Sun Safety Fact Sheet

Health Effects of UV Radiation

UV Radiation has both positive and negative effects. Positive effects of UV radiation include warmth, light, photosynthesis in plants, and vitamin D synthesis in the body. UV radiation also increases moods in people and kills pathogens (see diagram). But overexposure to UV radiation has adverse health effects. Overexposure to UV radiation is the primary environmental risk factor in the development of UV-related adverse health effects, which include diseases of the eye, immune suppression, and skin cancers.

Children are most at risk for overexposure to UV radiation. With one in five Americans developing skin cancer, childhood education about sun protection is a vital step toward reducing risk and improving public health. Many studies have concluded that sun exposure, especially sunburn, during childhood appears to increase the risk of melanoma, the most serious form of skin cancer. Just one or two blistering sunburns in childhood can double a person's risk of developing melanoma later in life.

Children are of particular concern because they spend a lot of time outdoors. Perhaps most importantly, skin cancer and other UV-related adverse health effects are largely preventable if sun protection practices are followed early and consistently. Educating school staff and students about sun safety can prevent many health problems related to overexposure to the sun.

Skin Cancer

According to the American Cancer Society, most of the more than 1 million cases of non-melanoma skin cancer diagnosed yearly in the United States are considered to be sun-related. Melanoma, the most serious type of skin cancer, will account for about 68,720 cases of skin cancer in 2009 and most (about 8,650) of the 11,590 deaths due to skin cancer each year.

Exposure to UV radiation appears to be the most important environmental factor in the development of skin cancer. Scientists believe that the increase in skin cancer has resulted from:

- Increased outdoor leisure time
- Decrease in the amount of clothing worn outdoors
- Decrease in atmospheric ozone levels

Skin cancer is a largely preventable disease. Exposure to UV radiation may be the most important preventable factor in determining a person's risk for skin cancer. There are three major types of skin cancers: basal cell carcinoma, squamous cell carcinoma, and melanoma

Basal Cell and Squamous Cell Cancers

Basal cell carcinoma is the most commonly diagnosed skin cancer. Basal cell carcinoma usually appears on overexposed skin on the face, ears, lips, and particularly the nose. Rarely does basal cell carcinoma result in death, but it can spread and cause more serious health problems. Basal cell carcinomas can start as a red patch or shiny bump that is pink, red, or white. It may be crusty or have an open sore that won't heal.

Squamous cell carcinoma is the second most common of skin cancers. Unlike basal cell carcinoma, it is more aggressive and can spread to other parts of the body and may result in death. Because of effective early detection and treatment, basal and squamous cell carcinomas have a cure rate of more than 95 percent. Squamous cell carcinomas appear as a scaly patch or raised warty growth.

Melanoma

Malignant melanoma is the most deadly of the three major skin cancers. The incidence of melanoma is increasing at a rate faster than that of any other cancer. Melanoma cases in the United States have almost doubled in the past two decades. Receiving one or two blistering sunburns before the age of 18 at least doubles an individual's risk for developing melanoma. Melanomas are usually dark brown or black mole-like patches with irregular edges.

Melanoma is the most aggressive of the skin cancers. If not caught early, melanoma can spread to other parts of the body and can be fatal. However, when detected early, it is one of the most curable cancers.

Eye Damage

Sunlight is the primary source of UV radiation that can damage tissues of the eye. Results from dozens of studies suggest that spending long hours in the sun without eye protection increases the chances of developing eye diseases, including cataracts. The 1998 Journal of the American Medical Association reported that even low amounts of sunlight can increase the risk of developing eye disorders.

The American Academy of Ophthalmology has cautioned that excess exposure to UV radiation may increase the incidence of cataracts. Cataracts are a form of eye damage that causes the loss of transparency in the lens, clouding vision. Everyone is at risk for developing cataracts. Another potential effect of UV radiation is a "burning" of the eye surface, called "snow blindness" or photokeratitis from sunlight. The effects usually disappear within a couple of days, but may lead to further complications later in life. UVB damage to the eyes is also cumulative, so it is never too late for people to start protecting their eyes.

