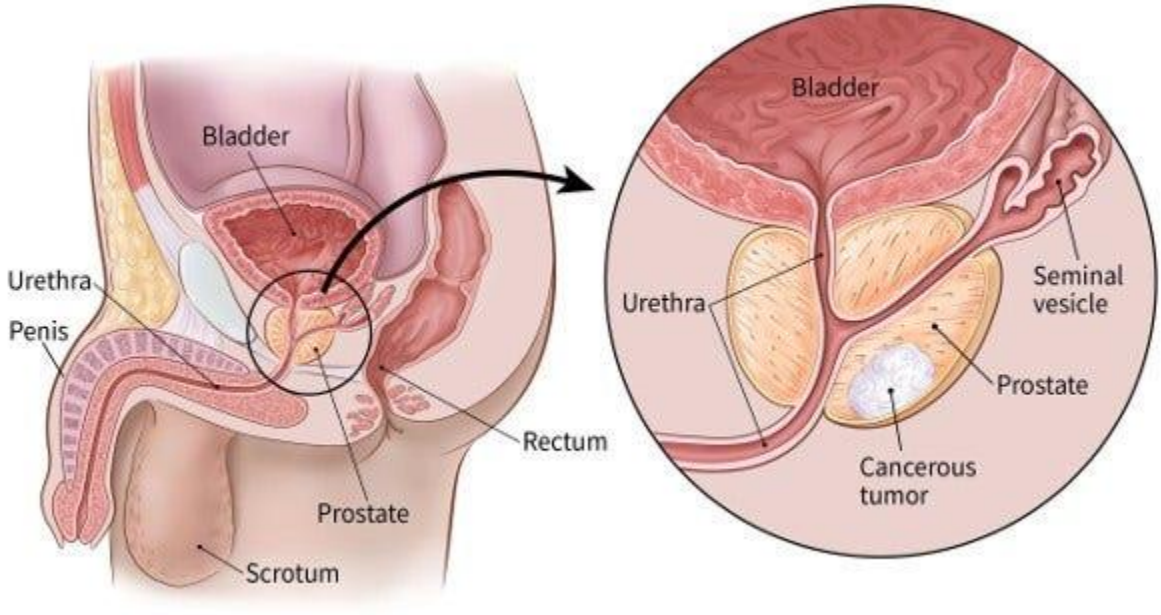
Prostate Cancer

What Is Prostate Cancer?
Prostate cancer begins when cells in the prostate gland start to grow out of control. The prostate is a gland found only in males. It makes some of the fluid that is part of semen.

The prostate

The prostate is below the bladder (the hollow organ where urine is stored) and in front of the rectum (the last part of the intestines). Just behind the prostate are glands called **seminal vesicles,** which make most of the fluid for semen. The **urethra***,* which is the tube that carries urine and semen out of the body through the penis, goes through the center of the prostate.



The prostate tends to grow as a man ages. In younger men, it is about the size of a walnut, but it can be much larger in older men.

Types of prostate cancer
Almost all prostate cancers are **adenocarcinomas**. These cancers develop from the gland cells in the prostate (the cells that make the prostate fluid that is added to the semen).

Other types of cancer that can start in the prostate include:

- **Small cell carcinoma (small cell neuroendocrine carcinoma)**
- **Other neuroendocrine tumors (including large cell carcinoma)**
- **Transitional cell carcinoma**
- **Sarcomas**

These other types of cancer are rare. If you are told you have prostate cancer, it is very likely to be an adenocarcinoma.

Some prostate cancers can grow and spread quickly, but most tend to grow slowly. To learn more, see the information on prostate cancer grades in Tests to Diagnose and Stage Prostate Cancer.

Possible pre-cancerous conditions of the prostate

Some research suggests that prostate cancer might start out as a pre-cancerous condition in some cases. These conditions are sometimes found when a man has a prostate biopsy (removal of small pieces of the prostate to look for cancer).

Prostatic intraepithelial neoplasia (PIN)

In PIN, the prostate cells don't look normal when seen with a microscope, but the abnormal cells don't look like they are invading into other parts of the prostate (like cancer cells would). PIN is not cancer, but it can sometimes lead to a higher risk of prostate cancer.

Based on how the patterns of cells look, PIN is classified as either:

- **Low-grade PIN** if the patterns of prostate cells appear almost normal, or
- **High-grade PIN** if the patterns of cells look more abnormal

Low-grade PIN is not thought to be related to a man's risk of prostate cancer.

If you have high-grade PIN, you may have a higher risk of developing prostate cancer over time. However, most often high-grade PIN does *not* turn into cancer.

Proliferative inflammatory atrophy (PIA)

In PIA, the prostate cells look smaller than normal, and there are signs of inflammation in the area. PIA is not cancer, and it's not yet clear if PIA might lead to high-grade PIN or prostate cancer.

