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# Colorectal Cancer Causes, Risk Factors, and Prevention

Learn about the risk factors for colorectal 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 colorectal cancer.

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

## Prevention

There's no way to completely prevent cancer. But there are things you can do that might help lower your risk. Learn more.

- [Can Colorectal Cancer Be Prevented?](#)
- [Genetic Testing, Screening, and Prevention for People with a Strong Family History of Colorectal Cancer](#)

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# Colorectal Cancer Risk Factors

- [Colorectal cancer risk factors you can change](#)
- [Colorectal cancer risk factors you cannot change](#)
- [Factors with unclear effects on colorectal cancer risk](#)

A risk factor is anything that raises your chances 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 having a risk factor, or even many, does not mean that you will get the disease. And some people who get the disease may not have any known risk factors.

Researchers have found several risk factors that might increase a person's chance of developing colorectal polyps or colorectal cancer.

## Colorectal cancer risk factors you can change

Many lifestyle-related factors have been linked to colorectal cancer. In fact, more than half of all colorectal cancers are linked to risk factors that can be changed.

### Being overweight or obese

If you are [overweight or obese](#)<sup>1</sup> (very overweight), your risk of developing and dying from colorectal cancer is higher. Being overweight raises the risk of colon and rectal cancer in people, but the link seems to be stronger in men. Getting to and staying at a [healthy weight](#)<sup>2</sup> may help lower your risk.

### Not being physically active

If you're not physically active, you have a greater chance of developing colon cancer. [Regular moderate to vigorous physical activity](#)<sup>3</sup> can help lower your risk.

### Certain types of diets

A diet that's high in red meats (such as beef, pork, lamb, or liver) and processed meats (like hot dogs and some luncheon meats) raises your colorectal cancer risk.

Cooking meats at very high temperatures (frying, broiling, or grilling) creates chemicals that might raise your cancer risk. It's not clear how much this might increase your colorectal cancer risk.

Having a low blood level of vitamin D may also increase your risk.

Following a [healthy eating pattern](#)<sup>4</sup> that includes plenty of fruits, vegetables, and whole grains, and that limits or avoids red and processed meats and sugary drinks probably lowers risk.

## Smoking

People who have smoked tobacco for a long time are more likely than people who don't smoke to develop and die from colorectal cancer. Smoking is a well-known cause of lung cancer, but it's linked to a lot of [other cancers](#)<sup>5</sup>, too. If you smoke and want to know more about quitting, see our [Guide to Quitting Smoking](#)<sup>7</sup>.

## Alcohol use

Colorectal cancer has been linked to moderate to heavy [alcohol](#)<sup>8</sup> use. Even light-to-moderate alcohol intake has been associated with some risk. It is best not to drink alcohol. If people do drink alcohol, they should have no more than 2 drinks a day for men and 1 drink a day for women. This could have many health benefits, including a lower risk of [many kinds of cancer](#)<sup>9</sup>.

## Colorectal cancer risk factors you cannot change

### Being older

Your risk of colorectal cancer goes up as you age. Younger adults can get it, but it's much more common after age 50. Colorectal cancer is rising among people who are younger than age 50 and the reason for this remains unclear.

### A personal history of colorectal polyps or colorectal cancer

If you have a history of [adenomatous polyps](#)<sup>10</sup> (adenomas), you are at increased risk of developing colorectal cancer. This is especially true if the polyps are large, if there are many of them, or if any of them show dysplasia.

If you've had colorectal cancer, even though it was completely removed, you are more likely to develop new cancers in other parts of the colon and rectum. The chances of this happening are greater if you had your first colorectal cancer when you were younger.

## **A personal history of inflammatory bowel disease**

If you have inflammatory bowel disease (IBD), including either ulcerative colitis or Crohn's disease, your risk of colorectal cancer is increased.

IBD is a condition in which the colon is inflamed over a long period of time. People who have had IBD for many years, especially if untreated, often develop **dysplasia**. Dysplasia is a term used to describe cells in the lining of the colon or rectum that look abnormal, but are not cancer cells. They can change into cancer over time.

If you have IBD, you may need to start getting screened for colorectal cancer when you are younger and be screened more often.

Inflammatory bowel disease is different from irritable bowel syndrome (IBS), which does not appear to increase your risk for colorectal cancer.

