UV (Ultraviolet) Radiation and Cancer Risk

UV (ultraviolet) radiation is a type of **electromagnetic radiation.** Like all radiation, UV radiation is energy that spreads as it travels. Exposure to UV, either from the sun or other sources, is a major risk factor for skin cancer.

Types of UV radiation

Different types of radiation[1] are described by the amount of energy particles (photons) they have and give off.

There are different types of UV rays, based on how much energy they have. They are all a type of electromagnetic radiation, which is energy that travels in waves at the speed of light. UV is close to the middle of the electromagnetic spectrum, just above visible light.

Image courtesy of fda.gov

Types of electromagnetic radiation that are lower in energy (lower frequency) include microwaves and radio waves[2]. Higher energy (higher frequency) radiation includes x-rays and gamma rays[3].

Higher energy types of radiation are called **ionizing radiation.** This means they have enough energy to remove an electron from (ionize) an atom or molecule. Ionizing radiation can damage the DNA (genes) in cells, which in turn may lead to cancer.

Some higher types of UV radiation are ionizing, but even the highest-energy UV rays don't have enough energy to penetrate deeply into the body, so their main effect is on the skin.

UV radiation is divided into 3 main groups:

- **UVA rays** have the least energy of UV rays. These rays can cause skin cells to age and can cause some indirect damage to cells' DNA. UVA rays are mainly linked to long-term skin damage such as wrinkles, but they are also thought to play a role in some skin cancers[4].
- **UVB rays** have slightly more energy than UVA rays. They can damage the DNA in skin cells directly and are the main rays that cause sunburns. They are also thought to cause most skin cancers.

- **UVC rays** have more energy than the other types of UV rays. Fortunately, they don't reach the ground because they react with ozone high in our atmosphere. So, they are not normally a risk factor for skin cancer. But UVC rays can also come from some man-made sources, such as arc welding torches, mercury lamps, and UV sanitizing bulbs used to kill bacteria and other germs (such as in water, air, food, or on surfaces).

How are people exposed to UV radiation?

Sunlight

Sunlight is the main source of UV radiation and both UVA and UVB rays can damage your skin. This is because the different types of UV rays reach the ground in different amounts. About 95% of the UV rays from the sun that reach the ground are UVA rays, with the remaining 5% being UVB rays.

The amount of UV exposure a person gets depends on the strength of the rays, the length of time the skin is exposed, and whether the skin is protected with clothing or sunscreen. To learn more, see What Factors Affect UV Risk?

Artificial sources of UV rays

People can also be exposed to artificial sources of UV rays. These include:

- **Sunlamps and sunbeds (tanning beds and booths):** The amount and type of UV radiation someone is exposed to from a tanning bed (or booth) depends on the specific lamps used in the bed, how long a person stays in the device, and how many times the person uses it. Most UV tanning beds emit mostly UVA rays, with the rest being UVB.
- **Phototherapy (UV therapy):** Some skin problems (such as psoriasis) are helped by treatment with UV light. One type of treatment, called PUVA, uses UVA radiation along with a drug called psoralen that makes the skin more sensitive to UV. Another treatment option uses UVB alone, without a drug.
- **Black-light lamps:** These lamps use bulbs that give off UV rays (mostly UVA). The bulb also gives off some visible light, but it has a filter that blocks most of that out while letting the UV rays through. These bulbs have a purple glow and are used to view fluorescent material. Bug-zapping insect traps also use "black light" that gives

- Spending time in the sun for recreation (including going to the beach)
- Spending a lot of time in the sun with unprotected or exposed skin
- Living in an area that gets a lot of sunlight
- Having had serious sunburns in the past (with more sunburns linked to a higher risk)

  Having signs of sun damage to the skin, such as liver spots, actinic keratoses (rough skin patches that can be precancerous), and solar elastosis (thickened, dry, wrinkled skin2ious ugh s..2 0 1 95.35 640 Tm 12 Tf 0 0 0ving hain2i0 Tm 0 u6pending tim /GS1

cancer (that is, if it is a carcinogen), but we do look to other respected organizations for help with this. Based on the available evidence, several expert agencies have evaluated the cancer-causing (carcinogenic) nature of UV radiation.