Photoaging/Wrinkling

A very high percentage of age-associated cosmetic skin problems can be attributed to sun. Chronic overexposure to the sun changes the texture and weakens the elastic properties of the skin. The epidermis, which is the outer layer of the skin, thickens, becomes leathery, and wrinkles as a result of sun exposure. The difference between skin tone, wrinkles, or pigmentation on the underside of a person's arm and the top side of the same arm illustrate the effects of sun exposure on skin. In most cases, the top side of the arm has had more exposure to the sun and shows greater sun damage. Sun-induced skin damage causes wrinkles and furrows, easy bruising, brown or "liver spots", precancerous lesions (actinic keratoses), and potentially skin cancer. Because photoaging of the skin is cumulative, it is never too late for a person to start a sun protection program.

Immune System Suppression

Scientists believe sunburns can alter the distribution and function of disease-fighting white blood cells in humans for up to 24 hours after exposure to the sun. Repeated overexposure to UV radiation can cause more damage to the body's immune system. Mild sunburns can directly suppress the immune functions of human skin where the sunburn occurred, even in people with dark skin.

Risks from Overexposure to UV Radiation

Exposure to UV radiation appears to be the most important environmental factor in the development of skin cancer and other UV related adverse health effects. Besides the immediate effect of sunburn, over time excess ultraviolet radiation can cause skin cancer, eye damage, immune system suppression, and premature aging.

Skin type is the most important factor in determining a person's risk for skin cancer. Skin types range from those individuals that burn easily and never suntan to those who do not burn at all. Some individual characteristics that are risk factors for skin cancer include

- fair skin,
- blue, green, or hazel eyes,
- light-colored hair,
- tendency to burn rather than suntan,
- history of severe burns, many moles,
- freckles,
- a family history of skin cancer.

Even people with dark complexions can get a sunburn. No one is exempt from the possibility of getting skin cancer or other serious health problems from the sun's UV rays.

The level of UV radiation that reaches the earth's surface is dependent on several factors.

- **Ozone**: The stratospheric ozone layer protects all life on earth from excessive exposure to UV radiation from the sun.
- **Intensity**: The sun's intensity varies throughout the day much like visible light. Around noon, the sun is at its highest, so the sun's rays have less distance to travel through the atmosphere and the intensity is highest.
- **Time of year**: Time of year causes the UV rays to vary.
- **Geographical location**: The sun's rays are strongest at the equator, where the sun is most directly overhead.
- **Altitude**: UV intensity increases with altitude because there is less atmosphere to absorb the damaging rays.
- **Weather**: Cloud cover reduces the amount of UV radiation reaching the earth.
- **Reflection**: UV rays are reflected off surfaces such as snow, water, sand, and concrete.

Preventing Harmful Effects of the Sun

Sunburn, skin cancers, and other sun-related adverse health effects are largely preventable when sun protection is practiced early and consistently. Despite the fact that suntanning and burning increase skin cancer risks, most Americans do not protect themselves from the sun's damaging rays.

Attitudinal barriers to the sun must be addressed and changed before behaviors will change. Attitudinal barriers to sun protection include the beliefs that it is necessary to use sunscreens only while at the beach or pool rather than year round, "a suntanned body is a healthy body," and "you can only get a sunburn in the summer". To overcome these barriers, education must begin early so habits can be developed early and consistently. Still, it is never too late to start sun protective habits.

The best sun protection is provided when all the sun-safe behaviors are practiced together. Sun protection habits include