## **A family history of colorectal cancer or adenomatous polyps**

Most colorectal cancers are found in people without a family history of colorectal cancer. Still, as many as 1 in 3 people who develop colorectal cancer have other family members who have had it.

People with a history of colorectal cancer in a first-degree relative (parent, sibling, or child) are at increased risk. The risk is even higher if that relative was diagnosed with cancer when they were younger than 50, or if more than one first-degree relative is affected.

The reasons for the increased risk are not clear in all cases. Cancers can “run in the family” because of inherited genes, shared environmental factors, or some combination of these.

Having family members who have had adenomatous polyps is also linked to a higher risk of colon cancer. (Adenomatous polyps are the kind of polyps that can become cancer.)

If you have a family history of adenomatous polyps or colorectal cancer, talk with your doctor about the possible need to start screening before age 45. If you've had adenomatous polyps or colorectal cancer, it's important to tell your close relatives so that they can pass along that information to their doctors and start screening at the right age.

## Having an inherited syndrome

About 5% of people who develop colorectal cancer have inherited [gene](#)<sup>11</sup> changes (mutations) that cause family cancer syndromes and can lead to them getting the disease.

The most common inherited syndromes linked with colorectal cancers are Lynch syndrome (hereditary non-polyposis colorectal cancer, or HNPCC) and familial adenomatous polyposis (FAP), but other rarer syndromes can increase colorectal cancer risk, too.

### ***Lynch syndrome (hereditary non-polyposis colon cancer or HNPCC)***

Lynch syndrome is the most common hereditary colorectal cancer syndrome. It accounts for about 2% to 4% of all colorectal cancers. In most cases, this disorder is caused by an inherited defect in either the *MLH1*, *MSH2* or *MSH6* gene, but changes in other genes can also cause Lynch syndrome. These genes normally help repair DNA that has been damaged.

The cancers linked to this syndrome tend to develop when people are relatively young. People with Lynch syndrome can have polyps, but they tend to only have a few. The lifetime risk of colorectal cancer in people with this condition may be as high as 50%, but this depends on which gene is affected.

Women with this condition also have a very high risk of developing cancer of the endometrium (lining of the uterus). Other cancers linked with Lynch syndrome include cancer of the ovary, stomach, small intestine, pancreas, kidney, prostate, breast, ureters (tubes that carry urine from the kidneys to the bladder), and bile duct. People with Turcot syndrome (a rare inherited condition) who have a defect in one of the Lynch syndrome genes are at a higher risk of colorectal cancer as well as a specific type of brain cancer called glioblastoma.

For more on Lynch syndrome, see [What Causes Colorectal Cancer?](#), [Can Colorectal Cancer Be Prevented?](#), and [Family Cancer Syndromes](#)<sup>12</sup>.

### ***Familial adenomatous polyposis (FAP)***

FAP is caused by changes (mutations) in the *APC* gene that a person inherits from parents. About 1% of all colorectal cancers are caused by FAP.

In the most common type of FAP, hundreds or thousands of polyps develop in a

person's colon and rectum, often starting at ages 10 to 12 years. Cancer usually develops in 1 or more of these polyps as early as age 20. By age 40, almost all people with FAP will have colon cancer if their colon hasn't been removed to prevent it. People with FAP also have an increased risk for cancers of the stomach, small intestines, pancreas, liver, and some other organs.

There are 3 sub-types of FAP:

- In **attenuated FAP** or **AFAP**, patients have fewer polyps (less than 100), and colorectal cancer tends to occur at a later age (40s and 50s).
- **Gardner syndrome** is a type of FAP that also causes non-cancer tumors of the skin, soft tissue, and bones.
- **Turcot syndrome** is a rare inherited condition in which people have a higher risk of many adenomatous polyps and colorectal cancer. People with Turcot syndrome who have the APC gene are also at risk of a specific type of brain cancer called medulloblastoma.

