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Rhabdomyosarcoma Causes, Risk Factors, and Prevention

Risk Factors and Causes

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

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

Prevention

There are no proven lifestyle-related or environmental causes of RMS, so at this time there is no way to protect against these cancers.

- [Can Rhabdomyosarcoma Be Prevented?](#)

Risk Factors for Rhabdomyosarcoma

A risk factor is anything that affects the chance of having a disease such as cancer. Different cancers have different risk factors.

Lifestyle-related risk factors such as body weight, physical activity, diet, and tobacco use play a major role in many adult cancers. But these factors usually take many years

to influence cancer risk, and they are not thought to play much of a role in cancers that are more common in childhood, including rhabdomyosarcoma (RMS).

Age and gender

RMS is most common in children younger than 10, but it can also develop in teens and adults. It is slightly more common in boys than in girls.

Inherited conditions

Some people have a tendency to develop certain types of cancer because they have inherited changes in their DNA (genes) from their parents. Some rare inherited conditions increase the risk of RMS (and usually some other tumors as well):

- Members of families with **Li-Fraumeni syndrome** are more likely to develop sarcomas (including RMS), breast cancer, leukemia, and some other cancers.
- Children with **Beckwith-Wiedemann syndrome** have a high risk of developing Wilms tumor, a type of kidney cancer, but they are also more likely to develop RMS and some other types of childhood cancer.
- **Neurofibromatosis type 1**, also known as *von Recklinghausen disease*, usually causes multiple nerve tumors (especially in nerves of the skin), but it also increases the risk of RMS.
- **Costello syndrome** is very rare. Children with this syndrome have high birth weights but then fail to grow well and are short. They also tend to have a large head. They are prone to develop RMS as well as some other tumors.
- **Noonan syndrome** is a condition in which children tend to be short, have heart defects, and can be slower than typical children in developing physical skills and learning things. They are also at higher risk for RMS.

These conditions are rare and account for only a small fraction of RMS cases. But they suggest that the key to understanding RMS might come from studying genes and how they work in very early life to control cell growth and development.

Exposures before birth

Some studies have suggested that being exposed to x-rays before birth might be linked with an increased risk of RMS in young children. Parental use of drugs such as marijuana and cocaine has been suggested as a possible risk factor as well. But the

studies that have found these links have been small, and more research is needed to see if these factors are truly linked to RMS.

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What Causes Rhabdomyosarcoma?

The cause of most cases of rhabdomyosarcoma (RMS) is not well understood, and there are very few known [risk factors](#) for this type of cancer. But researchers are learning how normal cells become cancerous because of certain changes in their DNA.

DNA is the chemical in each of our cells that makes up our **genes**, which control how our cells function. Genes are packaged in chromosomes (long strands of DNA in each cell). We normally have 23 pairs of chromosomes in each cell (one set of chromosomes comes from each parent). We usually look like our parents because they are the source of our DNA. But DNA affects more than how we look.

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

- Genes that help cells grow, divide, or stay alive are called **oncogenes**.
- Genes that slow down cell division or make cells die at the right time are called **tumor suppressor genes**.

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

Gene changes affecting RMS

A small portion of people with RMS have inherited gene changes from a parent that put them at higher risk. For example, people with Li-Fraumeni syndrome have changes in the *TP53* tumor suppressor gene, which cause it to make a defective p53 protein. The p53 protein normally causes cells with DNA damage to either pause and repair that damage or, if repair is not possible, to self-destruct. When p53 is not working, cells with DNA damage keep dividing, which can lead to further defects in other genes, and eventually cancer.

Gene changes in ARMS

Certain genes in a cell can be turned on when bits of DNA are switched from one chromosome to another. This type of change, called a *translocation*, can happen when a cell is dividing into 2 new cells. This seems to be the cause of most cases of alveolar rhabdomyosarcoma (ARMS). In these cancers, a small piece of chromosome 2 (or, less often, chromosome 1) often ends up on chromosome 13. This moves a gene called *PAX3* (or *PAX7* if it's chromosome 1) right next to a gene called *FOXO1*, creating a ***PAX/FOXO1 fusion gene***. The *PAX* genes play an important role in cell growth while an embryo's muscle tissue is being formed, but these genes usually shut down once they're no longer needed. Moving one of them next to the *FOXO1* gene keeps the *PAX* gene active, which seems to be what leads to the tumor forming.

Other translocations or other types of gene changes are also sometimes seen in ARMS. In fact, about 1 out of 4 cancers that doctors would usually classify as ARMS have been found *not* to have the *PAX/FOXO1* fusion gene typically seen in ARMS. Doctors have found that these cancers act more like embryonal rhabdomyosarcoma (ERMS), which generally requires less intensive treatment than ARMS.

Gene changes in ERMS

Research suggests that embryonal rhabdomyosarcoma (ERMS) develops in a different way. Cells of this tumor typically have lost a small piece of chromosome 11 that came from a person's mother, and it has been replaced by a second copy of that part of the chromosome from their father. This seems to make the *IGF2* gene on chromosome 11 overactive. The *IGF2* gene codes for a protein that can make these tumor cells grow. Other gene changes are probably important in these tumors as well.

Other gene changes

Changes in several different genes are usually needed for normal cells to become cancer cells. Scientists have found some other gene changes that set some RMS cells apart from normal cells, but there are likely still others that haven't been found yet.

What causes gene changes?

Researchers now understand many of the gene changes that can lead to RMS, but it's still not clear what causes these changes. Some gene changes can be inherited from a parent. Others might just be a random event that sometimes happens inside a cell, without having an outside cause. There are no known lifestyle-related or environmental causes of RMS, so it's important to know that there is nothing children with RMS or their parents could have done to prevent these cancers.

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Can Rhabdomyosarcoma Be Prevented?

The risk of many cancers that typically occur in adults can be reduced with certain lifestyle changes (such as staying at a healthy weight or quitting smoking), but at this time there are no known ways to prevent most cancers in children.

The only known **risk factors** for rhabdomyosarcoma (RMS) – age, gender, and certain inherited conditions – can't be changed. There are no proven lifestyle-related or environmental causes of RMS, so at this time there is no known way to protect against these cancers.

References

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