Skin Cancer and Sunlight Canada

Does sunlight cause skin cancer?

There is evidence that sunlight causes skin cancer. Skin cancer can be treated and cured without serious consequences. However, in some cases the condition can be life-threatening if not diagnosed in time.

Skin cancer is an occupational concern for people who work under the sun. The risk however, may be reduced through awareness of the problem, and by taking measures to prevent exposure to sunlight.

Are there different types of radiation in sunlight?

Yes. The types of radiation include:

- visible light, which gives us the colours we see
- infrared radiation which gives us the warmth we feel
- ultraviolet (UV) radiation

Except in extreme situations, neither visible light nor infrared radiation from sunlight causes health problems. However, ultraviolet (UV) radiation can cause harmful effects to the skin.

There are three basic types of ultraviolet radiation:

- UVA (long-wave UV)
- UVB (sunburn UV)
- UVC (short-wave UV)

Table 1 summarizes the general features of each type.

Table 1
Types of Ultraviolet Radiation and Their Features

Ultraviolet Radiation Type	General Features

Ultraviolet A radiation UVA, long-wave UV)	**-not filtered out in the atmosphere -passes through glass -produces some tanning -once considered harmless but now believed harmful over the long term -levels remain relatively constant throughout the day**
Ultraviolet B radiation (UVB, sunburn radiation)	**-some filtered out in the atmosphere by the ozone layer -does not pass through glass -causes sunburn, tanning, wrinkling, aging of the skin and skin cancer -highest intensity at noontime**
Ultraviolet C radiation (UVC, short-wave UV)	**-filtered out in the atmosphere by the ozone layer before reaching earth -major artificial sources are germicidal lamps (to kill bacteria) -burns the skin and causes skin cancer**

How does sunlight affect the skin?

When ultraviolet radiation reaches the skin, some radiation is reflected away from the surface. The remaining radiation is scattered into the tissues just beneath the skin's surface. A fraction of this radiation is absorbed by the skin's living cells.

Ultraviolet radiation absorbed by living cells damages sensitive substances that influence the skin's normal growth and appearance. Damage can result in:

- sunburn
- increased rate of aging of the skin
- skin cancer

Sunburn

Sunburn is the most familiar and immediate effect of ultraviolet radiation on the skin. It is an inflammation caused by an increase in blood-flow beneath the skin. The reaction is not normally instantaneous, but reaches a bright red colour within 15 to 20 hours. The condition can be very painful and sometimes causes peeling of the skin.

Brief intense exposure can cause severe sunburn in people who are not accustomed to strong sunlight. There is evidence that this type of exposure, as well as long-term exposures, might be linked to serious forms of skin cancer later in life.

Increased Rate of Aging of the Skin

Repeated exposure to the sun's ultraviolet radiation eventually causes skin damage similar to the aging process. Patches of skin become thin and less elastic, and develop blemishes, sun freckles, and wrinkles. These changes may take many years of exposure but when they occur, the damage is irreversible.

Skin Cancer

If exposure to sunlight continues for several years, the damaged skin has an increased chance of developing one of the forms of skin cancer. Exposure to ultraviolet radiation increases the risk of developing these cancers (although it may not be the only cause of the disease). While the exact relationship is not 100% defined, it appears that intermittent (occasional) exposure and exposure during childhood and adolescence are likely important predictors for basal cell carcinoma, and cutaneous malignant melanoma. High levels of chronic exposure, such as working outdoors, is more often associated with squamous cell tumours.

The following facts also link sunlight exposure to skin cancer:

- Most skin cancer occurs in areas of skin most heavily exposed to sunlight (ears, forehead, arms, etc).
- Skin cancer among people who are sensitive to sunlight is more common in regions with stronger sunlight.
- People with genetic diseases that make them more sensitive to sunlight have a greater chance of developing skin cancer.
- Studies show that ultraviolet radiation similar to sunlight causes skin cancer in animals.

What types of skin cancer are linked to sunlight exposure?

Three different types of skin cancer are linked to sunlight exposure:

- basal cell cancer
- squamous cell cancer
- malignant melanoma

Basal Cell Cancer

Basal cell cancer is the most common of all cancers in North America and Europe. It is usually found in areas of the skin exposed to sunlight, but sometimes occurs in other areas as well. This type of skin cancer appears as a raised, hard, red or red-grey, pearly wound often found on the forehead, eyelids, cheeks, nose, and lips. Although there is always a chance it could become serious, basal cell cancer usually does not spread. Most cases are easily treated and cured.