The **International Agency for Research on Cancer (IARC)** is part of the World Health Organization (WHO). One of its major goals is to identify causes of cancer. Based on the available data, IARC has made the following determinations:

- **Solar radiation** is *carcinogenic to humans*.
- **Use of UV-emitting tanning devices** is *carcinogenic to humans*.
- **UV radiation (including UVA, UVB, and UVC)** is *carcinogenic to humans*.

The **National Toxicology Program (NTP)** is formed from parts of several different US government agencies, including the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA). The NTP has made the following determinations:

- **Solar radiation** is *known to be a human carcinogen*.
- **Exposure to sunlamps or sunbeds** is *known to be a human carcinogen*.
- **Broad-spectrum UV radiation** is *known to be a human carcinogen*.
- **UVA radiation** is *reasonably anticipated to be a human carcinogen*.
- **UVB radiation** is *reasonably anticipated to be a human carcinogen*.
- **UVC radiation** is *reasonably anticipated to be a human carcinogen*.

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- Supports restrictions being put on indoor tanning
- Does not support any statements that promote indoor tanning as “safe”

Are there any other health issues related to UV radiation?

In addition to **skin cancer**, exposure to UV rays can cause other health problems:

- **Sunburn** due to damage from UV rays from the sun and indoor tanning devices
- **Skin damage** that leads to premature aging of the skin and signs of sun damage such as wrinkles, leathery skin, liver spots, actinic keratosis[10], and solar elastosis.
- **Eye problems** due to UV rays causing the cornea (on the front of the eye) become inflamed or burned. They can also lead to the formation of cataracts (clouding of the lens of the eye) and pterygium (tissue growth on the surface of the eye), both of which can impair vision.
- **Weakened immune system** causing the body to have a harder time fending off infections. This can lead to problems such as reactivation of herpes triggered by exposure to the sun or other sources of UV rays. It can also cause vaccines to be less effective.
- **Certain medications** can also make you more sensitive to UV radiation, making you more likely to get sunburned. And certain medical conditions can be made worse by UV radiation.

Hyperlinks

1. www.cancer.org/cancer/risk-prevention/radiation-exposure.html
2. www.cancer.org/cancer/risk-prevention/radiation-exposure/extremely-low-frequency-radiation.html
3. www.cancer.org/cancer/risk-prevention/radiation-exposure/x-rays-gamma-rays.html
4. www.cancer.org/cancer/types/skin-cancer.html
5. www.cancer.org/cancer/types/basal-and-squamous-cell-skin-cancer.html
6. www.cancer.org/cancer/types/melanoma-skin-cancer.html
7. www.cancer.org/cancer/types/merkel-cell-skin-cancer.html
8. www.cancer.org/cancer/types/eye-cancer.html

business-and-entertainment-products/sunlamps-and-sunlamp-products-tanning-bedsbooths on June 26, 2024.

US Food and Drug Administration (FDA). The Risks of Tanning. 2023. Accessed at https://www.fda.gov/radiation-emitting-products/tanning/risks-tanning on June 26, 2024.

US National Toxicology Program (NTP). *15th Report on Carcinogens: Ultraviolet-Radiation-Related Exposures.* 2021. Accessed at https://ntp.niehs.nih.gov/sites/default/files/ntp/roc/content/profiles/ultravioletradiationrelatedexposures.pdf on March 5, 2024.

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Written by

The American Cancer Society medical and editorial content team (https://www.cancer.org/cancer/acs-medical-content-and-news-staff.html)

Our team is made up of doctors and oncology certified nurses with deep knowledge of cancer care as well as editors and translators with extensive experience in medical writing.