 30% of papillary thyroid cancers overall, and in a larger percentage of these cancers in children and/or linked with radiation exposure. These *RET* mutations usually are acquired during a person's lifetime rather than being inherited. They are found only in cancer cells and are not passed on to the person's children.

Many papillary thyroid cancers have a mutated *BRAF* gene. The *BRAF* mutation is less common in thyroid cancers in children and in cancers thought to develop because of exposure to radiation. Cancers with *BRAF* changes tend to grow and spread to other parts of the body more quickly.

Both *BRAF* and *RET/PTC* changes are thought to make cells grow and divide. It is extremely rare for papillary cancers to have changes in both the *BRAF* and *RET/PTC* genes. Some doctors now advise testing thyroid biopsy samples for these gene mutations, as they can help diagnose cancer and may also affect the patient's outlook (see [Tests for thyroid cancer²](#)).

Changes in other genes have also been linked to papillary thyroid cancer, including those in the *NTRK1* gene.

Follicular thyroid cancer

Acquired changes in the *RAS* oncogene as well as changes in the PAX8–PPAR-rearrangement have a role in causing some follicular thyroid cancers.

Anaplastic thyroid cancer

These cancers tend to have some of the mutations described above and often have changes in the *TP53* tumor suppressor gene.

Medullary thyroid cancer

People who have medullary thyroid cancer (MTC) have mutations in different parts of the *RET* gene than people with papillary carcinoma. Nearly all patients with the inherited form of MTC and about 1 of every 10 with the sporadic (non-inherited) form of MTC have a mutation in the *RET* gene. Most patients with sporadic MTC have gene mutations only in their cancer cells. People with familial MTC and MEN 2 inherit the *RET* mutation from a parent. These mutations are in every cell in the body and can be

detected by DNA tests.

Hyperlinks

1. www.cancer.org/cancer/thyroid-cancer/causes-risks-prevention/risk-factors.html
2. www.cancer.org/cancer/thyroid-cancer/detection-diagnosis-staging/how-diagnosed.html

References

Davidge-Pitts CJ and Thompson GB. Chapter 82: Thyroid Tumors. In: DeVita VT, Lawrence TS, Rosenberg SA, eds. *DeVita, Hellman, and Rosenberg's Cancer: Principles and Practice of Oncology*. 10th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2015.

Malchoff CD. Oncogenes and tumor suppressor genes in thyroid nodules and nonmedullary thyroid cancer. <https://www.uptodate.com/contents/oncogenes-and-tumor-suppressor-genes-in-thyroid-nodules-and-nonmedullary-thyroid-cancer>. UpToDate website. Updated Aug 9, 2017. Accessed February 20, 2019.

National Cancer Institute. Physician Data Query (PDQ). Thyroid Cancer Treatment. 02/06/2019. Accessed at https://www.cancer.gov/types/thyroid/hp/thyroid-treatment-pdq#_313_toc. on February 20, 2019.

Schneider DF, Mazeh H, Lubner SJ, Jaume JC, and Chen H. Chapter 71: Cancer of the Endocrine System. In: Niederhuber JE, Armitage JO, Dorshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 5th ed. Philadelphia, Pa. Elsevier: 2014.

See all references for Thyroid Cancer (www.cancer.org/cancer/thyroid-cancer/references.html)

Last Medical Review: March 14, 2019 Last Revised: March 14, 2019

Can Thyroid Cancer Be Prevented?

Most people with thyroid cancer have no known risk factors, so it is not possible to prevent most cases of this disease.

Radiation exposure, especially in childhood, is a known [thyroid cancer risk factor](#)¹. Because of this, doctors no longer use radiation to treat less serious diseases. Imaging tests such as x-rays and CT scans also expose children to radiation, but at much lower doses, so it's not clear how much they might raise the risk of thyroid cancer (or other cancers). If there is an increased risk it is likely to be small, but to be safe, children should not have these tests unless they are absolutely needed. When they are needed, they should be done using the lowest dose of radiation that still provides a clear picture.

[Genetic tests](#)² can be done to look for the gene mutations found in familial medullary thyroid cancer (MTC). Because of this, most of the familial cases of MTC can be prevented or treated early by removing the thyroid gland. Once the disease is discovered in a family, the rest of the family members can be tested for the mutated gene.

If you have a family history of MTC, it is important that you see a doctor who is familiar with the latest advances in genetic counseling and genetic testing for this disease. Removing the thyroid gland in children who carry the abnormal gene will probably prevent a cancer that might otherwise be fatal.

Hyperlinks

1. www.cancer.org/cancer/thyroid-cancer/causes-risks-prevention/risk-factors.html
2. www.cancer.org/cancer/cancer-causes/genetics.html

References

Davidge-Pitts CJ and Thompson GB. Chapter 82: Thyroid Tumors. In: DeVita VT, Lawrence TS, Rosenberg SA, eds. *DeVita, Hellman, and Rosenberg's Cancer: Principles and Practice of Oncology*. 10th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2015.

National Cancer Institute. Physician Data Query (PDQ). Thyroid Cancer Treatment. 02/06/2019. Accessed at https://www.cancer.gov/types/thyroid/hp/thyroid-treatment-pdq#_313_toc. on February 20, 2019.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology: Thyroid Carcinoma. V.3.2018. Accessed at

https://www.nccn.org/professionals/physician_gls/pdf/thyroid.pdf on February 20, 2019.

Schneider DF, Mazeh H, Lubner SJ, Jaume JC, and Chen H. Chapter 71: Cancer of the Endocrine System. In: Niederhuber JE, Armitage JO, Dorshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 5th ed. Philadelphia, Pa. Elsevier: 2014.

See all references for Thyroid Cancer (www.cancer.org/cancer/thyroid-cancer/references.html)

Last Medical Review: March 14, 2019 Last Revised: March 14, 2019

Written by

The American Cancer Society medical and editorial content team
(www.cancer.org/cancer/acs-medical-content-and-news-staff.html)

Our team is made up of doctors and oncology certified nurses with deep knowledge of cancer care as well as journalists, editors, and translators with extensive experience in medical writing.

American Cancer Society medical information is copyrighted material. For reprint requests, please see our Content Usage Policy (www.cancer.org/about-us/policies/content-usage.html).

cancer.org | 1.800.227.2345