
Kidney Cancer Causes, Risk Factors, and Prevention

Learn about the risk factors for kidney cancer and what you might be able to do to help lower your risk.

Risk Factors

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

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

Prevention

At this time there is no way to prevent kidney cancer. But there are things you can do that might lower your risk for it. Learn more.

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

Risk Factors for Kidney Cancer

- [Smoking](#)
- [Obesity](#)

- [High blood pressure](#)
- [Family history of kidney cancer](#)
- [Workplace exposures](#)
- [Sex](#)
- [Race](#)
- [Certain medicines](#)
- [Advanced kidney disease](#)
- [Genetic and hereditary risk factors](#)

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

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

Scientists have found several risk factors that could make you more likely to develop kidney cancer.

Smoking

[Smoking](#)¹ increases the risk of developing renal cell carcinoma (RCC), the most common type of kidney cancer. The increased risk seems to be related to how much you smoke. The risk drops if you stop smoking, but it takes many years to get to the risk level of someone who never smoked.

Obesity

People who are very [overweight](#)² have a higher risk of developing RCC. Obesity may cause changes in certain hormones that can lead to RCC.

High blood pressure

The risk of kidney cancer is higher in people with high blood pressure. This risk does not seem to be lowered even if someone is taking medicines to treat the high blood pressure.

Family history of kidney cancer

People with a strong family history of renal cell cancer (without one of the known inherited conditions listed below) have a higher chance of developing this cancer. This risk is highest for people who have a brother or sister with the cancer. It's not clear whether this is due to shared genes, something that both people were exposed to in the environment, or both.

Workplace exposures

Many studies have suggested that workplace exposure to certain substances, such as trichloroethylene, increases the risk for RCC.

Sex

RCC is about twice as common in men as in women. Men are more likely to smoke and are more likely to be exposed to cancer-causing chemicals at work, which may account for some of the difference.

Race

African Americans have a slightly higher rate of RCC than do White people. The reasons for this are not clear.

Certain medicines

Acetaminophen: Some studies have suggested that acetaminophen, a common pain medicine, may be linked to an increase in the risk of RCC.

Advanced kidney disease

People with advanced kidney disease, especially those needing dialysis, have a higher risk of RCC. (Dialysis is a treatment used to remove toxins from your body if your kidneys do not work properly.)

Genetic and hereditary risk factors

Some people inherit genes that can increase their chances of developing certain types

of cancer. The DNA in each of your cells that you get from your parents may have changes that give you this risk.

Some rare inherited conditions can increase a person's risk of kidney cancer. It is important that people who have hereditary conditions linked to RCC see their doctors often, especially if they have already been diagnosed with RCC. Some doctors might recommend regular imaging tests (such as CT scans) to look for new kidney tumors in these people.

Most of the conditions listed here result in a much higher risk for getting kidney cancer, although they account for only a small portion of kidney cancers overall.

von Hippel-Lindau disease

People with this condition often develop several kinds of tumors and cysts (fluid-filled sacs) in different parts of the body. They have an increased risk for developing clear cell RCC, especially at a younger age. They may also have benign tumors in their eyes, brain, spinal cord, pancreas, and other organs; and a type of adrenal gland tumor called **pheochromocytoma**. This condition is caused by mutations (changes) in the *VHL* gene.

Hereditary papillary renal cell carcinoma

People with this condition have a tendency to develop one or more papillary RCCs, but they do not have tumors in other parts of the body, as is the case with the other inherited conditions listed here. This disorder is usually linked to changes in the *MET* gene.

Hereditary leiomyoma-renal cell carcinoma

People with this syndrome develop smooth muscle tumors called **leiomyomas** (fibroids) of the skin and uterus (in women) and have a higher risk for developing papillary RCCs. It has been linked to changes in the *FH* gene.

Birt-Hogg-Dube (BHD) syndrome

People with this syndrome develop many small benign skin tumors and have an increased risk of different kinds of kidney tumors, including RCCs and oncocytomas. They may also have benign or malignant tumors of several other tissues. The gene linked to BHD is known as *FLCN*.

Familial renal cancer

People with this condition develop tumors called **paragangliomas** of the head and neck region and thyroid cancers. They also tend to get kidney cancer in both kidneys before age 40. It is caused by defects in the genes *SDHB* and *SDHD*.

