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About Prostate Cancer

Overview

If you have been diagnosed with prostate cancer or are worried about it, you likely have a lot of questions. Learning some basics is a good place to start.

- [What Is Prostate Cancer?](#)

Research and Statistics

See the latest estimates for new cases of prostate cancer and deaths in the US and what research is currently being done.

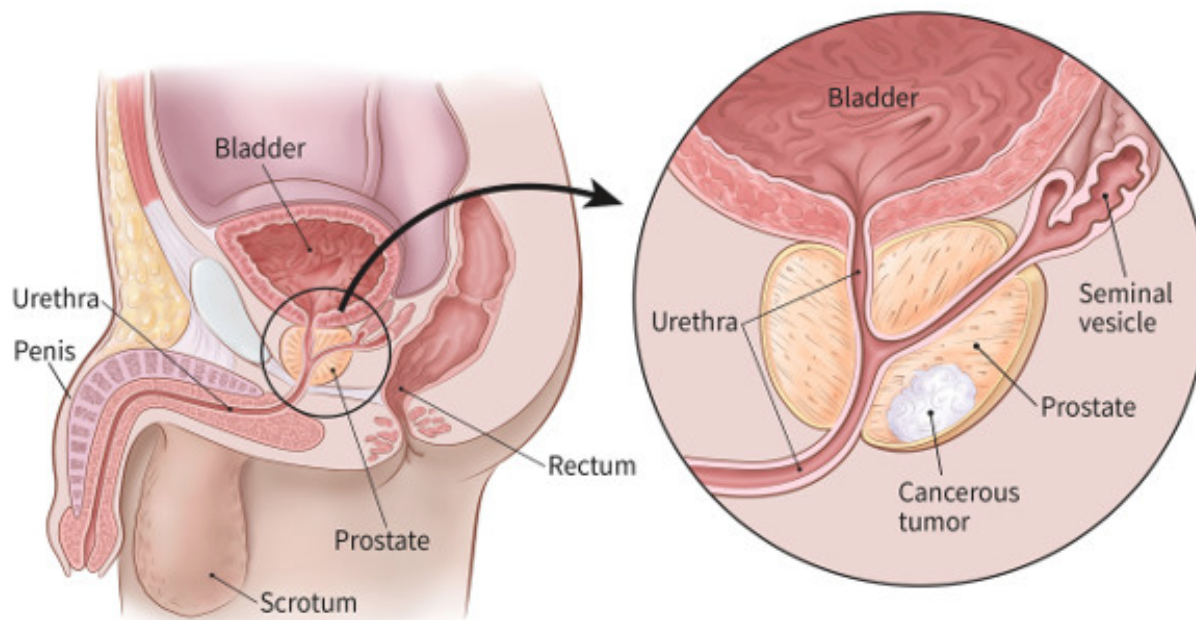
- [Key Statistics for Prostate Cancer](#)
 - [What's New in Prostate Cancer Research?](#)
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What Is Prostate Cancer?

Cancer starts when cells in the body begin to grow out of control. Cells in nearly any part of the body can become cancer cells, and can then spread to other areas of the body. To learn more about cancer and how it starts and spreads, see [What Is Cancer?](#)¹

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 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** that 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 size of the prostate can change 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 (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 carcinomas
- Neuroendocrine tumors (other than small cell carcinomas)
- Transitional cell carcinomas
- Sarcomas

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

Some prostate cancers grow and spread quickly, but most grow slowly. In fact, autopsy studies show that many older men (and even some younger men) who died of other causes also had prostate cancer that never affected them during their lives. In many cases, neither they nor their doctors even knew they had it.

Possible pre-cancerous conditions of the prostate

Some research suggests that prostate cancer starts out as a pre-cancerous condition, although this is not yet known for sure. These conditions are sometimes found when a man has a [prostate biopsy](#)² (removal of small pieces of the prostate to look for cancer).