For more on non-cancer conditions that might be seen on a prostate biopsy, including PIN, see Tests to Diagnose and Stage Prostate Cancer.

Prostate Cancer Risk Factors

Any man, or person born with a prostate, is at risk for developing prostate cancer, but there are factors that can increase your risk. Understanding how these factors apply to you might help you make decisions about screening for prostate cancer.

What is a risk factor?

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 several, does not mean that you will get the disease. Many people with one or more risk factors never get cancer, while others who get cancer may have had few or no known risk factors.

Researchers have found some factors that can affect prostate cancer risk.

Older age

Prostate cancer is rare in men younger than 40, but the chance of having prostate cancer rises rapidly after age 50. About 6 in 10 prostate cancers are found in men older than 65.

Race/ethnicity

Prostate cancer develops more often in African American men and in Caribbean men of African ancestry than in men of other races. And when it does develop in these men, they tend to be younger.

Prostate cancer occurs less often in Asian American, Hispanic, and Latino men than in non-Hispanic White men. The reasons for these racial and ethnic differences are not clear.

Family history

Prostate cancer seems to run in some families, which suggests that in some cases there may be an inherited or genetic factor. Still, most prostate cancers occur in men **without** a family history of it.

Having a father or brother with prostate cancer more than doubles a man's risk of developing this disease. (The risk is higher for men who have a brother with the disease than for those who have a father with it.) The risk is much higher for men with several affected relatives, particularly if their relatives were young when the cancer was found.

Inherited gene changes

Certain gene changes (known as **variants** or **mutations**) that are inherited from a parent can raise prostate cancer risk, although these probably account for only a small percentage of prostate cancers overall. For example:

- Inherited variants of the ***BRCA1* or *BRCA2* gene**, which are linked to an increased risk of breast, ovarian, and other cancers in some families, can also increase prostate cancer risk in men (especially mutations in *BRCA2*).
- Men with **Lynch syndrome** (also known as **hereditary non-polyposis colorectal cancer,** or **HNPCC**), a condition caused by inherited gene changes, are at increased risk for some types of cancer, including prostate cancer.

Other inherited gene changes can also raise a man's risk of prostate cancer. For more on some of these gene changes, see What Causes Prostate Cancer?

Factors with less clear effects on prostate cancer risk

Diet

The exact role of diet in prostate cancer is not clear, but several factors have been studied.

Men who consume a lot of **dairy products** may have a slightly higher chance of getting prostate cancer.

Some studies have suggested that men who consume a lot of **calcium** (through foods or supplements) may have a higher risk of developing prostate cancer. But most studies have not found such a link with the levels of calcium found in the average diet, and it's important to note that calcium is known to have other important health benefits.

Dietary vegetable intake, soy products, coffee, and multivitamin use have also been studied. However, none of these factors has consistently been linked to prostate cancer risk.

Obesity

Obesity does not seem to increase the overall risk of getting prostate cancer.

Some studies have found that men with obesity have a lower risk of getting a low-grade (slower-growing) form of the disease, but a higher risk of getting more aggressive (faster-growing) prostate cancer. The reasons for this are not clear.

Some studies have also found that men with obesity may be at higher risk for having more advanced prostate cancer and of dying from prostate cancer, but not all studies have found this.

Smoking

Most studies have not found a link between smoking and **getting** prostate cancer. Some research has linked smoking to a small increased risk of dying from prostate cancer, but this finding needs to be confirmed by other studies. Importantly, smoking is clearly linked with many other health effects, including an increased risk of many other types of cancer.

Chemical exposures

Research has suggested that exposure to some chemicals might increase prostate cancer risk. For example:

Some studies have suggested a link between exposure to **arsenic** and a higher risk of prostate cancer. To learn more, see Arsenic and Cancer Risk.

There is some evidence that **firefighters** can be exposed to chemicals that may increase their risk of prostate cancer. To learn more, see Firefighters and Cancer Risk.

A few studies have suggested a possible link between exposure to **Agent Orange**, a chemical used widely during the Vietnam War, and the risk of prostate cancer, although not all studies have found such a link. The National Academies of Science, Engineering, and Medicine considers there to be “limited/suggestive evidence” of a link between Agent Orange exposure and prostate cancer. To learn more, see Agent Orange and Cancer.

Inflammation of the prostate

Some studies have suggested that **prostatitis** (inflammation of the prostate gland) may be linked to an increased risk of prostate cancer, but other studies have not found such a link. Inflammation is often seen in samples of prostate tissue that also contain cancer. The link between the two is not yet clear, and this is an active area of research.

Sexually transmitted infections

Researchers have looked to see if sexually transmitted infections (like gonorrhea or chlamydia) might increase the risk of prostate cancer, because they can lead to inflammation of the prostate. So far, studies have had conflicting results, and no firm conclusions have been reached.