Cowden syndrome

People with this syndrome have a high risk of [breast](#)³, [thyroid](#)⁴ and kidney cancers. It is linked to changes in the *PTEN* gene.

Tuberous sclerosis

People with this syndrome develop many, usually benign (noncancerous) tumors in different parts of the body including the skin, brain, lungs, eyes, kidneys, and heart. Although the kidney tumors are most often benign, occasionally they can be clear cell RCC. It is caused by defects in the genes *TSC1* and *TSC2*.

Sickle cell trait and disease

Some people inherit a change in a gene that codes for hemoglobin, the protein in red blood cells that helps them carry oxygen. People who inherit this gene change from one parent have sickle cell trait (SCT), but usually don't have obvious symptoms from it. People who inherit gene changes from both parents have sickle cell disease (SCD). People with either SCT or SCD have an increased risk of renal medullary carcinoma (RMC). This rare subtype of RCC most often occurs in younger people, tends to grow quickly, and can be hard to treat. The increased risk of RMC is thought to be caused by changes in the *SMARCB1* gene.

Hyperlinks

1. www.cancer.org/cancer/risk-prevention/tobacco.html
2. www.cancer.org/cancer/risk-prevention/diet-physical-activity/body-weight-and-cancer-risk.html
3. www.cancer.org/cancer/types/breast-cancer.html
4. www.cancer.org/cancer/types/thyroid-cancer.html

References

Choyke PL, Glenn GM, Walther MM, Zbar B, Linehan WM. Hereditary renal cancers. *Radiology*. 2003 Jan;226(1):33-46.

Clague J, Lin J, Cassidy A, et al. Family history and risk of renal cell carcinoma: Results from a case-control study and systematic meta-analysis. *Cancer Epidemiol Biomarkers Prev*. 2009;18:801-807.

Correa AF, Lane BR, Rini BI, Uzzo RG. Ch 66 - Cancer of the kidney. In: DeVita VT, Hellman S, Rosenberg SA, eds. *Cancer: Principles and Practice of Oncology*. 11th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2019.

Holland P, Merrimen J, Pringle C, Wood LA. Renal medullary carcinoma and its association with sickle cell trait: A case report and literature review. *Curr Oncol*. 2020 Feb;27(1):e53-e56. Epub 2020 Feb 1.

Howlader N, Noone AM, Krapcho M, Miller D, Brest A, Yu M, Ruhl J, Tatalovich Z, Mariotto A, Lewis DR, Chen HS, Feuer EJ, Cronin KA (eds). SEER Cancer Statistics Review, 1975-2016, National Cancer Institute. Bethesda, MD, https://seer.cancer.gov/csr/1975_2016/, based on November 2018 SEER data submission, posted to the SEER web site, April 2019.

Karami S, Daughtery SE, Schwartz K, Davis FG, Ruterbusch JJ, Wacholder S, et al. Analgesic use and risk of renal cell carcinoma: A case-control, cohort and meta-analytic assessment. *Int J Cancer*. 2016;139:584-92. doi: 10.1002/ijc.30108. Epub 2016 Apr 9.

Kushi LH, Doyle C, McCullough M, Rock CL, Demark-Wahnefried W, Bandera EV, Gapstur S, Patel AV, Andrews K, Gansler T; American Cancer Society 2010 Nutrition and Physical Activity Guidelines Advisory Committee. American Cancer Society Guidelines on nutrition and physical activity for cancer prevention: Reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin*. 2012 Jan-Feb;62(1):30-67.

McNamara MA, Zhang T, Harrison MR, George DJ. Ch 79 - Cancer of the kidney. In: Niederhuber JE, Armitage JO, Doroshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 6th ed. Philadelphia, Pa: Elsevier; 2020.

National Cancer Institute. Physician Data Query (PDQ). Renal Cell Cancer Treatment – Patient Version. 2019. <https://www.cancer.gov/types/kidney/patient/kidney-treatment-pdq>. Updated November 8, 2019. Accessed on November 14, 2019.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in

Oncology: *Kidney Cancer*. V.2.2020. Accessed at: www.nccn.org on November 14, 2019.

Wang TW, Asman K, Gentzke AS, et al. Tobacco Product Use Among Adults — United States, 2017. *MMWR Morb Mortal Wkly Rep* 2018;67:1225–1232. DOI: <http://dx.doi.org/10.15585/mmwr.mm6744a2>.