Prostatic intraepithelial neoplasia (PIN)

In PIN, there are changes in how the prostate gland cells look when seen with a microscope, but the abnormal cells don't look like they are growing into other parts of the prostate (like cancer cells would). Based on how abnormal the patterns of cells look, they are classified as:

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

Low-grade PIN is not thought to be related to a man's risk of prostate cancer. On the other hand, high-grade PIN is thought to be a possible precursor to prostate cancer. If you have a prostate biopsy and high-grade PIN is found, there is a greater chance that you might develop prostate cancer over time.

PIN begins to appear in the prostates of some men as early as in their 20s. But many men with PIN will never develop prostate cancer.

For more on PIN, see [Tests to Diagnose and Stage Prostate Cancer](#)³.

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, but researchers believe that PIA may sometimes lead to high-grade PIN, or perhaps directly to prostate cancer.

Hyperlinks

1. www.cancer.org/treatment/understanding-your-diagnosis/what-is-cancer.html

2. www.cancer.org/cancer/prostate-cancer/detection-diagnosis-staging/how-diagnosed.html
3. www.cancer.org/cancer/prostate-cancer/detection-diagnosis-staging/how-diagnosed.html

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Key Statistics for Prostate Cancer

How common is prostate cancer?

Other than skin cancer, prostate cancer is the most common cancer in American men. The American Cancer Society's estimates for prostate cancer in the United States for 2022 are:

- About 268,490 new cases of prostate cancer
- About 34,500 deaths from prostate cancer

Risk of prostate cancer

About 1 man in 8 will be diagnosed with prostate cancer during his lifetime.

Prostate cancer is more likely to develop in older men and in non-Hispanic Black men. About 6 cases in 10 are diagnosed in men who are 65 or older, and it is rare in men under 40. The average age of men at diagnosis is about 66.

Deaths from prostate cancer

Prostate cancer is the second leading cause of cancer death in American men, behind only lung cancer. About 1 man in 41 will die of prostate cancer.

Prostate cancer can be a serious disease, but most men diagnosed with prostate cancer do not die from it. In fact, more than 3.1 million men in the United States who have been diagnosed with prostate cancer at some point are still alive today.

For statistics related to survival, see [Survival Rates for Prostate Cancer](#)¹.

Visit our [Cancer Statistics Center](#)² for more key statistics.

Hyperlinks

1. www.cancer.org/cancer/prostate-cancer/detection-diagnosis-staging/survival-rates.html
2. cancerstatisticscenter.cancer.org/

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Last Revised: January 12, 2022

What's New in Prostate Cancer Research?

Research into the causes, prevention, detection, testing, and treatment of prostate cancer is being done in many medical centers throughout the world.

Genetics

New research on [gene changes](#)¹ linked to prostate cancer is helping scientists better understand how prostate cancer develops. This could make it possible to design medicines to target those changes.

Tests for abnormal prostate cancer genes might also help identify men at high risk who might benefit from screening or from chemoprevention clinical trials, which use drugs to try to keep them from getting cancer.

In men already diagnosed with prostate cancer, tests for certain gene changes can give men and their doctors a better idea of how likely the cancer is to grow and spread, which might influence treatment options (see below).

Prevention

Researchers continue to look for foods (or substances in them) that can help lower prostate cancer risk. Scientists have found some substances in tomatoes (lycopenes) and soybeans (isoflavones) that might help prevent some prostate cancers. Studies are now looking at the possible effects of these compounds more closely.

Scientists are also trying to develop related compounds that are even more potent and might be used as dietary supplements. But so far, most research suggests that a balanced diet including these foods as well as other fruits and vegetables is probably of greater benefit than taking specific substances as dietary supplements.

One vitamin that may be important in prevention is vitamin D. Some studies have found

that men with high levels of vitamin D seem to have a lower risk of developing the more lethal forms of prostate cancer. Overall though, studies have not found that vitamin D protects against prostate cancer.

Some research has suggested that men who regularly take certain medicines (such as aspirin or cholesterol-lowering statins) for a long time might have a lower risk of getting or dying from prostate cancer. Still, more research is needed to confirm this, and to confirm that any benefit outweighs potential risks.