Vasectomy

Some studies have suggested that men who have a vasectomy (minor surgery to make men infertile) have a slightly increased risk for prostate cancer, but other studies have found no increase in risk. Research on this possible link is still underway.

Signs and Symptoms of Prostate Cancer

Most prostate cancers are found early, through screening, before it has a chance to cause noticeable problems. But not everyone chooses to get prostate cancer screening. And screening may not catch all cancers. Whether you are being screened regularly or not, it's important to be aware of the signs and symptoms of prostate cancer and to check with your health care provider if you notice any of them.

Signs and symptoms of early prostate cancer

Early prostate cancer usually causes no symptoms. While not common, symptoms of early prostate cancer might include:

- Problems urinating, including a slow or weak urinary stream or the need to urinate more often, especially at night
- Blood in the urine or semen

Signs and symptoms of advanced prostate cancer
Advanced prostate cancer means it has grown larger and has possibly spread to other areas. When prostate cancer is advanced, it can cause problems with urination and blood in the urine or semen, as well as other symptoms, including:

- Trouble getting an erection (erectile dysfunction or ED)
- Pain in the hips, back (spine), chest (ribs), or other areas, from cancer that has spread to the bones
- Weakness or numbness in the legs or feet, or even loss of bladder or bowel control, from cancer in the spine pressing on the spinal cord
- Weight loss
- Feeling very tired

Tests to Diagnose and Stage Prostate Cancer
Most prostate cancers are first found as a result of screening. (See Screening Tests for Prostate Cancer.) Early prostate cancers usually don't cause symptoms, but more advanced cancers are sometimes first found because of symptoms they cause.

If prostate cancer is suspected based on results of screening tests or symptoms, tests will be needed to be sure. If you're seeing your primary care doctor, you might be referred to a **urologist**, a doctor who treats diseases of the genital and urinary tract, including prostate cancer.

The actual diagnosis of prostate cancer can only be made with a prostate biopsy (discussed below).

Medical history and physical exam
If your doctor suspects you might have prostate cancer, you will be asked about any symptoms you are having, such as urinary or sexual problems, and how long you have had them. You might also be asked about possible risk factors, including your family history.

Your doctor will also examine you. This might include a digital rectal exam (DRE), during which the doctor inserts a gloved, lubricated finger into your rectum to feel for any bumps or hard areas on the prostate that might be cancer. If you do have cancer, the DRE can sometimes help tell if it's only on one side of the prostate, if it's on both sides, or if it's likely to have spread beyond the prostate to nearby structures. Your doctor may also examine other areas of your body.

After the exam, your doctor might order some tests.

PSA blood test

Prostate-specific antigen (PSA) is a protein made by cells in the prostate gland (both normal cells and cancer cells). PSA is mostly in semen, but a small amount is also in the blood.

Use in men who might have prostate cancer

The PSA blood test can be used to screen for prostate cancer in men without symptoms. It's also one of the first tests done in men who have symptoms that might be caused by prostate cancer.

PSA in the blood is measured in units called nanograms per milliliter (ng/mL). The chance of having prostate cancer goes up as the PSA level goes up, but **there is no set cutoff point that can tell for sure if a man does or doesn't have prostate cancer**.

Many doctors use a PSA cutoff point of 4 ng/mL or higher when deciding if a man might need further testing, while others might recommend it starting at a lower level, such as 2.5 or 3.

- **Most men *without* prostate cancer have PSA levels under 4 ng/mL of blood.** Still, a level below 4 is not a guarantee that a man doesn't have cancer.
- **Men with a PSA level between 4 and 10 (often called the "borderline range") have about a 1 in 4 chance of having prostate cancer.** However, up to half of these are low-grade cancers that may not require treatment – (see "Prostate cancer grade," below.)
- **If the PSA is more than 10, the chance of having prostate cancer is over 50%.** However, some of these are low-grade cancers that may not require treatment (see "Prostate cancer grade," below).

If your PSA level is high, you might need further tests to look for prostate cancer.

To learn more about how the PSA test is used to look for prostate cancer, including factors that can affect PSA levels, special types of PSA tests, and what the next steps might be if you have an abnormal PSA level, see Screening Tests for Prostate Cancer.

Use in men already diagnosed with prostate cancer

The PSA test can also be useful if you have already been diagnosed with prostate cancer.

- In men just diagnosed with prostate cancer, the PSA level can be used together with physical exam results and tumor grade (determined on the biopsy, described further on) to help decide if other tests (such as CT scans or bone scans) are needed.
- The PSA level is used to help determine the stage (extent) of your cancer. If the cancer hasn't spread, the PSA level can also help decide which risk group the cancer falls into. This can affect which treatment options might be best for you.