Squamous Cell Cancer

Squamous cell cancer occurs most frequently on the skin exposed to sunlight over long periods of time. As such, this type of skin cancer tends to develop where maximum exposure to radiation occurs – forehead, cheeks, nose, lower lip, and tops of the ears. It also usually develops in areas where the skin has been damaged by the sun – areas with blemishes or sun freckles. The blemishes develop into rough, scaly patches with small areas of open wound that do not heal. They eventually grow into larger wounds with crusts. This type of cancer can be removed with a good chance of total cure, if caught in time. It is most dangerous if it occurs on mucous membranes such as on the lip.

Malignant Melanoma

Malignant melanoma, although rarer, is the most serious of the skin cancers. It often shows itself as a mole or pigment spot that begins to bleed, grow, or change its colour, shape or texture. It usually spreads if not treated in the early stage. The exact nature of the relationship between malignant melanoma and sun light is not completely clear. However, brief intense exposure (intermittent exposure) to strong sunlight appears to increase the risk of malignant melanoma in people who are not used to strong sunlight. If caught early, malignant melanoma can be treated and

cured. If treatment is delayed, it is often fatal.

What factors affect a person’s risk?

Four main factors influence the risk of skin cancer:

- skin pigment and ability to tan
- heredity
- exposure to chemicals
- amount of exposure to sunlight

Skin Pigment and Ability to Tan

Ultraviolet radiation from sunlight affects everybody’s skin to some extent, but the skin’s response varies widely from person to person. Peoples’ sensitivity to the sun varies according to the amount of pigment in the skin and the skin’s ability to tan.

Ultraviolet radiation causes tanning in two different ways: by immediate tanning and by delayed tanning. Immediate tanning causes the skin to darken in response to UVA. This darkening begins during the period of exposure, but fades within a few hours or days. The amount of tanning increases according to the skin’s natural darkness and previous amount of tanning.

Delayed tanning occurs two to three days after exposure to either UVA or UVB. It lasts from several weeks to months, and is maintained by repeated exposure to sunlight. With delayed tanning, the skin increases its production and distribution of dark pigment. The skin also becomes thicker. These changes can follow sunburning or develop gradually over a long period of repeated brief exposures to sunlight.

Some people burn easily after the first hour of sun exposure following winter or any period away from the sun. Other people, especially those with dark skin, rarely burn. This difference in reaction makes it possible to classify skin into one of six different types (see Table 2).

Table 2
Classification of Skin Types

Type	Natural Skin Colour	UV Sensitivity and Tendency to Burn	Skin Cancer Risk
1	Very fair, pale white, often freckled	Highly sensitive. Always burns, never tans.	Greatest risk of skin cancer.
2	Fair, white skin	Very sensitive. Burns easily, tans minimally.	High risk of skin cancer.
3	Light brown	Sensitive. Burns moderately, usually tans.	High risk of skin cancer.

4	**Moderate brown**	**Less sensitive. Burns minimally, tans well.**	**At risk of skin cancer.**
5	**Dark brown**	**Minimal sensitivity. Rarely burns.**	**Skin cancers are relatively rare, but those that occur are often detected at a later, more dangerous stage. Increased risk of low vitamin D levels.**
6	**Deeply pigmented dark brown to black**	**Minimal sensitivity. Never burns.**	**Skin cancers are relatively rare, but those that occur are often detected at a later, more dangerous stage. Increased risk of low vitamin D levels.**

Table adapted from: SunSmart Victoria (2012, Cancer Council Victoria), Australia

The risk of skin cancer from the sun generally follows the same pattern. Darker skinned people have lower risk of sun-induced skin cancer. The person most prone to skin cancer caused by sunlight tans poorly and suffers sunburn easily. Frequent and/or intense sunburn in children with fair skin and freckles has been linked to malignant melanoma later in life.

Heredity

For reasons not completely understood, people with Celtic heritage (Irish, Scottish or Northern European) have increased risk of skin cancer from the sun. Genetic diseases that affect the skin can also increase the risk. For example, albinism, a genetic condition which prevents the production of normal skin pigments, makes the skin sensitive to ultraviolet light.