Scientists have also tested certain hormonal medicines called **5-alpha reductase inhibitors** as a way of reducing prostate cancer risk. This is discussed in [Can Prostate Cancer Be Prevented?²](#)

Early detection

Doctors agree that the prostate-specific antigen (PSA) blood test is not a perfect test for finding prostate cancer early. It misses some cancers, and it sometimes finds cancers that probably never need to be treated. Researchers are working on strategies to address these issues.

One approach is to try to improve on the test that measures the total PSA level, as described in [Screening Tests for Prostate Cancer³](#).

Another approach is to develop new tests based on other forms of PSA, or other tumor markers. Several newer tests seem to be more accurate than the PSA test, including:

- The **Prostate Health Index (PHI)**, which combines the results of total PSA, free PSA, and proPSA to help determine how likely it is that a man has prostate cancer that might need treatment
- The **4Kscore test**, which combines the results of total PSA, free PSA, intact PSA, and human kallikrein 2 (hK2), along with some other factors, to help determine how likely a man is to have prostate cancer that might need treatment
- Tests (such as **Progensis**) that look at the level of **prostate cancer antigen 3 (PCA3)** in the urine after a digital rectal exam (DRE). The DRE pushes some of the prostate cells into the urine. The higher the level, the more likely that prostate cancer is present.
- Tests that look for an abnormal gene change called **TMPRSS2:ERG** in prostate cells in urine collected after a DRE. This gene change is found in some prostate cancers, but it is rarely found in the cells of men without prostate cancer.
- **ExoDx Prostate(IntelliScore)**, or **EPI**, a test that looks at levels of 3 biomarkers in

a urine sample to help determine a man's risk of having aggressive (high-grade) prostate cancer.

- **ConfirmMDx**, which is a test that looks at certain genes in the cells from a prostate biopsy sample.

These tests aren't likely to replace the PSA test any time soon, but they might be helpful in certain situations. For example, some of these tests might be useful in men with a slightly elevated PSA, to help determine whether they should have a [prostate biopsy](#)⁴. Some of these tests might be more helpful in determining if men who have already had a prostate biopsy that didn't find cancer should have another biopsy. Doctors and researchers are trying to determine the best way to use each of these tests.

Diagnosis

Doctors doing prostate biopsies often rely on [transrectal ultrasound \(TRUS\)](#)⁵, which creates black and white images of the prostate using sound waves, to know where to take samples from. But standard ultrasound may miss some areas containing cancer. There are several newer approaches to diagnosing prostate cancer.

- One approach measures blood flow within the gland using a technique called **color Doppler ultrasound**. (Tumors often have more blood vessels around them than normal tissue.) It may make prostate biopsies more accurate by helping to ensure the right part of the gland is sampled.
- An even newer technique may enhance color Doppler further. The patient is first injected with a contrast agent containing microbubbles, which helps improve the ultrasound images. Promising early results have been reported, and further research on this technique is under way.
- Another approach combines MRI and TRUS images to help guide prostate biopsies, especially in men who previously had negative TRUS-guided biopsies but the doctor still suspects have cancer. This test, known as **MRI/TRUS fusion-guided biopsy**, is discussed in [Tests to Diagnose and Stage Prostate Cancer](#)⁶.

Staging

Determining the [stage \(extent\) of prostate cancer](#)⁷ plays a key role in determining a man's treatment options. But imaging tests for prostate cancer such as [CT](#)⁸ and [MRI](#)⁹ scans can't detect all areas of cancer, especially small areas of cancer in lymph nodes,

so doctors are now looking at newer types of imaging tests.

Multiparametric MRI can be used to help determine the extent of the cancer and how aggressive it might be, which might affect a man's treatment options. 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.

Enhanced MRI may help find lymph nodes that contain cancer cells. Patients first have a standard MRI. They are then injected with tiny magnetic particles and have another scan the next day. Differences between the 2 scans point to possible cancer cells in the lymph nodes. Early results of this technique are promising, but it needs more research before it becomes widely used.