### ***Rare inherited conditions linked to colorectal cancer***

- **Peutz-Jeghers syndrome (PJS)**: People with this inherited condition tend to have freckles around the mouth (and sometimes on their hands and feet) and a special type of polyp called **hamartomas** in their digestive tracts. These people are at a much higher risk for colorectal cancer, as well as other cancers, such as cancers of the breast, ovary, and pancreas. They usually are diagnosed at a younger than usual age. This syndrome is caused by mutations in the *STK11 (LKB1)* gene.
- **MUTYH-associated polyposis (MAP)**: People with this syndrome develop many colon polyps. These will almost always become cancer if not watched closely with regular colonoscopies. These people also have an increased risk of other cancers of the GI (gastrointestinal) tract and thyroid. This syndrome is caused by mutations in the *MUTYH* gene (which is involved in "proofreading" the DNA and fixing any mistakes) and often leads to cancer at a younger age.
- **Cystic fibrosis (CF)**: CF is an inherited condition in which the cells in some body organs make mucus that is thicker and stickier than normal. This can lead to health problems, especially in the lungs and pancreas. As better medical care has helped people with CF live longer, it's become clear that people with CF are also at increased risk for colorectal cancer, which usually occurs at a much earlier age than in people without CF. The risk for colorectal cancer is even higher in people who have had an organ transplant, such as a lung transplant. CF is caused by

mutations in the *CFTR* gene.

Since many of these syndromes are linked to colorectal cancer at a young age and also linked to other types of cancer, identifying families with these inherited syndromes is important. It lets doctors recommend specific steps such as screening and other preventive measures when the person is younger. Information on risk assessment, and genetic counseling and testing for many of these syndromes can be found in [Genetic Testing, Screening, and Prevention for People with a Strong Family History of Colorectal Cancer](#).

### **Your racial and ethnic background**

American Indian and Alaska Native people have the highest rates of colorectal cancer in the US, followed by African American men and women.

Jews of Eastern European descent (Ashkenazi Jews) have one of the highest colorectal cancer risks of any ethnic group in the world.

### **Having type 2 diabetes**

People with type 2 (usually non-insulin dependent) diabetes have an increased risk of colorectal cancer. Both type 2 diabetes and colorectal cancer share some of the same risk factors (such as being overweight and physical inactivity). But even after taking these factors into account, people with type 2 diabetes still have an increased risk. They also tend to have a less favorable prognosis (outlook) after diagnosis.

### **Factors with unclear effects on colorectal cancer risk**

#### **Night shift work**

Some studies suggest working a night shift regularly might raise the risk of rectal cancer. This might be due to changes in levels of melatonin, a hormone that responds to changes in light. More research is needed.

#### **Previous treatment for certain cancers**

Some studies have found that men who survive testicular cancer seem to have a higher rate of colorectal cancer and some other cancers. This might be because of the treatments they have received, such as radiation therapy.

Several studies have suggested that men who had radiation therapy to treat prostate cancer might have a higher risk of rectal cancer because the rectum receives some radiation during treatment. Most of these studies are based on men treated in the 1980s and 1990s, when radiation treatments were less precise than they are today. The effect of more modern radiation methods on rectal cancer risk is not clear, but research continues to be done in this area.

## Hyperlinks

1. [www.cancer.org/cancer/risk-prevention/diet-physical-activity/body-weight-and-cancer-risk.html](http://www.cancer.org/cancer/risk-prevention/diet-physical-activity/body-weight-and-cancer-risk.html)
2. [www.cancer.org/cancer/risk-prevention/diet-physical-activity/take-control-your-weight.html](http://www.cancer.org/cancer/risk-prevention/diet-physical-activity/take-control-your-weight.html)
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8. [www.cancer.org/cancer/risk-prevention/diet-physical-activity/alcohol-use-and-cancer.html](http://www.cancer.org/cancer/risk-prevention/diet-physical-activity/alcohol-use-and-cancer.html)
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11. [www.cancer.org/cancer/understanding-cancer/genes-and-cancer.html](http://www.cancer.org/cancer/understanding-cancer/genes-and-cancer.html)
12. [www.cancer.org/cancer/risk-prevention/genetics/family-cancer-syndromes.html](http://www.cancer.org/cancer/risk-prevention/genetics/family-cancer-syndromes.html)

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## What Causes Colorectal Cancer?

- [Inherited gene mutations](#)
- [Acquired gene mutations](#)

Researchers have found several [factors that can increase a person's risk of colorectal cancer](#), but it's not yet clear exactly how all of these factors might cause this cancer.

Cancer is caused by changes in the DNA inside our cells. DNA is the chemical in our cells that makes up our genes, which control 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.

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 *tumor suppressor genes*.

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

For more about how genes changes can lead to cancer, see [Genes and Cancer](#)<sup>1</sup>.