- PSA tests are often an important part of determining how well treatment is working, as well as in watching for a possible recurrence of the cancer after treatment. (See Following PSA Levels During and After Treatment.)

Prostate biopsy

If the results of a PSA blood test, DRE, or other tests suggest that you might have prostate cancer, you will most likely need a prostate biopsy.

A biopsy is a procedure in which small samples of the prostate are removed and looked at with a microscope. A **core needle biopsy** is the main method used to diagnose prostate cancer. It is usually done by a urologist.

During the biopsy, the doctor usually looks at the prostate with an imaging test, such as transrectal ultrasound (TRUS) or MRI, or a 'fusion' of the two (all discussed below). The doctor quickly inserts a thin, hollow needle into the prostate. This is done either through the wall of the rectum (a **transrectal** biopsy) or through the skin between the scrotum and anus (a **transperineal** biopsy). When the needle is pulled out it removes a small cylinder (core) of prostate tissue. This is repeated several times. Most often the doctor will take about 12 core samples from different parts of the prostate.

Though the procedure sounds painful, each biopsy usually causes only some brief discomfort because it is done with a special spring-loaded biopsy instrument. The device inserts and removes the needle in a fraction of a second. Most doctors who do the biopsy will numb the area first by injecting a local anesthetic alongside the prostate. You might want to ask your doctor if there are plans to do this.

The biopsy itself takes about 10 minutes and is usually done in the doctor's office. You will likely be given antibiotics to take before the biopsy and possibly for a day or 2 after to reduce the risk of infection.

For a few days after the procedure, you may feel some soreness in the area and might notice blood in your urine. You may also have some light bleeding from your rectum, especially if you have hemorrhoids. Many men notice blood in their semen or have rust-colored semen, which can last for several weeks after the biopsy, depending on how often you ejaculate.

Getting the results of the biopsy

Your biopsy samples will be sent to a lab, where a doctor with special training, called a **pathologist**, will look at them with a microscope to see if they contain cancer cells. Getting the results (in the form of a pathology report) usually takes 1 to 3 days, but it can sometimes take longer. The results might be reported as:

- **Negative for cancer:** No cancer cells were seen in the biopsy samples.
- **Positive for cancer:** Cancer cells were seen in the biopsy samples.
- **Suspicious or atypical:** Something abnormal was seen, but it might not be cancer. (Different types of suspicious and atypical results are discussed below.)

If the biopsy is negative for cancer

If the prostate biopsy results are negative (that is, if they don't show cancer), and the chance that you have prostate cancer isn't very high based on your PSA level and other tests, you might not need any more tests, other than repeat PSA tests (and possibly DREs) sometime later.

But even if many samples are taken, biopsies can still sometimes miss a cancer if none of the biopsy needles pass through it. This is known as a **false-negative** result. If your doctor still strongly suspects you have prostate cancer (because your PSA level is very high, for example), they might suggest:

- Getting **other lab tests** (of blood, urine, or the prostate biopsy samples) to help get a better idea of if you might have prostate cancer. Examples of such tests include the Prostate Health Index (PHI), 4Kscore test, PCA3 tests (such as Progensa), and ConfirmMDx. These tests are discussed in What's New in Prostate Cancer Research?
- Getting an **MRI** of the prostate (described below) – if it hasn't been done already) – which might show suspicious areas in the prostate that should be biopsied
- Getting a **repeat prostate biopsy**. This might include getting samples of parts of the prostate not biopsied the first time, or using imaging tests such as MRI to look more closely for abnormal areas to target.

Prostate cancer grade (Gleason score or Grade Group)

If prostate cancer is found on a biopsy, it will be assigned a **grade**. The grade of the cancer is based on how abnormal the cancer looks under the microscope. Higher-grade cancers look more abnormal, and they're more likely to grow and spread quickly. There are 2 main ways to describe the grade of a prostate cancer.

Gleason score

The Gleason system, which has been in use for many years, assigns grades using the numbers 1 through 5, based on how much the cancer looks like normal prostate tissue.

- A grade of 1 is assigned if the cancer looks a lot like normal prostate tissue.
- A grade of 5 is assigned if the cancer looks very abnormal.
- Grades 2 through 4 have features in between these extremes.

Almost all prostate cancers are given a grade 3 or higher; grades 1 and 2 are not often used.

Since prostate cancers often have areas with different grades, a grade is assigned to the 2 areas that make up most of the cancer. These grades are then added to yield the **Gleason score** (also called the **Gleason sum**).

The first number assigned is the grade that is most common in the tumor. For example, if the Gleason score is written as 3+4=7, it means most of the tumor is grade 3 and less is grade 4, and they are added for a Gleason score of 7.

Although most often the Gleason score is based on the 2 areas that make up most of the cancer, there are some exceptions. For example, when a biopsy sample has either a lot of high-grade cancer or there are 3 grades, including high-grade cancer, the way the Gleason score is determined is modified to reflect the aggressive (fast-growing) nature of the cancer.