Exposure to Chemicals

Exposure to certain chemicals can increase the skin’s sensitivity to ultraviolet light through a process called photosensitization. Examples of such chemicals include:

- coal tar, coal tar pitches, and petroleum products containing polycyclic aromatic hydrocarbons (PAHs)
- certain printing chemicals used in photosensitive printing processes
- certain drugs including antibiotics, oral contraceptives, anti-inflammatories, tranquilizers, and anti-nausea drugs
- chemicals called psoralens found naturally in certain plants, fruits and vegetables

Check with your physician or pharmacist if you suspect abnormal or severe reaction to sun exposure after taking new medication. However, simple skin contact with psoralens, which are found in figs, parsnips, citrus plants, or mouldy celery, can make the skin more susceptible to sunburns in some individuals.

Experimental studies show that chemicals called “promoters” can increase the cancer-causing ability of ultraviolet radiation. On the other hand, ultraviolet radiation itself can act as a promoter. In particular, ultraviolet radiation (UVR) can increase the cancer-causing ability of chemicals from coal tar and coal tar pitches.

Amount of Exposure to Sunlight

The damaging effects of ultraviolet radiation accumulate over the years. In general, the risk of developing skin cancer increases with the amount of time spent under the sun and the intensity of radiation. The intensity of radiation varies according to the season of the year, time of day, geographic location (latitude), elevation above sea level, reflection from surfaces (e.g., white sand or concrete, water, snow), stratospheric ozone, clouds, and air pollution.

Recent studies have focused on the effects of intermittent (short-term, occasional) sun exposure in comparison to chronic (long-term) exposure. It appears that the type of exposure may influence the type of cancer that develops. For example, intermittent solar exposure may be an important factor leading to the onset of basal cell carcinoma of the skin. Childhood sun exposure may also play an important part in the development of these cancers later in adult life. The pattern for cutaneous melanoma is similar to that for basal cell carcinoma.

In contrast, the relationship between squamous cell carcinoma and solar UVR appears to be quite different. For squamous cell tumours, high levels of chronic occupational sunlight exposure, especially in the 10 years prior to diagnosis, results in an elevated risk for this cancer in the highest exposure group.

What is the UV Index?

In order to address the growing concern by Canadians regarding changes in UVR resulting from ozone depletion, Environment Canada rates the UV intensity as UV Index on a scale of 0 (when there is no sunlight) to 11+ (extreme). It can go to the mid-teens at midday in the tropics. In Canada the UV Index is categorized into low (2 or less), moderate (between 3 and 5), high (between 6 and 7), very high (between 8 and 10) and extreme (greater than 11).

The human health effects and precautions relating to the UV Index are summarized in the following table.

Table 3

UV Index	Description	Sun Protection Actions
0 – 2	**Low**	**• Minimal sun protection required for normal activity. • Wear sunglasses on bright days. If outside for more than one hour, cover up and use sunscreen. • Reflection off snow can nearly double UV strength. Wear sunglasses and apply sunscreen on your face.**

3 – 5	**Moderate**	**• Take precautions – cover up, wear a hat, sunglasses and sunscreen especially if you will be outside for 30 minutes or more. • Look for shade near midday when the sun is strongest.**
6 – 7	**High**	**• Protection required – UV radiation damages the skin and can cause sunburn. • Reduce time in the sun between 11 a.m. and 4 p.m. and take full precautions – seek shade, cover up, wear a hat, sunglasses and sunscreen.**
8 – 10	**Very High**	**• Extra precautions required – unprotected skin will be damaged and can burn quickly. • Avoid the sun between 11 a.m. and 4 p.m. and take full precautions – seek shade, cover up, wear a hat, sunglasses and sunscreen.**
11+	**Extreme**	**• Values of 11 or more are very rare in Canada. However, the UV Index can reach 14 or more in the tropics and southern U.S. • Take full precautions. Unprotected skin will be damaged and can burn in minutes. Avoid the sun between 11 a.m. and 4 p.m., cover up, wear a hat, sunglasses and sunscreen. • White sand and other bright surfaces reflect UV radiation and increase UV exposure.**

Sources:

Sun Protection Messages, Environment and Climate Change Canada

Global Solar UV Index: A Practical Guide. A joint recommendation of the World Health Organization, World Meteorological Organization, United Nations Environment Programme, and the International Commission on Non-Ionizing Radiation Protection.

What workers are at risk?

