

The author collecting information on sun exposure.

Even on a fairly cloudy day, there is a lot of UV exposure.

These children are wearing a small monitor to measure their sun exposure.

A school playground, with shading over the main play area.

You, me and UV – Under the sun in South Africa

Dr Caradee Wright from the CSIR Environmental Health Research Group talks about sunny South Africa. Just how harmful are our solar UV rays? What does previous research tell us about how much UV radiation our children are likely to receive and what are the health risks?

On average, places in South Africa experience between six and 12 hours of sunshine per day. That is a maximum of 4 380 hours of sunshine per year. Of course, on heavily cloudy and rainy days, less sunshine reaches us, but generally, South Africans enjoy a frequent supply of blue skies and bright sun. What does this mean in terms of our potential exposure to solar ultraviolet radiation (UVR)?

What is solar UV radiation?

The sun's rays may be defined as the solar electromagnetic spectrum, covering a broad wavelength range. The shorter the wavelength, the greater the radiation energy and the capability to produce chemical and biological reactions.

Solar UVR is a relatively small part of the spectrum and may be further divided into three bands: UV-C (100-280 nm), UV-B (280-315 nm), and UV-A (315-400 nm).

Most UV-C is absorbed by ozone in our atmosphere and only very little reaches us on the Earth's surface. UV-B and UV-A are the radiation bands that we have to be concerned about because they do reach the Earth's surface, and they have the potential to do us harm.

Adverse health effects of solar UV exposure

For humans, exposure to solar UVR has both positive and negative effects. Just the right amount of sun exposure helps our bodies produce sufficient vitamin D to maintain healthy bones, to provide us with a feeling of well-

being and to help us fight against certain diseases.

Too little solar UV exposure means our bodies might not be able to produce enough vitamin D, which can lead to rickets and osteoporosis. Our biggest concern in South Africa is when we 'get too much sun': the harmful effects of excess solar UVR exposure affect our skin, eyes and immune system.

Sunburn and skin cancer are probably the two most commonly experienced adverse effects of too much sun exposure. Sunburn is described as a photo-injury. While we cannot see or feel solar UVR, we can see the effects it has when it reaches our skin, blood rushes to the damaged area and makes our skin feel warm and look red.

The relationship between sun exposure and skin cancer is more complex. Non-melanoma skin cancers, such as squamous cell carcinoma and basal cell carcinoma, are seldom fatal; however, they may be extremely disfiguring and cause pain. Melanoma skin cancers are fatal; in other words, if they are not detected early enough and treated accordingly, they can cause death.

Photo-ageing is another consequence of spending too much time in the sun without adequate sun protection. Wrinkling, fine lines, dryness and discolouration are some of the irreversible effects you face as you get older when you have spent too much time outdoors.

The 'skin you're in' provides you

with some protection against sunburn and skin cancer. This depends on how much naturally occurring pigment or melanin you have. The darker your skin, the more melanin you have and the greater your natural protection against the sun's damaging UVR.

South Africa: where the sun shines all year long

South Africa is situated in the subtropics of the Southern Hemisphere. Several studies suggest a general downward trend in total column ozone over South Africa since 1979. Since ozone absorbs solar UVR and prevents it from reaching the Earth's surface, less ozone means potentially more UVR reaching the ground.

Instruments to measure ambient levels (UVR reaching the ground or a flat surface) are located at several universities and airports around South Africa. However, no single, nationally co-ordinated solar UVR monitoring network exists.

Previous personal exposure research in South Africa

Too much exposure to solar UVR is one of the few readily modifiable skin cancer risk factors, and exposure during childhood and adolescence is implicated in the development of skin cancer.

The amount of solar UVR reaching the ground is not the same as the amount that reaches a person. This depends on whether the person is sitting, lying down or standing and moving around. Also, whether the person is in full sun or in the shade and if they are using sun protection

– hat, clothes, sunscreen, sunglasses and so on.

Three previous studies in South Africa have looked at how much solar UVR South Africans are likely to be exposed to. In 2000, a Health Impact Assessment was carried out to find out how much solar UVR a child, an indoor worker, and an outdoor worker living in Durban were likely to be exposed to during one year. Results suggested that children were highly susceptible to getting sunburnt during peak UVR hours (two hours around midday) since school break times often occur during these hours. Also, an outdoor worker, such as a car guard, was identified as being at highest risk for developing non-melanoma skin cancer.

In 2001, special film called polysulphone was used to measure the daily solar UVR exposure of schoolchildren and teenagers in Durban. This film degrades in sunlight and mimics the reaction of human skin when it is sunburnt. We found that some children experienced very high exposure levels. The most important factor was the activity they were doing, for example, swimming and running.

Polysulphone film was also attached to a mannequin to try and work out which parts of the body are most likely to experience sunburn. For an unprotected human body, the top of the head and the shoulders were the body parts most at risk. The nose, tips of the ears and forehead were also risk areas.

Knowledge collected in New Zealand that may be useful to South Africa

A study, co-funded by the University of Otago, the National Institute for Water and Atmospheric Research (NIWA), the Cancer Society of New

Zealand and the National Research Foundation (NRF) of South Africa, measured the solar UVR exposure and activities of New Zealand schoolchildren using high-tech electronic UVR monitors and activity diaries, respectively.

High UVR exposure activities included physical education, athletics and the school lunch break. Children generally received higher exposures on schooldays compared to weekend days. A similar finding was made for South African schoolchildren.

Children knew about the dangers associated with the sun but only half of those in the study used sunscreen. The sun protection message is getting through to children loud and clear, but many fail to heed it, partly because the people close to them still like the look of a suntanned body.

What do we need to know more about for the future?

- How the solar UVR climate may be changing, especially in South Africa.
- Access to high-quality and up-to-date health data about skin cancer mortality and morbidity that will help us identify high-risk areas.
- Survey to identify sun-related knowledge, attitudes and behaviours of the South African population, especially vulnerable groups.
- Current sunburn and skin cancer prevention and awareness work, and a way to evaluate success. □

Caradee Wright currently leads the Environmental Health Research Group at the CSIR in Pretoria. Her postgraduate studies were carried out at the University of Otago in New Zealand (PhD Public Health) and the University of KwaZulu-Natal (MScSc). Caradee's research interests focus on human exposure to environmental risks, namely, air pollution and solar ultraviolet radiation.

Health risks and benefits of solar UV exposure

Just enough UV	Too little UV	Too much UV
<i>Vitamin D production</i>	<i>Inadequate vitamin D production</i>	<i>Immunosuppression</i>
■ Healthy bones	■ Osteomalacia ■ Osteoporosis ■ Rickets	■ Activating latent virus infections
<i>Resistance to disease</i>	<i>Psychiatric disorders</i>	<i>Eyes</i>
■ Non-Hodgkin's lymphoma ■ Prostate cancer ■ Breast cancer ■ Colon cancer	■ Seasonal affective disorder ■ Schizophrenia	■ Cortical cataract ■ Snow blindness ■ Pterygium ■ Squamous cell carcinoma of the cornea ■ Squamous cell carcinoma of the conjunctiva
<i>Psychological and general well-being</i>		<i>Skin</i>
		■ Sunburn ■ Solar keratoses ■ Photodermatoses ■ Basal cell carcinoma of the skin ■ Squamous cell carcinoma of the skin ■ Cutaneous malignant melanoma