In theory, the Gleason score can be between 2 and 10, but scores below 6 are not often used.

Based on the Gleason score, prostate cancers are often divided into 3 groups:

- Cancers with a **Gleason score of 6 or less** may be called **well-differentiated** or **low-grade**. These cancers tend to grow slowly and are unlikely to spread. (In fact, some doctors have questioned whether these should even be called cancers.)
- Cancers with a **Gleason score of 7** may be called **moderately differentiated** or **intermediate-grade**.
- Cancers with **Gleason scores of 8 to 10** may be called **poorly differentiated** or **high-grade**.

Grade Groups
In recent years, doctors have come to realize that the Gleason score might not always be the best way to describe the grade of the cancer, for a couple of reasons:

- The outcomes for men with prostate cancer can be divided into more than just the 3 groups mentioned above. For example, men with a Gleason score of 3+4=7 cancer tend to do better than those with a 4+3=7 cancer. And men with a Gleason score of 8 cancer tend to do better than those with a Gleason score of 9 or 10.
- The scale of the Gleason score can be misleading for men with prostate cancer. For example, a man with a Gleason score of 6 cancer might assume that his cancer is in the middle of the range of grades (which in theory go from 2 to 10), even though grade 6 cancers are actually the lowest grade seen in practice. This might lead a man to think his cancer is more likely to grow and spread quickly, when grade 6 cancers typically do not spread or cause death. This misunderstanding could affect his decisions about treatment.

Because of this, doctors have developed **Grade Groups**, ranging from 1 (most likely to grow and spread slowly) to 5 (most likely to grow and spread quickly):

- Grade Group 1 = Gleason 6 (or less)
- Grade Group 2 = Gleason 3+4=7
- Grade Group 3 = Gleason 4+3=7
- Grade Group 4 = Gleason 8
- Grade Group 5 = Gleason 9-10

The Grade Groups will likely replace the Gleason score over time, but currently you might see either one (or both) on a biopsy pathology report.

Other information in a pathology report if cancer is found
Along with the grade of the cancer (if it is present), the pathology report often contains other information about the cancer, such as:

- The number of biopsy core samples that contain cancer (for example, “7 out of 12”)
- The percentage of cancer in each of the cores
- Whether the cancer is on one side (left or right) of the prostate or on both sides (bilateral)

Suspicious, atypical, or other results
Sometimes a biopsy sample might not look like prostate cancer, but it doesn’t look quite normal, either.

Prostatic intraepithelial neoplasia (PIN): In PIN, there are changes in how the prostate cells look, but the abnormal cells don’t look like they’ve grown into other parts of the prostate (like cancer cells would). PIN is often divided into 2 groups:

- **Low-grade PIN:** The patterns of prostate cells appear almost normal.
- **High-grade PIN:** The patterns of cells look more abnormal.

Many men begin to develop **low-grade PIN** at an early age, but low-grade PIN is not thought to be related to prostate cancer risk. If low-grade PIN is reported on a prostate biopsy, your follow-up is usually the same as if nothing abnormal was seen.

If **high-grade PIN** is found on a biopsy, you might have a higher chance of developing prostate cancer over time. This is why doctors often watch men with high-grade PIN carefully and may advise another prostate biopsy (or lab tests to help determine the risk of having cancer, such as the Prostate Health Index [PHI], 4Kscore test, PCA3 tests [such as Progensa], or ConfirmMDx). This is especially true if high-grade PIN is found in different parts of the prostate (known as **multifocal high-grade PIN**), or if the original biopsy didn’t take samples from all parts of the prostate.

Intraductal carcinoma: In intraductal carcinoma, prostate cancer (carcinoma) cells can be seen growing into pre-existing prostate ducts. This condition is often seen next to high-grade (fast-growing) prostate cancer.

If intraductal carcinoma is found on a prostate biopsy, there’s a strong chance that there is high-grade prostate cancer near where the biopsy was taken from. Because of this, doctors often recommend treating the prostate with surgery or radiation therapy.

Atypical small acinar proliferation (ASAP): This might also be called **glandular atypia** or **atypical glandular proliferation**. It might also just be reported as “suspicious

for cancer." All of these terms mean that there are cells in the biopsy sample that look like they might be cancer, but there are too few of them to be sure. If one of these terms is used, there's a high chance that there is also cancer in the prostate, which is why many doctors recommend getting another biopsy within a few months.

Proliferative inflammatory atrophy (PIA): In PIA, the prostate cells look smaller than normal, and there are signs of inflammation in the area. PIA is not cancer, and it's not yet clear if it leads to high-grade PIN or to prostate cancer directly.