Last Revised: February 10, 2023

What Causes Kidney Cancer?

- [Changes \(mutations\) in genes](#)

Although many [risk factors](#) can increase the chance of developing renal cell cancer (RCC), it is not yet clear how some of these risk factors cause kidney cells to become cancer.

Changes (mutations) in genes

Cancer is caused by changes in the DNA inside our cells. DNA is the chemical in our cells that makes up our genes. Genes control how our cells function. DNA, which comes from both our parents, affects more than just how we look.

Some genes help control when our cells grow, divide into new cells, and die:

- Certain genes that help cells grow, divide, and stay alive are called **oncogenes**.
- Genes that help keep cell division under control or cause cells to die at the right time are called **tumorsuppressor genes**.

Cancers can be caused by DNA mutations (changes) that turn on oncogenes or turn off tumor suppressor genes, resulting in cells growing out of control. Changes in many different genes are usually needed to cause kidney cancer.

Inherited gene mutations

Certain inherited DNA changes can run in some families and increase the risk of kidney

cancer. These syndromes, which cause a small portion of all kidney cancers, are described in [Risk Factors for Kidney Cancer](#).

For example, *VHL*, the gene that causes von Hippel-Lindau (VHL) disease, is a tumor suppressor gene. It normally helps keep cells from growing out of control. Mutations (changes) in this gene can be inherited from parents. When the *VHL* gene is mutated, it is no longer able to control the abnormal growth, and kidney cancer is more likely to develop.

Inherited changes in the following tumor suppressor genes also lead to an increased risk of kidney cancer:

- The *FH* genes (linked to hereditary leiomyomas which can cause fibroids in the skin and uterus)
- The *FLCN* gene (as seen in Birt-Hogg-Dube syndrome)
- The *SDHB* and *SDHD* genes (as seen in familial renal cancer)

People with hereditary papillary renal cell carcinoma have inherited changes in the *MET* oncogene that cause it to be turned on all the time. This can lead to uncontrolled cell growth and makes the person more likely to develop papillary RCC.

Special genetic tests can detect some of the gene mutations associated with these inherited syndromes. If you have a family history of kidney cancer or other cancers linked to these syndromes, you may want to ask your doctor about genetic counseling and genetic testing. The American Cancer Society recommends discussing genetic testing with a qualified cancer genetics professional before any genetic testing is done. For more on this, see [Understanding Genetic Testing for Cancer](#)¹ and [What Happens during Genetic Testing for Cancer?](#)²

Acquired gene mutations

Some gene mutations happen during a person's lifetime and are not passed on. They affect only cells that come from the original mutated cell. These DNA changes are called **acquired** mutations.

In most cases of kidney cancer, the DNA mutations that lead to cancer are acquired during a person's life rather than having been inherited. Certain risk factors, such as exposure to cancer-causing chemicals (like those found in tobacco smoke), probably play a role in causing these acquired mutations, but so far it's not known what causes most of them. Progress has been made in understanding how tobacco increases the risk for developing kidney cancer. Your lungs absorb many of the cancer-causing

chemicals in tobacco smoke into the bloodstream. Because your kidneys filter this blood, many of these chemicals become concentrated in the kidneys. Several of these chemicals are known to damage kidney cells in ways that can cause the cells to become cancer.

[Obesity](#)³, another risk factor for this cancer, alters the balance of some of the body's hormones. Researchers are now learning how certain hormones help control the growth (both normal and abnormal) of many different tissues in the body, including the kidneys.

Most people with sporadic (non-inherited) clear cell RCC have changes in the *VHL* gene in their tumor cells that have caused the gene to stop working properly. These gene changes are acquired during a person's life rather than being inherited.

Other gene changes may also cause renal cell carcinomas. Researchers continue to look for these changes. For more about how genes changes can lead to cancer, see [Genetics and Cancer](#)⁴.