## Inherited gene mutations

Some DNA mutations can be passed on in families and are found in all of a person's cells. These are called *inherited* mutations. A very small portion of colorectal cancers are caused by inherited gene mutations. Many of these DNA changes and their effects on the growth of cells are now known. For example:

- **Familial adenomatous polyposis (FAP), attenuated FAP (AFAP), and Gardner syndrome** are caused by inherited changes in the *APC* gene. The *APC* gene is a tumor suppressor gene; it normally helps keep cell growth in check. In people with inherited changes in the *APC* gene, this “brake” on cell growth is turned off, causing hundreds of polyps to form in the colon. Over time, cancer will nearly always develop in one or more of these polyps.
- **Lynch syndrome (hereditary non-polyposis colon cancer, or HNPCC)** is caused by changes in genes that normally help a cell repair damaged DNA. A mutation in one of the DNA repair genes like *MLH1*, *MSH2*, *MSH6*, *PMS2*, and *EPCAM*, can allow DNA errors to go unfixed. These errors will sometimes affect growth-regulating genes, which may lead to the development of cancer.
- **Peutz-Jeghers syndrome** is caused by inherited changes in the *STK11 (LKB1)* gene, a tumor suppressor gene.
- **MUTYH-associated polyposis (MAP)** is caused by mutations in the *MUTYH* gene, which is involved in how the cell “proofreads” or checks the DNA and fixes errors when cells divide.
- **Cystic fibrosis (CF)** is caused by inherited mutations in the *CFTR* gene. Exactly how changes in this gene increase colorectal cancer risk isn't yet clear.

Special genetic tests can find gene mutations linked to these inherited conditions. If you have a family history of colorectal polyps or cancer or other symptoms linked to one of

these conditions, 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 Risk<sup>2</sup>](#) and [What Happens during Genetic Testing for Cancer Risk?<sup>3</sup>](#)

## Acquired gene mutations

Most gene mutations that lead to cancer are *acquired* mutations. They happen during a person's lifetime and are not passed on to their children. These DNA changes affect only cells that come from the original mutated cell.

In most cases of colorectal cancer, the DNA mutations that lead to cancer are acquired during a person's life rather than having been inherited. Certain [risk factors](#) probably play a role in causing these acquired mutations, but so far it's not known what causes most of them.

There doesn't seem to be a single genetic pathway to colorectal cancer that's the same in all cases. In many cases, the first mutation occurs in the *APC* gene. This leads to an increased growth of colorectal cells because of the loss of this "brake" on cell growth. Further mutations may then occur in other genes, which can lead the cells to grow and spread uncontrollably. Other genes that aren't known yet are probably involved as well.

## Hyperlinks

1. [www.cancer.org/cancer/understanding-cancer/genes-and-cancer.html](http://www.cancer.org/cancer/understanding-cancer/genes-and-cancer.html)
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## Can Colorectal Cancer Be Prevented?

- [Colorectal cancer screening](#)
- [Body weight, physical activity, and diet](#)
- [Not smoking](#)
- [Vitamins, calcium, and magnesium](#)
- [Non-steroidal anti-inflammatory drugs \(NSAIDs\)](#)
- [Hormone replacement therapy for women](#)

There's no sure way to prevent colorectal cancer. But there are things you can do that might help lower your risk, such as changing the [risk factors](#) that you can control.

### Colorectal cancer screening

Screening is the process of looking for cancer or pre-cancer in people who have no symptoms of the disease. Regular colorectal cancer screening is one of the most powerful tools for preventing colorectal cancer.

From the time the first abnormal cells start to grow into polyps, it usually takes about 10 to 15 years for them to develop into colorectal cancer. With regular screening, most polyps can be found and removed before they have the chance to turn into cancer.

Screening can also [find colorectal cancer early](#)<sup>1</sup>, when it's small and easier to treat.

If you're age 45 or older, you should start getting screened for colorectal cancer. Several types of tests can be used. Talk to your health care provider about which ones might be good options for you. No matter which test you choose, the most important thing is to get tested.

If you have a strong family history of colorectal polyps or cancer, talk with your doctor about your risk. You might benefit from [genetic counseling](#)<sup>2</sup> to review your family medical tree to see how likely it is that you have a [family cancer syndrome](#)<sup>3</sup>.

## Body weight, physical activity, and diet

You might be able to lower your risk of colorectal cancer by managing your diet and physical activity.