Testing prostate cancer cells for gene or protein changes

If you have prostate cancer, the cancer cells from your biopsy might be tested for certain gene or protein changes that could affect your treatment options. For example:

If your cancer hasn't spread, your doctor might recommend a **molecular or genomic test** of your cancer cells to help determine how quickly the cancer is likely to grow and spread. Tests such as Decipher, Oncotype DX Prostate, Prolaris, and Promark can help you and your doctor decide if active surveillance might be right for you, or if treatment such as surgery or radiation therapy might be a better option. For more on these tests, see Risk Groups and Lab Tests to Help Determine Risk for Localized Prostate Cancer.

If your cancer has spread, tests might be done to look for specific gene or protein changes in the cancer cells, which can show if certain targeted therapy drugs are likely to be helpful in treating the cancer. For example, the cancer cells might be tested for changes (mutations) in the *BRCA* genes or in other genes involved in repairing damaged DNA. If the cells have changes in one of these genes, targeted drugs called PARP inhibitors might be helpful for you.

Genetic testing for some men with prostate cancer

Doctors recommend that some men with prostate cancer consider genetic counseling and testing to look for certain inherited gene changes. This typically includes men who:

- Have family members with a known inherited gene change that affects prostate cancer risk (such as a *BRCA* gene mutation or Lynch syndrome)
- Have a strong family history of prostate cancer (or certain other cancers)
- Have had another type of cancer (especially breast cancer)
- Are of Ashkenazi Jewish descent
- Have prostate cancer that has spread to other parts of the body
- Have prostate cancer with high-risk features or that includes intraductal carcinoma
- Have been found to have a gene change in their prostate cancer cells (such as a *BRCA* gene change) that might have been inherited

To learn more, see Genetic Counseling and Testing for Prostate Cancer Risk.

Imaging tests for prostate cancer

Imaging tests use x-rays, magnetic fields, sound waves, or radioactive substances to create pictures of the inside of your body. One or more imaging tests might be used to:

- Look for cancer in the prostate.
- Help the doctor see the prostate during certain procedures (such as a prostate biopsy or certain types of prostate cancer treatment).
- Look for spread of prostate cancer to other parts of the body.

Which tests you might need will depend on the situation. For example, a prostate biopsy is typically done with transrectal ultrasound (TRUS) and/or MRI to help guide the biopsy. If you are found to have prostate cancer, you might need imaging tests of other parts of your body to look for possible cancer spread. (Men with a normal digital rectal exam (DRE), a low blood PSA level, and a low Gleason score may not need any other tests because the chance that the cancer has spread is so low.)

The imaging tests used most often to look for prostate cancer include:

Transrectal ultrasound (TRUS)

For this test, a small probe about the width of a finger is lubricated and placed in your rectum. The probe gives off sound waves that enter the prostate and create echoes. The probe picks up the echoes, and a computer turns them into a black-and-white image of the prostate.

The test often takes less than 10 minutes and is usually done in a doctor's office or outpatient clinic. You will feel some pressure when the probe is inserted, but it is usually not painful. The area may be numbed before the procedure.

TRUS might be used in different situations:

- It is sometimes used to look for suspicious areas in the prostate in men who have an abnormal DRE or PSA test result (although it can miss some cancers).
- It can be used during a **prostate biopsy** to guide the needles into the correct areas of the prostate.
- It can be used to measure the size of the prostate, which can help determine the **PSA density** (described in Screening Tests for Prostate Cancer).
- It can be used as a guide during some forms of **treatment,** such as brachytherapy (internal radiation therapy) or cryotherapy.

Newer forms of TRUS, such as color Doppler ultrasound and micro-ultrasound, might be even more helpful in some situations. (See What's New in Prostate Cancer Research?)

Magnetic resonance imaging (MRI)

MRI scans create detailed images of soft tissues in the body using radio waves and strong magnets. MRIs can give doctors a very clear picture of the prostate and nearby

areas. A contrast material called gadolinium might be injected into a vein before the scan to better see details.

MRI might be used in different situations:

- It can be used to help determine if a man with an abnormal screening test or with symptoms that might be from prostate cancer should get a prostate biopsy. (The type of MRI often used for this, known as **multiparametric MRI**, is described below.)
- If a prostate biopsy is planned, an MRI might be done to help locate and target areas of the prostate that are most likely to contain cancer. This is often done as an **MRI/ultrasound fusion biopsy**, which is described below.
- MRI can be used **during** a prostate biopsy to help guide the needles into the prostate.
- If prostate cancer has been found, MRI can be done to help determine the extent (stage) of the cancer. MRI scans can show if the cancer has spread outside the prostate into the seminal vesicles or other nearby structures. This can be very important in determining your treatment options. But MRI scans aren't usually needed for newly diagnosed prostate cancers that are likely to be confined to the prostate based on other factors.