For standard positron-emission tomography (PET) scans, a type of radioactive tracer known as FDG is injected into the body and then detected with a special camera. Unfortunately, these scans aren't very helpful in staging prostate cancer. But **newer types of PET scans** may be more helpful in detecting prostate cancer in different parts of the body. These newer tests use tracers other than FDG, such as radioactive sodium fluoride, fluciclovine, choline, or carbon acetate. Some newer tests (known as *PSMA PET scans*) use radioactive tracers that attach to prostate-specific membrane antigen (PSMA), a substance that is often found in large amounts on prostate cancer cells. Some of these newer tests are now being used in certain centers, while others are still being studied. For more information, see [Tests to Diagnose and Stage Prostate Cancer](#)¹⁰.

Treatment

Newer treatments are being developed, and improvements are being made among many standard prostate cancer treatment methods.

Surgery

Doctors are constantly improving the [surgical techniques](#)¹¹ used to treat prostate cancer. The goal is to remove all of the cancer while lowering the risk of complications and side effects from the surgery.

Radiation therapy

As described in [Radiation Therapy for Prostate Cancer](#)¹², advances in technology are making it possible to aim radiation more precisely than in the past. Current methods such as conformal radiation therapy (CRT), intensity modulated radiation therapy (IMRT), and proton beam radiation help doctors avoid giving radiation to normal tissues as much as possible. These methods are expected to increase the effectiveness of radiation therapy while reducing the side effects.

Technology is making other forms of radiation therapy more effective as well. New computer programs allow doctors to better plan the radiation doses and approaches for both external radiation therapy and brachytherapy. Planning for brachytherapy can now even be done during the procedure (intraoperatively).

Newer treatments for early-stage cancers

Researchers are looking at newer forms of treatment for early-stage prostate cancer. These new treatments could be used either as the first type of treatment or after unsuccessful radiation therapy.

One treatment, known as **high-intensity focused ultrasound (HIFU)**, destroys cancer cells by heating them with highly focused ultrasonic beams. This treatment has been used in some countries for a while, and is now available in the United States. Its safety and effectiveness are now being studied, although most doctors in the US don't consider it to be a proven first-line treatment for prostate cancer at this time.

Nutrition and lifestyle changes

Many studies have looked at the possible benefits of specific nutrients (often as supplements) in helping to treat prostate cancer, although so far none have shown a clear benefit. Some compounds being studied include extracts from pomegranate, green tea, broccoli, turmeric, flaxseed, and soy.

One study has found that men who choose not to have treatment for their localized prostate cancer may be able to slow its growth with intensive lifestyle changes. The men in the study ate a vegan diet (no meat, fish, eggs, or dairy products) and exercised frequently. They also took part in support groups and yoga. After one year the men saw, on average, a slight drop in their PSA level. It isn't known if this effect will last since the report only followed the men for 1 year. The regimen may also be hard for some men to follow.

It's important for men thinking about taking any type of nutritional supplement to talk to their health care team first. They can help you decide which ones you can use safely

while avoiding those that might be harmful.

Hormone therapy

Several newer forms of hormone therapy have been developed in recent years. Some of these may be helpful when standard forms of hormone therapy are no longer working.

Some examples include abiraterone (Zytiga), enzalutamide (Xtandi), and apalutamide (Erleada), which are described in [Hormone Therapy for Prostate Cancer](#)¹³. Others are now being studied as well.

5-alpha reductase inhibitors, such as finasteride (Proscar) and dutasteride (Avodart), are drugs that block the conversion of testosterone to the more active dihydrotestosterone (DHT). These drugs are being studied to treat prostate cancer, either to help with active surveillance, or if the PSA level rises after prostatectomy.

Chemotherapy

Studies in recent years have shown that many chemotherapy drugs can affect prostate cancer. Some, such as docetaxel (Taxotere) and cabazitaxel (Jevtana) have been shown to help men live longer.

Results of large studies have shown that giving men with metastatic prostate cancer chemotherapy (docetaxel) earlier in the course of the disease might help them live longer.

Other new chemo drugs and combinations of drugs are being studied as well.

Immunotherapy

The goal of immunotherapy is to boost the body's immune system to help fight off or destroy cancer cells.

