

Cancer Risk Factors

Prevention

1. Cancers risk factors include exposure to chemicals, or other substances and certain behavior.
2. They also include things that people cannot control, like age and family history. **A family history of certain cancers can signify a possible inherited cancer syndrome.**
3. Most cancer risk and protective factors are initially identifies in epidemiology studies. In these studies, scientists look at large groups of people and compare those who develop cancer with those who don't. These studies may show that people who develop cancer are more or less likely to behave in certain ways or to be exposed to certain substances than those who do not develop cancer.
4. The list below includes the most

studied known or suspected risk factors for cancer. Although some risk factors can be avoided, others, such as growing older cannot. Limiting your exposure to avoidable risk factors may lower your risk of developing certain cancers.

5. Most studies known or suspected risk factors

- ✓ Age
- ✓ Alcohol
- ✓ Cancer-Causing substances
- ✓ Chronic inflammation
- ✓ Diet
- ✓ Hormones
- ✓ Immunosuppression(**reduction or weakening of the body's immune system**)
- ✓ Infectious agents
- ✓ Obesity
- ✓ Radiation

- ✔ Sunlight
- ✔ Tobacco

6. Factors that are known to increase the risk of cancer

- Cigarette smoking and tobacco use
- Infections
- Radiation
- Immunosuppressive medicines after organ transplant.

7. Factors that may affect the risk of cancer

- Diet
- Alcohol
- Physical activity
- Obesity
- Diabetes
- Environmental risk factors

8. Tobacco is strongly linked to an increased risk of many kinds of cancer.

Smoking cigarettes is the leading cause of the following types of cancer:

- Acute myelogenous leukemia(AML)
- Bladder cancer
- Cervical cancer
- Esophageal cancer
- Kidney cancer
- Lung cancer
- Oral cavity cancer
- Pancreatic cancer
- Stomach cancer

9. It is believed that smoking causes 30% of all the cancer deaths in the United States.

10. Certain viruses and *bacteria* are able to cause cancer. Viruses and other infection causing agents cause more cases of cancer in the developing world (about 1 in 4 cases) than in developed nations(less than 1 in 10 cases of

cancer)

11. Examples of cancer causing bacteria and viruses include

- ✓ Human papillomavirus(HPV) increases the risk for cancers of the cervix, penis, vagina, anus and oropharynx.
- ✓ Hepatitis B and C viruses increase the risk of liver cancer
- ✓ Epstein- barr virus increases the risk of burrito lymphoma
- ✓ Helicobacter pylori increases the risk of gastric cancer.

12. Two vaccines to prevent infection by cancer causing agents have already been developed and approved by USFDA. One vaccine is to prevent infection with Hepatitis B virus and the other protects against infection with strains of Human papillomavirus(HPV) that causes cervical cancer.

13. Being exposed to radiation is a

known cause of cancer. There are two main type of radiation linked with increased risk for cancer.

- **Ultraviolet radiation** from sunlight; This is the **main cause of non-melanoma skin cancers**.
- **Ionizing Radiation**: These includes medical radiations from tests to diagnose cancer, such as X-rays, CT- scans, fluoroscopy, and nuclear medicine scans
- **Radon gas in our homes**

14. Scientists believe that ionizing radiation causes leukemia, thyroid cancer, and breast cancer in women. Ionizing radiation may also be linked to myeloma a decayers of the lung, stomach, colon, esophagus, bladder, and ovary. Being exposed to radiation from diagnostic X-rays increase the risk of cancer in patients and Xray technicians.

15. The growing use of CT scans over

the last 20 years has increased exposure to ionizing radiation. The risk of cancer also increases with the number of CT scans a patient has, and the radiation dose used each time.

16. Immunosuppressive medicines are used after an organ has been transplanted from one person to another. These medicines stop an organ that has been transplanted from being rejected. These medicines decrease the body's immunity and help prevent organ rejection. Immunosuppressive medicines are linked to an increased risk of cancer because they lower the body's ability to keep cancer from forming. The risk of cancer, especially cancer caused by a virus, is higher in the first 6 months after the organ transplant, but the risk lasts for many years.