**Weight:** Being overweight or obese increases the risk of colorectal cancer in both men and women, but the link seems to be stronger in men. **Staying at a healthy weight may help lower your risk.**

**Physical activity:** Being more active lowers your risk of colorectal cancer and polyps. Regular moderate to vigorous activity can lower the risk. [Limiting your sitting and lying down time may also lower your risk.](#)<sup>4</sup> **Increasing the amount and intensity of your physical activity may help reduce your risk.**

**Diet:** Overall, diets that are high in vegetables, fruits, and whole grains, and low in red and processed meats, probably lower colorectal cancer risk, although it's not exactly clear which factors are important. Many studies have found a link between red meats (beef, pork, and lamb) or processed meats (such as hot dogs, sausage, and lunch meats) and increased colorectal cancer risk.

In recent years, some large studies have shown conflicting evidence that fiber in the diet probably lowers colorectal cancer risk. Research in this area is still under way. Recent studies looking specifically at whole grain intake, however, show that colorectal cancer risk appears to go down as you add more whole grains to your diet.

**Limiting red and processed meats and eating more vegetables, fruits, and whole grains may help lower your risk.**

**Alcohol:** Several studies have found a higher risk of colorectal cancer with increased [alcohol intake](#)<sup>5</sup>, especially among men. It is best not to drink alcohol. For people who do

drink, they should have no more than 1 drink per day for women or two drinks per day for men. **Not drinking alcohol may help reduce your risk.**

For more about diet and physical activity, see the [American Cancer Society Guidelines for Diet and Physical Activity for Cancer Prevention](#)<sup>6</sup>.

## Not smoking

Long-term smoking is linked to an increased risk of colorectal cancer, as well as many other cancers and health problems. **Quitting smoking may help lower your risk of colorectal cancer and many other types of cancer, too.** If you smoke [and would like help quitting](#)<sup>7</sup>, call the American Cancer Society at 1-800-227-2345.

## Vitamins, calcium, and magnesium

Some studies suggest that taking a daily multi-vitamin containing folic acid, or folate, may lower colorectal cancer risk, but not all studies have found this. In fact, some studies have hinted that folic acid might help existing tumors grow. More research is needed in this area.

Some studies have suggested that vitamin D, which you can get from sun exposure, in certain foods, or in a vitamin pill, might lower colorectal cancer risk. Studies have shown that low vitamin D levels are associated with an increased risk of colorectal cancer as well as other cancers. Because of concerns that excess sun exposure can cause skin cancer, most experts do not recommend this as a way to lower colorectal cancer risk at this time. More studies are needed to determine if increasing vitamin D intake from a supplement can help prevent colorectal cancer. Avoiding a low vitamin D level may be helpful; it is best to talk with your doctor about whether your vitamin D level should be tested.

Low levels of dietary calcium have been linked with an increased risk of colorectal cancer in some studies. Other studies suggest that increasing calcium intake may lower colorectal cancer risk. Calcium is important for a number of health reasons aside from possible effects on cancer risk. But because of the possible increased risk of prostate cancer in men with high calcium/dairy product intake, and the possible lower risk of other cancers like colorectal cancer and breast cancer, the American Cancer Society does not have any specific recommendations regarding dairy food consumption for cancer prevention.

Calcium and vitamin D might work together to reduce colorectal cancer risk, as vitamin D aids in the body's absorption of calcium. Still, not all studies have found that



supplements of these nutrients reduce risk.

A few studies have found a possible link between a diet that's high in magnesium and reduced colorectal cancer risk, especially among women. More research is needed to determine if this link exists.

## **Non-steroidal anti-inflammatory drugs (NSAIDs)**

Many studies have found that people who regularly take aspirin or other non-steroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen (Motrin, Advil) and naproxen (Aleve), have a lower risk of colorectal cancer and polyps.

But aspirin and other NSAIDs can cause serious or even life-threatening side effects, such as bleeding from stomach irritation or stomach ulcers, which may outweigh the benefits of these medicines for the general public. For this reason, the American Cancer Society does not recommend taking NSAIDs just to lower colorectal cancer risk if you are someone at average risk.

Still, for some people in their 50s who have a high risk of heart disease, where low-dose aspirin is found to be beneficial, the aspirin may also have the added benefit of reducing the risk of colorectal cancer.

Because aspirin or other NSAIDs can have serious side effects, check with your doctor before starting any of them on a regular basis.