All outdoor workers potentially exposed to the sun’s ultraviolet radiation are at risk, including:

- agricultural workers
- farmers
- horticultural workers
- maintenance workers
- pipeline workers
- ranchers
- athletes
- fishermen
- landscapers

- military personnel
- police
- ski instructors
- brick masons
- gardeners
- lifeguards
- oilfield workers
- postal carriers
- sailors
- construction workers
- greenskeepers
- loggers
- open-pit miners
- railroad track workers
- surveyors

How can I reduce the risk of skin cancer from sunlight?

Skin cancer is the result of decades of exposure to the sun. It is important to be aware of the risks and take precautions while under the sun from as early in life as possible. Approaches to prevent skin cancer include:

- reducing exposure to sunlight
- wearing protective clothing
- using sunscreens on exposed skin
- examining the skin regularly for suspicious spots

In the winter time, it may be advisable to the above precautions when exposed to sun for prolonged periods, especially in the presence of snow or at high altitudes.

Reducing Exposure

Workers should avoid unnecessary exposure to the sun, especially to the intense midday rays between 11:00 a.m. and 4:00 p.m. during the summer. If possible, people should plan outdoor work for early morning or late afternoon, and work in the shade as much as possible. Umbrellas, buildings, trees, canopies, etc., can protect against the direct rays from the sun. Work, and take breaks in the shade when ever possible. Set up shade structures when shade is not available. In addition, water, white sand or concrete, snow, and ice can reflect from around 10 percent to 85 percent of the sun’s ultraviolet radiation. Skin may require extra protection against these indirect, reflected rays.

Workplaces can also rotate workers between site locations to help reduce UV exposure.

Wearing Protective Clothing and Sunglasses

The use of wide brim hats and clothes made from close-knit fabric can protect the skin and scalp from ultraviolet radiation. Although long-sleeved shirts and long-legged pants may not be comfortable in extremely hot weather, they do help protect the skin. Not all clothing offers the same protection. For example, a white cotton T-shirt may have an SPF of 7 while a long-sleeved denim shirt has an estimated SPF of 1700. And some fabrics like cotton lose about 50% of their SPF rating when they get wet. Workers should be informed about different fabric characteristics that effect the transmission of sunlight. Also wear wrap-around sunglasses that absorb UVA and UVB radiation.

Using Protective Sunscreens

Workers should liberally apply protective sunscreen on exposed skin 20 minutes before working in the sun, then reapply it during the periods they spend under the sun, as directed by the manufacturer’s instructions (usually every two hours). Most sunscreens are colourless, invisible, and cosmetically acceptable provided they do not stain clothing or produce adverse skin reactions.

Sunscreens should be used in addition to, not instead of, working in shade and wearing suitable clothing, hats, and sunglasses. Sunscreens are not intended to extend the exposure time to sunlight, but rather to reduce the effects of sunlight when people have to be in the sun. The level of protection depends greatly on how the sunscreen is applied.

A wide variety of sunscreens are available. They all contain chemical ingredients that weaken (but do not eliminate) the effects of ultraviolet radiation. The most widely used protective chemicals are PABA (para-aminobenzoic acid) and closely related chemicals such as cinnamates, salicylates, benzophenones, or anthranilates. Some sunscreens contain only one of these protective chemicals while others may have two or more for greater reliability. Products such as baby oil, cocoa butter, or skin oils that do not have protective chemicals, do not protect against sunburn, skin aging, or skin cancer.

Manufacturers label sunscreens with a sun protection factor (SPF). The higher the factor, the greater the protection from the sun.

- SPF 15 sunscreen may absorb 93 percent of UVB radiation.
- SPF 30 sunscreen may absorb 97 percent of UVB radiation.

The Canadian Cancer Society recommends a broad spectrum sunscreen (protects against UVA and UVB rays) with an SPF of 30 or higher. Follow the manufacturer’s directions. For example, sunscreens should be applied 20 minutes before going outdoors, and reapplied every two hours, or more often if perspiring (sweating), swimming, or working in water. Use a broad spectrum lip balm with an SPF of 30 or higher as well.

People with skin sensitive to sunlight should use a sunscreen with a high SPF. A sunscreen’s effectiveness also depends upon its ability to withstand heat, humidity and sweat. Most sunscreens are not water-resistant and people need to reapply them after perspiring or getting wet.

Examining Skin Regularly

People who work under the sun should examine their skin regularly for any unusual changes. The danger signs include any wound, sore, or patch of skin that won’t heal or constantly scales. Also examine for any growing lump, particularly if brown or bluish in colour. It is important to get medical care for anything that looks suspicious rather than wait until the problem becomes untreatable.