To improve the accuracy of the MRI, you might have a probe, called an **endorectal coil**, placed inside your rectum for the scan. This can be uncomfortable for some men. If needed, you can be given medicine to make you feel sleepy (sedation).

Multiparametric MRI (mpMRI): This MRI technique can be used to help better define possible areas of cancer in the prostate, as well as to get an idea of how quickly a cancer might grow. It can also help show if the cancer has grown outside the prostate or spread to other parts of the body.

For this test, a standard MRI is done to look at the anatomy of the prostate, and then at least one other type of MRI (such as diffusion weighted imaging [DWI], dynamic contrast enhanced [DCE] MRI, or MR spectroscopy) is done to look at other parameters of the prostate tissue. The results of the different scans are then compared to help find abnormal areas.

When mpMRI is done to help determine if a man might have prostate cancer, the results are typically reported using the **Prostate Imaging Reporting and Data System**, or **PI-RADS**. In this system, abnormal areas in the prostate are assigned a category on a scale ranging from PI-RADS 1 (very unlikely to be a clinically significant cancer) to PI-RADS 5 (very likely to be a clinically significant cancer).

MRI/ultrasound fusion-guided prostate biopsy: In this approach, a man gets an MRI a few days or weeks before the biopsy to look for abnormal areas in the prostate. During the biopsy itself, TRUS is used to view to prostate, and a special computer program is used to fuse the MRI and TRUS images on a computer screen. This can

help ensure the doctor gets biopsy samples from any suspicious areas seen on the images.

Bone scan

If prostate cancer spreads to distant parts of the body, it often goes to the bones first. A bone scan can help show if cancer has reached the bones.

For this test, you are injected with a small amount of low-level radioactive material, which settles in damaged areas of bone throughout the body. A special camera detects the radioactivity and creates a picture of your skeleton.

A bone scan might suggest cancer in the bone, although other non-cancerous conditions such as arthritis can sometimes look similar on the scan. To be sure, other tests, such as plain x-rays, CT or MRI scans, or even a bone biopsy, might be needed.

Positron emission tomography (PET) scan

A PET scan is similar to a bone scan, in that a slightly radioactive substance (known as a **tracer**) is injected into the blood, which can then be detected with a special camera. But PET scans use different tracers that collect mainly in cancer cells.

The most common tracer for standard PET scans is FDG, which is a type of sugar. Unfortunately, this type of PET scan isn't very useful in finding prostate cancer cells in the body. However, newer types of tracers can often be helpful in looking for prostate cancer.

PET scans using newer tracers: Newer tracers that have been found to be better at detecting prostate cancer cells include:

- Fluciclovine F18
- Sodium fluoride F18
- Choline C11

PSMA PET scans: Other newer tracers attach to prostate-specific membrane antigen (PSMA), a protein that is often found in large amounts on prostate cancer cells. These tracers include:

- Ga 68 PSMA-11 (also known as Ga 68 gozetotide, Locametz, Illuccix, and Gozellix)
- 18F-DCFPyl (also known as piflufolastat F 18 or Pylarify)
- 18F-rhPSMA-7.3 (also known as flotufolastat F 18 or Posluma)

These newer types of PET scans are most often used if it's not clear if (or exactly where) prostate cancer has spread. For example, one of these tests might be done if the results of a bone scan aren't clear, or if a man has a rising PSA level after treatment but it's not clear where the cancer is in the body. PSMA PET scans can also be used to

help determine if the cancer can be treated with a radiopharmaceutical that targets PSMA.

The pictures from a PET scan aren't as detailed as MRI or CT scan images, but they can often show areas of cancer anywhere in the body. Some machines can do a PET scan and either an MRI (PET-MRI) or a CT scan (PET-CT) at the same time, which can give more detail about areas that show up on the PET scan.

Doctors are still learning about the best ways to use these newer types of PET scans, and some of them might not be available yet in all imaging centers.

Computed tomography (CT) scan

A CT scan uses x-rays to make detailed, cross-sectional images of your body. This test isn't often needed for newly diagnosed prostate cancer if the cancer is likely to be confined to the prostate based on other findings (DRE result, PSA level, and Gleason score). Still, it can sometimes help tell if prostate cancer has spread into nearby lymph nodes. If your prostate cancer has come back after treatment, a CT scan can often tell if it is growing into other organs or structures in your pelvis.

CT scans are not as useful as magnetic resonance imaging (MRI) for looking at the prostate gland itself.

Lymph node biopsy

In a lymph node biopsy, also known as **lymph node dissection** or **lymphadenectomy**, one or more lymph nodes are removed to see if they have cancer cells. This isn't done very often for prostate cancer, but it might be used to find out if the cancer has spread from the prostate to nearby lymph nodes.

