



Fact sheet N° 305
December 2009

Ultraviolet radiation and human health

KEY FACTS

- Skin cancer is caused primarily by exposure to ultraviolet (UV) radiation – either from the sun or from artificial sources such as sunbeds.
- Globally in 2000, over 200 000 cases of melanoma were diagnosed and there were 65 000 melanoma-associated deaths.
- Excessive sun exposure in children and adolescents is likely to contribute to skin cancer in later life.
- Worldwide approximately 18 million people are blind as a result of cataracts, of these 5% of all cataract related disease burden is directly attributable to UV radiation exposure.
- Sun protection is recommended when the ultraviolet index is 3 and above.

Ultraviolet radiation

Ultraviolet (UV) radiation is a component of solar radiation. UV radiation levels are influenced by a number of factors.

- Sun elevation: the higher the sun in the sky, the higher the UV radiation level.
- Latitude: the closer to the equator, the higher the UV radiation levels.
- Cloud cover: UV radiation levels are highest under cloudless skies but even with cloud cover, they can be high.
- Altitude: UV levels increase by about 5% with every 1000 metres altitude.
- Ozone: ozone absorbs some of the UV radiation from the sun. As the ozone layer is depleted, more UV radiation reaches the Earth's surface.
- Ground reflection: many surfaces reflect the sun's rays and add to the overall UV exposure (e.g. grass, soil and water reflect less than 10% of UV radiation; fresh snow reflects up to 80%; dry beach sand reflects 15%, and sea foam reflects 25%).

Health effects

Small amounts of UV radiation are beneficial to health, and play an essential role in the production of vitamin D. However, excessive exposure to UV radiation is associated with different types of skin cancer, sunburn, accelerated skin ageing, cataract and other eye diseases. There is also evidence that UV radiation reduces the effectiveness of the immune system.

Effects on the skin

Excessive UV exposure results in a number of chronic skin changes.

- Cutaneous malignant melanoma: a life-threatening malignant skin cancer.
- Squamous cell carcinoma of the skin: a malignant cancer, which generally progresses less rapidly than melanoma and is less likely to cause death.
- Basal cell carcinoma of the skin: a slow-growing skin cancer appearing predominantly in older people.
- Photoageing: a loss of skin tightness and the development of solar keratoses.

Effects on the eyes

Acute effects of UV radiation include photokeratitis and photoconjunctivitis (inflammation of the cornea and conjunctiva, respectively). These effects are reversible, easily prevented by protective eyewear and are not associated with any long-term damage.

Chronic effects of UV radiation include:

- Cataract: an eye disease where the lens becomes increasingly opaque, resulting in impaired vision and eventual blindness;
- Pterygium: a white or creamy fleshy growth on the surface of the eye;
- Squamous cell carcinoma of the cornea or conjunctiva: a rare tumour of the surface of the eye.

Other health effects

UV radiation appears to diminish the effectiveness of the immune system by changing the activity and distribution of the cells responsible for triggering immune responses. Immunosuppression can cause reactivation of the herpes simplex virus in the lip ("cold sores").

Disease burden

Excessive exposure to UV radiation caused the loss of approximately 1.5 million DALYs (disability-adjusted life years) and 60 000 premature deaths in the year 2000.

Between 50% and 90% of skin cancers are due to UV radiation. In 2000, there were 200 000 cases of melanoma and 65 000 melanoma-associated deaths worldwide. In addition, there were 2.8 million cases of squamous cell carcinoma and 10 million cases of basal cell carcinoma.

Some 18 million people worldwide are blind as a result of cataracts; of these, as many as 5% may be due to UV radiation. Cataracts attributable to UV radiation are estimated to have caused the loss of about 500 000 DALY's in 2000.

Vulnerable groups

Children and adolescents are particularly vulnerable to the harmful effects of UV radiation. Excessive sun exposure in children is likely to contribute to skin cancer in later life. The mechanisms are unclear, but it may be that skin is more susceptible to the harmful effects of UV radiation during childhood.

A person's skin type is also important. Fair-skinned people suffer more from sunburn and have a higher risk of skin cancer than dark-skinned people. However, even though the incidence of skin cancer is lower in dark-skinned people, the cancers are often detected at a later, more dangerous stage. The risk of eye damage, premature ageing of the skin and immunosuppression is independent of skin type.

Protective measures

WHO recommends the following measures to protect against exposure to UV radiation.

- Limit time in the midday sun.
- Seek shade
- Wear protective clothing such as a broad brimmed hat to protect the eyes, face and neck.
- Wear sunglasses with side panels that provide 99 to 100 percent UV-A and UV-B protection.
- Use and liberally reapply broad-spectrum sunscreen of sun protection factor (SPF) 30+ on skin areas that cannot be covered by clothes. Sun protection is best achieved by seeking shade and wearing clothes rather than applying sunscreens. Sunscreens should not be used for extending time spent in the sun, and people using sunscreen during sun tanning should voluntarily limit their time spent in the sun.
- Avoid sunbeds: use of sunbeds before the age of 35 is associated with a 75% increase in the risk of melanoma. Unless under medical supervision, sunbeds or sunlamps should not be used. WHO recommends banning their use by people under 18 years old.
- Protect babies and young children: always keep babies in the shade.

Encouraging children to take the simple precautions above will prevent both short-term and long-term damage while still allowing them to enjoy the time they spend outdoors. Parents and guardians should ensure that children are protected adequately.

Preventing vitamin D deficiency

While protection against over-exposure to UV radiation is the main health concern, UV in small amounts is essential to good health as it leads to the production of vitamin D in the body. Vitamin D strengthens the bone and musculoskeletal system. People who have very low sun exposure – such as those in institutional care or are housebound, people with deeply pigmented skin living in high latitudes or those who, for religious or cultural reasons cover their entire body surface when they are outdoors – should, in consultation with their doctor, consider oral vitamin D supplementation.

WHO response

The Global Solar UV Index

The UV index (UVI) is the international standard for UV measurement, developed by WHO, the United Nations Environment Program and the World Meteorological Organization. It is designed to indicate the potential for adverse health effects and to encourage people to protect themselves. The higher the UVI value, the greater the potential for damage to the skin and eye, and the less time it takes for harm to occur. Sun protection should be used when the UV index reaches 3 or above.

The Global UV Index, from low (green) to extreme (purple)

WHO encourages the media and the tourism industry to publish UVI forecasts and promote sun protection messages.

INTERSUN Programme

WHO, through the global INTERSUN programme, aims to reduce the burden of disease resulting from exposure to UV radiation. The project encourages research and develops an appropriate response to health risks through guidelines, recommendations and information dissemination. Beyond its scientific objectives, INTERSUN provides guidance to national authorities and other agencies about effective sun awareness programmes. These address different target audiences such as occupationally exposed people, tourists, school children and the general public.

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