Hyperlinks

1. www.cancer.org/cancer/risk-prevention/genetics/genetic-testing-for-cancer-risk/understanding-genetic-testing-for-cancer.html
2. www.cancer.org/cancer/risk-prevention/genetics/genetic-testing-for-cancer-risk/what-happens-during-genetic-testing-for-cancer.html
3. www.cancer.org/cancer/risk-prevention/diet-physical-activity/body-weight-and-cancer-risk.html
4. www.cancer.org/cancer/risk-prevention/genetics.html

References

Choyke PL, Glenn GM, Walther MM, Zbar B, Linehan WM. Hereditary renal cancers. *Radiology*. 2003 Jan;226(1):33-46.

Clague J, Lin J, Cassidy A, et al. Family history and risk of renal cell carcinoma: Results from a case-control study and systematic meta-analysis. *Cancer Epidemiol Biomarkers Prev*. 2009;18:801-807.

Correa AF, Lane BR, Rini BI, Uzzo RG. Ch 66 - Cancer of the kidney. In: DeVita VT, Hellman S, Rosenberg SA, eds. *Cancer: Principles and Practice of Oncology*. 11th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2019.

Kushi LH, Doyle C, McCullough M, Rock CL, Demark-Wahnefried W, Bandera EV, Gapstur S, Patel AV, Andrews K, Gansler T; American Cancer Society 2010 Nutrition and Physical Activity Guidelines Advisory Committee. American Cancer Society Guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin*. 2012 Jan-Feb;62(1):30-67.

Linehan WM, Schmidt LS. Ch 62 - Molecular biology of kidney cancer. In: DeVita VT, Hellman S, Rosenberg SA, eds. *Cancer: Principles and Practice of Oncology*. 9th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2015.

McNamara MA, Zhang T, Harrison MR, George DJ. Ch 79 - Cancer of the kidney. In: Niederhuber JE, Armitage JO, Doroshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 6th ed. Philadelphia, Pa: Elsevier; 2020.

National Cancer Institute. Physician Data Query (PDQ). Renal Cell Cancer Treatment – Patient Version. 2019. <https://www.cancer.gov/types/kidney/patient/kidney-treatment-pdq>. Updated November 8, 2019. Accessed on November 14, 2019.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology: *Kidney Cancer*. V.2.2020. Accessed at: www.nccn.org on November 12, 2019.

Last Revised: February 1, 2020

Can Kidney Cancer Be Prevented?

In many cases, the cause of kidney cancer is not known. In some other cases (such as with [inherited conditions](#)), even when the cause is known it may not be preventable. But there are some ways you may be able to reduce your risk of this disease.

[Cigarette smoking](#)¹ is responsible for a large percentage of cases, so stopping smoking may lower your risk.

[Obesity](#)² and high blood pressure are also risk factors for renal cell cancer. Maintaining a healthy weight by exercising and choosing a diet high in fruits and vegetables may also reduce your chance of getting this disease.

Avoiding exposure to harmful substances such as trichloroethylene at work, may also reduce your risk for renal cell cancer.

Hyperlinks

1. www.cancer.org/cancer/risk-prevention/tobacco.html
2. www.cancer.org/cancer/risk-prevention/diet-physical-activity/body-weight-and-cancer-risk.html

References

Correa AF, Lane BR, Rini BI, Uzzo RG. Ch 66 - Cancer of the kidney. In: DeVita VT, Hellman S, Rosenberg SA, eds. *Cancer: Principles and Practice of Oncology*. 11th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2019.

Kushi LH, Doyle C, McCullough M, Rock CL, Demark-Wahnefried W, Bandera EV, Gapstur S, Patel AV, Andrews K, Gansler T; American Cancer Society 2010 Nutrition and Physical Activity Guidelines Advisory Committee. American Cancer Society Guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin*. 2012 Jan-Feb;62(1):30-67.

McNamara MA, Zhang T, Harrison MR, George DJ. Ch 79 - Cancer of the kidney. In: Niederhuber JE, Armitage JO, Doroshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 6th ed. Philadelphia, Pa: Elsevier; 2020.

National Cancer Institute. Physician Data Query (PDQ). Renal Cell Cancer Treatment – Patient Version. 2019. <https://www.cancer.gov/types/kidney/patient/kidney-treatment-pdq>. Updated November 8, 2019. Accessed on November 14, 2019.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology: *Kidney Cancer*. V.2.2020. Accessed at: www.nccn.org on November 12, 2019.

Last Revised: February 1, 2020

Written by

The American Cancer Society medical and editorial content team
(<https://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