## **Hormone replacement therapy for women**

Some studies have shown that taking estrogen and progesterone after menopause (sometimes called *menopausal hormone therapy* or *combined hormone replacement therapy*) may reduce a woman's risk of developing colorectal cancer, but other studies have not.

Because taking estrogen and progesterone after menopause can also increase a woman's risk of heart disease, blood clots, and cancers of the breast and lung, it's not commonly recommended just to lower colorectal cancer risk.

If you're considering using menopausal hormone therapy, be sure to discuss the risks and benefits with your doctor.

## Hyperlinks

1. [www.cancer.org/cancer/types/colon-rectal-cancer/detection-diagnosis-staging.html](http://www.cancer.org/cancer/types/colon-rectal-cancer/detection-diagnosis-staging.html)
2. [www.cancer.org/cancer/risk-prevention/diet-physical-activity.html](http://www.cancer.org/cancer/risk-prevention/diet-physical-activity.html)
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## Genetic Testing, Screening, and Prevention for People with a Strong Family History of Colorectal Cancer

- [Testing for Lynch syndrome \(hereditary non-polyposis colorectal cancer, or HNPCC\)](#)
- [Testing for familial adenomatous polyposis \(FAP\)](#)
- [Testing for other inherited cancer syndromes](#)

If you have a family history of colorectal polyps or cancer, you have a higher risk of getting colorectal cancer yourself. This risk can be even higher in people with a strong family history of colorectal cancer. Cancer in close (first-degree) relatives such as parents, brothers, and sisters is most concerning, but cancer in more distant relatives can also be important. Having 2 or more relatives with colorectal cancer is more concerning than having only one relative with it. It's also more concerning if your relatives were diagnosed with cancer at a younger age than usual.

**If you have a family history of colorectal cancer, talk with your doctor.** You might benefit from speaking with a genetic counselor or other health professional who is trained in genetic counseling. They can review your family history to see how likely it is that you have a family cancer syndrome. The counselor can also help you decide if genetic testing is right for you. If you have testing and are found to have an abnormal

gene, there might be steps you can take to help lower your risk of colorectal cancer, such as starting routine screening at an earlier age or even having surgery.

But before getting genetic testing, it's important to know ahead of time what the results might or might not tell you about your risk. Genetic testing is not perfect. The tests might not provide clear answers for some people. This is why meeting with a genetic counselor or cancer genetics professional is important before deciding to be tested. To learn more about this, see [Understanding Genetic Testing for Cancer<sup>1</sup>](#) and [What Happens During Genetic Testing for Cancer?<sup>2</sup>](#)

Genetic tests can help show if members of certain families have inherited a high risk of colorectal cancer due to [inherited cancer syndromes](#) such as Lynch syndrome (also known as hereditary non-polyposis colorectal cancer, or HNPCC) or familial adenomatous polyposis (FAP).

In families known to have one of these inherited syndromes, family members who decide not to get tested are still usually advised to start routine screening for colorectal cancer at an early age, and to get screened more often. Family members who are tested and are found not to have the mutated gene may be able to be screened at the same age and frequency as people at average risk.

## **Testing for Lynch syndrome (hereditary non-polyposis colorectal cancer, or HNPCC)**

Lynch syndrome can greatly increase a person's risk for colorectal cancer. The lifetime risk of colorectal cancer in people with this condition can range from about 10% to about 80%, depending on which gene mutation is causing the syndrome.

People with Lynch syndrome are also at increased risk for some other cancers, such as cancers of the uterus (endometrium), ovaries, stomach, small bowel, pancreas, kidneys, brain, ureters (tubes that carry urine from the kidneys to the bladder), and bile duct.

### **Who should be tested for Lynch syndrome?**

There are two sets of guidelines that doctors often use to determine who might be likely to benefit from genetic counseling or testing: the Amsterdam criteria (based on family history) and the revised Bethesda guidelines (for people diagnosed with colorectal cancer).

#### ***Amsterdam criteria***

Doctors have found that many families with Lynch syndrome tend to have certain characteristics, which are known as the *Amsterdam criteria*:

At least 3 relatives have a cancer linked with Lynch syndrome and:

- One is a first-degree relative (parent, brother or sister, or child) of the other 2 relatives.
- At least 2 successive generations are affected.
- At least 1 relative had their cancer when they were younger than age 50.