Lymph node removal during surgery to treat prostate cancer

If surgery is being done to treat prostate cancer and there is more than a very small chance that the cancer might have spread (based on factors such as a high PSA blood level or a high Gleason score from the biopsy), the surgeon may remove lymph nodes in the pelvis during the operation to remove the prostate (**radical prostatectomy**).
See Surgery for Prostate Cancer.

The lymph nodes and the prostate are then sent to the lab to be looked at. The lab results are usually available several days after surgery.

Lymph node biopsy as a separate procedure

A lymph node biopsy is rarely done as a separate procedure. It's sometimes used when a radical prostatectomy isn't planned (such as for some men who choose treatment with radiation therapy), but when it's still important to know if the lymph nodes contain cancer.

Most often, this is done as a **needle biopsy**. To do this, the doctor uses an imaging test (such as an MRI or CT scan) to guide a long, hollow needle through the skin in the

lower abdomen and into an enlarged lymph node. The skin is numbed with local anesthesia before the needle is inserted. The sample removed by the needle is then sent to the lab and looked at for cancer cells.

Can Prostate Cancer Be Prevented?
There is no sure way to prevent prostate cancer. Many prostate cancer risk factors, such as age, race, and family history, can't be controlled. But there are some things you can do that might lower your risk of prostate cancer.

Body weight, physical activity, and diet
The effects of body weight, physical activity, and diet on prostate cancer risk aren't completely clear, but there are things you can do that might lower your risk.

Some studies have found that men with **excess body weight** have a higher risk of developing advanced prostate cancer or prostate cancer that is more likely to be fatal.

Although not all studies agree, several have found a higher risk of prostate cancer in men whose diets are high in **dairy products and calcium**.

For now, the best advice about diet and activity to possibly reduce the risk of prostate cancer is to:

- Get to and stay at a healthy weight.
- Be physically active.
- Follow a healthy eating pattern, which includes a variety of colorful fruits and vegetables and whole grains, and avoids or limits red and processed meats, sugar-sweetened beverages, and highly processed foods.

It may also be sensible to limit calcium supplements and to not get too much calcium in the diet. (This does not mean that men who are being **treated for** prostate cancer should not take calcium supplements if their doctor recommends them.)

To learn more, see the American Cancer Society Guideline for Diet and Physical Activity for Cancer Prevention.

Vitamin, mineral, and other supplements
Vitamin E and selenium: Some early studies suggested that taking vitamin E or selenium supplements might lower prostate cancer risk.

But a large study known as the Selenium and Vitamin E Cancer Prevention Trial (SELECT) found that **neither vitamin E nor selenium supplements lowered prostate cancer risk**. In fact, men in the study taking the vitamin E supplements were found to have a slightly higher risk of prostate cancer.

Soy and isoflavones: Some early research has suggested possible benefits from soy proteins (called isoflavones) in lowering prostate cancer risk. Several studies are now looking more closely at the possible effects of these proteins.

Taking any supplement could have both risks and benefits. Before starting vitamins or other supplements, talk with your doctor.

Medicines

Some drugs might help reduce the risk of prostate cancer.

5-alpha reductase inhibitors

5-alpha reductase is an enzyme in the body that changes testosterone into dihydrotestosterone (DHT), the main hormone that causes the prostate to grow. Drugs called **5-alpha reductase inhibitors**, such as **finasteride** and **dutasteride**, block this enzyme from making DHT. These drugs are used to treat benign prostatic hyperplasia (BPH), a non-cancerous growth of the prostate.

Large studies of both of these drugs have tested if they might also be useful in lowering prostate cancer risk. In these studies, men taking either drug were less likely to develop prostate cancer after several years than men getting an inactive placebo.

When the results were looked at more closely, the men who took these drugs had fewer low-grade prostate cancers, but they had about the same risk of higher-grade prostate cancers, which are more likely to grow and spread. It's not clear if these drugs can lower the risk of dying from prostate cancer, as men in these studies had similar survival rates whether or not they took one of these drugs.

These drugs can cause sexual side effects such as lowered sexual desire and erectile dysfunction (impotence), as well as the growth of breast tissue in some men. But they can help with urinary problems from BPH, such as trouble urinating and leaking urine (incontinence).

These drugs aren't approved by the FDA specifically to help lower prostate cancer risk, although doctors can prescribe them "off label" for this use. Men who want to know more about these drugs should discuss them with their doctors.

Aspirin

Some research suggests that men who take a daily aspirin might have a lower risk of getting and dying from prostate cancer. But more research is needed to show if the possible benefits outweigh the risks. Long-term aspirin use can have side effects, including an increased risk of bleeding in the digestive tract. While aspirin can also have other health benefits, at this time most doctors don't recommend taking it just to try to lower prostate cancer risk.

Other drugs

Other drugs and dietary supplements that might help lower prostate cancer risk are now being studied. But so far, no drug or supplement has been found to be helpful in studies large enough for experts to recommend them.