Vaccines

Unlike vaccines against infections like measles or mumps, prostate cancer vaccines are designed to help treat, not prevent, prostate cancer. One possible advantage of these types of treatments is that they seem to have very limited side effects. An example of this type of vaccine is sipuleucel-T (Provenge), which has received FDA approval (described in [Immunotherapy for Prostate Cancer](#)¹⁴).

Several other types of vaccines to treat prostate cancer are being tested in clinical trials.

Immune checkpoint inhibitors

An important part of the immune system is its ability to keep itself from attacking other normal cells in the body. To do this, it uses “checkpoints” – proteins on immune cells that need to be turned on (or off) to start an immune response. Cancer cells sometimes use these checkpoints to avoid being attacked by the immune system. But newer drugs that target these checkpoints hold a lot of promise as cancer treatments.

For example, newer drugs such as pembrolizumab (Keytruda) and nivolumab (Opdivo) target the immune checkpoint protein PD-1, while atezolizumab (Tecentriq) targets the related PD-L1 protein. These types of drugs have been shown to be useful in treating many types of cancer, including some prostate cancers with [DNA mismatch repair \(MMR\) gene](#)¹⁵ changes (although these are rare in prostate cancer). Studies are now being done to see how well these drugs might work against other prostate cancers.

One promising approach for the future might be to combine a checkpoint inhibitor with another drug. For example, combining it with a prostate cancer vaccine might strengthen the immune response and help the vaccine work better. Other types of drugs might help the immune system better recognize the cancer cells, which might help the checkpoint inhibitor itself work better.

Chimeric antigen receptor (CAR) T-cell therapy

In this treatment, immune cells called T cells are removed from the patient’s blood and altered in the lab so they have receptors called chimeric antigen receptors (CARs) on their surface. These receptors can be made to attach to proteins on the surface of prostate cells. The altered T cells are then multiplied in the lab and put back into the patient’s blood. The hope is that they can then find the prostate cancer cells in the body and launch a precise immune attack against them.

This technique has shown some encouraging results against prostate cancer in early clinical trials, but more research is needed to see how useful it can be. CAR T-cell therapy for prostate cancer is a complex treatment with potentially serious side effects, and it is only available in clinical trials at this time.

Targeted therapy drugs

Newer drugs are being developed that target specific parts of cancer cells or their surrounding environments. Each type of targeted therapy works differently, but all alter

the way a cancer cell grows, divides, repairs itself, or interacts with other cells.

PARP inhibitors

Some men with prostate cancer have mutations in DNA repair genes (such as *BRCA2*) that make it hard for cancer cells to fix damaged DNA. Drugs called poly-adenosine diphosphate ribose polymerase (PARP) inhibitors work by blocking a different DNA repair pathway. Cancer cells are more likely to be affected by these drugs than normal cells.

PARP inhibitors such as olaparib, rucaparib, and niraparib have shown promising results in early studies of men with one of these gene mutations, and these drugs are now being studied in larger clinical trials.

Monoclonal antibodies

These are manmade versions of immune proteins that can be designed to attach to very specific targets on cancer cells (such as the PSMA protein on prostate cancer cells). For prostate cancer, most of the monoclonal antibodies being studied are linked to chemo drugs or to small radioactive molecules. The hope is that once injected into the body, the antibody will act like a homing device, bringing the drug or radioactive molecule directly to the cancer cells, which might help them work better. Several monoclonal antibodies are now being studied in clinical trials.

Treating prostate cancer that has spread to the bones

Doctors are studying the use of **radiofrequency ablation (RFA)** to help control pain in men whose prostate cancer has spread to one or more areas in the bones. During RFA, the doctor uses a CT scan or ultrasound to guide a small metal probe into the area of the tumor. A high-frequency current is passed through the probe to heat and destroy the tumor. RFA has been used for many years to treat tumors in other organs such as the liver, but its use in treating bone pain is still fairly new. Still, early results are promising.

Hyperlinks

1. www.cancer.org/cancer/prostate-cancer/causes-risks-prevention/what-causes.html
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