- Limit sun exposure during the hours when the sun's rays are the strongest, 10am to 4pm. To the extent possible, people should limit their exposure to the sun during these hours and practice all of the sun protective behaviors. Your shadow is an indicator of the sun's intensity. If your shadow is shorter than you are, the sun is at its highest intensity. The American Academy of Dermatology has established the Shadow Rule: No Shadow-SEEK SHADE.
- Refer to the daily UV index when planning outdoor events. The UV Index is a daily forecast of the intensity of the sun's UV rays. The Index indicates the risk of overexposure to skin-damaging UV radiation and can be used to help plan outdoor activities to minimize overexposure.
- Seek shade whenever possible. Shade structures such as trees and umbrellas provide year round protection. Although trees do not offer complete sun protection, they provide about 60 percent blockage from the sun's rays.
- Wear a wide-brimmed hat, sunglasses, and long-sleeved, tightly woven clothing. Clothing can physically block out the sun's harmful rays and should be one of the first lines of defense against sun exposure. Sunglasses should block out 100 percent of UVA and UVB radiation to protect the eyes from damage. Hats are the best way to minimize UV radiation exposure to the face, head, ears, and neck.
- Use broad-spectrum sunscreens whose active ingredients block UVA and UVB rays. The Sun Protective Factor (SPF) should be a minimum of 15. Sunscreens should be used every day, including cloudy days. They should be applied liberally and evenly before going out into the sun and should be applied frequently, especially after swimming.
- Avoid tanning salons. Artificial UV radiation is just as bad for your skin as sunlight. Most tanning devices use UVA rays which have been shown to go deeper into the skin and contribute to premature wrinkling and skin cancer.
- Limit exposure to the reflective surfaces like snow and water. UV rays can be reflected off of sand, tile, water, snow, and buildings. It is important to practice all the sun protective behaviors even when you are in the shade.

What Is the UV Index

The ozone layer shields the Earth from harmful UV radiation. Ozone depletion, as well as seasonal and weather variations, causes different amounts of UV radiation to reach the Earth at any given time. The UV Index is a daily forecast of the UV radiation levels people might experience. The Index predicts the next day's levels on a 0 to 10+ scale, helping people determine appropriate sun protection behaviors.

0 to 2 Minimal

A UV Index reading of 0 to 2 means minimal danger from the sun's UV rays for the average person. Most people can stay in the sun for up to one hour during the hours of peak sun strengths, 10 a.m. to 4 p.m., without burning. People with very sensitive skin and infants should always be protected from prolonged sun exposure.

3 to 4 Low

A UV Index reading of 3 to 4 means low risk of harm from unprotected sun exposure. Fair-skinned people, however, might burn in less than 20 minutes. Wear a hat with a wide brim and sunglasses to protect your eyes. Use a sunscreen with an SPF of at least 15 and wear long-sleeved shirts and long pants when outdoors.

5 to 6 Moderate

A UV Index reading of 5 to 6 means moderate risk of harm from unprotected sun exposure. Fair-skinned people might burn in less than 15 minutes. Apply a sunscreen with an SPF of at least 15. Wear a wide-brim hat and sunglasses to protect your eyes. Use sunscreen if you work outdoors and remember to protect sensitive areas like the nose and the rims of the ears. Sunscreen prevents sunburn and some of the sun's damaging effects on the immune system. Use lip balm or lip cream containing a sunscreen. Lip balms can help protect some people from getting cold sores.

7 to 9 High

A UV Index reading of 7 to 9 means high risk of harm from unprotected sun exposure. Fair-skinned people might burn in less than 10 minutes. Minimize sun exposure during midday hours, from 10 a.m. to 4 p.m. Protect yourself by liberally applying a sunscreen with an SPF of at least 15. Wear protective clothing and sunglasses to protect the eyes. When outside, seek shade. Don't forget that water, sand, pavement, and grass reflect UV rays even under a tree, near a building, or beneath a shady umbrella. Wear long-sleeved shirts and trousers made from tightly woven fabrics. UV rays can pass through the holes and spaces of loosely knit fabrics.

10+ Very High

A UV Index reading of 10+ means very high risk of harm from unprotected sun exposure. Fair-skinned people might burn in less than 5 minutes. Outdoor workers are especially at risk as are vacationers who can receive very intense sun exposure. Minimize sun exposure during midday hours, from 10 a.m. to 4 p.m. Apply sunscreen with an SPF of at least 15 liberally every 2 hours. Avoid being in the sun as much as possible. Wear sunglasses that block 99 to 100 percent of all UV rays (both UVA and UVB). Some reduction in blue light also might be beneficial but colors should not be severely distorted. Wear a cap or hat with a wide brim, which will block roughly 50 percent of UV radiation from reaching the eyes. Wearing sunglasses as well can block the remainder of UV rays.

For more information about the UV Index, contact EPA's Stratospheric Protection Hotline at (800) 296-1996 or the UV Index Web site at www.epa.gov/ozone/uvindex/uvover.html.