If all of these apply to your family, then you might want to seek genetic counseling. But even if your family history satisfies the Amsterdam criteria, it doesn't always mean you have Lynch syndrome. And many families with Lynch syndrome do not meet the Amsterdam criteria.

### ***Revised Bethesda guidelines***

A second set of criteria, called the revised Bethesda guidelines, can be used to help decide whether a person with colorectal cancer should be tested for genetic changes that are seen with Lynch syndrome. (These changes are called **microsatellite instability or MSI**.) These criteria include at least one of the following:

- The person is younger than 50 years when diagnosed with colorectal cancer.
- The person has or had a second colorectal cancer or another cancer ([endometrial](#)<sup>3</sup>, [stomach](#)<sup>4</sup>, [pancreas](#)<sup>5</sup>, [small intestine](#)<sup>6</sup>, [ovary](#)<sup>7</sup>, [kidney](#)<sup>8</sup>, [brain](#)<sup>9</sup>, ureters, or [bile duct](#)<sup>10</sup>) linked to Lynch syndrome.
- The person is younger than 60 years, and the cancer has certain characteristics seen with Lynch syndrome when it's viewed under a microscope.
- The person has a first-degree relative (parent, sibling, or child) younger than 50 who was diagnosed with colorectal cancer or another cancer linked to Lynch syndrome.
- The person has 2 or more first- or second-degree relatives (aunts, uncles, nieces, nephews, or grandparents) who had colorectal cancer or another Lynch syndrome-related cancer at any age.

If a person with colorectal cancer has any of the Bethesda criteria, testing for MSI may be advised. If MSI is found, the doctor typically will recommend that the patient be tested for Lynch syndrome-associated gene mutations.

It's important to know that most people who meet the Bethesda criteria do not have Lynch syndrome, and that you can have Lynch syndrome and not meet any of the criteria listed. Not all doctors use the Bethesda guidelines to decide who should have MSI testing. In fact, it is now recommended that all colorectal cancers be tested for [MMR deficiency or MSI](#)<sup>11</sup>. For anyone whose cancer has a high MSI level or is missing (deficient in) one of the MMR proteins, doctors will most likely recommend genetic testing for Lynch syndrome.

Even if you don't have cancer, your doctor may suspect that Lynch syndrome runs in your family based on cases of colorectal cancer and other cancers associated with this syndrome in your relatives. In that case, your doctor might recommend genetic counseling to evaluate your risk.

### **If your family carries Lynch syndrome**

In families known to carry a Lynch syndrome gene mutation, doctors recommend that family members who have tested positive for the mutation and those who have not been tested should start colonoscopy screening during their early 20s, or 2 to 5 years younger than the youngest person in the family with a diagnosis (whichever is earlier). Testing should be done every 1 or 2 years. This way polyps can be found and removed and any cancers can be found at the earliest possible stage. (See [American Cancer Society Guideline for Colorectal Cancer Screening](#)<sup>12</sup> .)

### **Testing for familial adenomatous polyposis (FAP)**

Familial adenomatous polyposis (FAP) typically causes hundreds of polyps in the colon and rectum, which over time leads to colorectal cancer. For people with FAP, the lifetime risk of developing colorectal cancer is nearly 100%, and in most cases it develops before the age of 50. Because FAP causes polyps and cancer earlier than the usual age colorectal cancer screening is started, it sometimes isn't diagnosed until someone already has cancer.

Genetic counseling and testing are available for people who may have FAP based on their personal or family history. If changes in the gene that causes FAP are found in one person, doctors will recommend that their close relatives (brothers, sisters, and children) be tested. FAP may also be suspected if a person is found to have many polyps during a colonoscopy that was done because of problems like rectal bleeding or anemia.

People who test positive for the gene change linked to FAP should start being screened with colonoscopy at 10 to 15 years of age. (See [American Cancer Society Recommendations for Colorectal Cancer Early Detection](#)<sup>13</sup>.) Many doctors recommend

that people with FAP have their colon removed when they're in their 20s to prevent cancer from developing.

## Testing for other inherited cancer syndromes

Certain other inherited syndromes, such as MUTYH-associated polyposis and Peutz-Jeghers syndrome, can also greatly increase a person's risk of colorectal cancer. If you have certain criteria that suggest you might have one of the syndromes, your doctor might recommend genetic counseling and testing to look for the gene changes that cause them.

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