17. Ways to avoid or control things known to cause cancer:

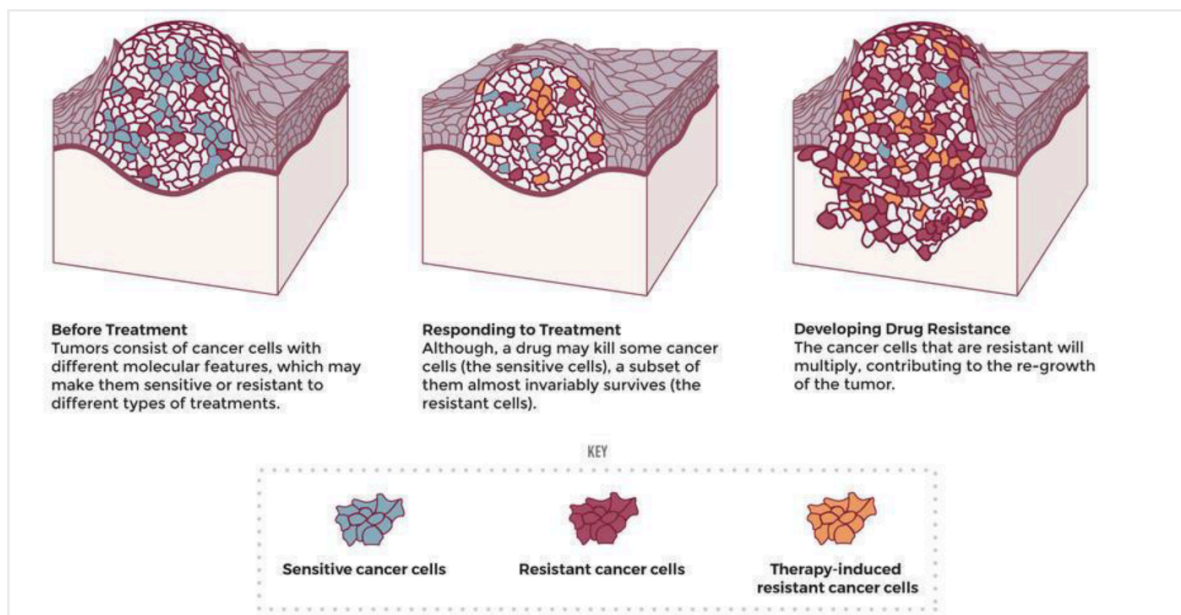
- Changes in diet and lifestyle
- Finding precancerous conditions early. These conditions are those that may become cancer.
- Chemoprevention into treat a precancerous condition to to keep cancer from starting
- Risk reducing surgery

Adaptation to Cancer Therapy

What is drug resistance?

1. It is the major case of cancer treatment failure. While a treatment may be effective initially , the heterogeneity of cancer and its ability to adapt can allow the cancer to become resistant to the treatment and regrow. Solving the puzzle of why this

happens and how to overcome or prevent it is a goal that NCI is pursuing on many fronts, including basic science to understand biological mechanisms and clinical trials testing new treatment strategies.



How cancer cells become drug resistant?

1. Poor Drug penetration: Drug can not get into the cancer cells easily
2. Rapid drug efflux: Drug can get into the cancer cells normally, but get out very fast before reaching its target
3. Target loss: Drug target protein/molecule inside the cancer cells disappears

4. Drug is neutralized by the cancer cells readily
5. Drug mutates the genetic material inside the cancer cells but its is fixed readily by the cancer cells

Adaptive therapy strategy

Traditional Maximum Tolerated Dose (MTD) Approach:

- Gives the highest safe dose continuously
- Quickly eliminates drug-sensitive cancer cells (purple cells)
- Creates intense selection pressure favoring drug-resistant cells (green cells)
- Leads to "competitive release" - resistant cells multiply rapidly without competition
- Results in rapid treatment failure

Adaptive Therapy Strategy:

- Uses an evolution-based approach
- Stops treatment *before* all sensitive cells are eliminated
- Allows sensitive cells to out-compete

resistant cells during treatment breaks

- Takes advantage of the fact that sensitive cells typically have a fitness advantage over resistant cells when no drug is present
- "Steers" the tumor back toward its pre-treatment, drug-sensitive state

Key Advantages of Adaptive Therapy

- Maintains tumor control for much longer periods
- Mathematical models suggest it can work for up to 20 treatment cycles
- Significantly extends treatment effectiveness compared to continuous therapy
- Eventually fails as resistant cells gradually accumulate, but provides much longer disease control

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