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Caring for all life under the sun

Skin cancer and its prevention

Adèle Green

Cancer and Population Studies, QIMR Berghofer Medical Research Institute, Brisbane, Australia and CRUK Manchester Institute, University of Manchester, Manchester, UK

There are three main types of skin cancer: basal cell carcinoma (BCC) and squamous cell carcinoma (SCC), which arise in the outer layers of the skin, and melanoma, arising in the pigment-producing cells responsible for our skin colour. BCC is by far the most common type, followed by SCC. Both have low mortality rates, however, treatment costs can be a major burden in places with high incidence of skin cancer. Melanoma is less common but much more serious if it is not excised at an early stage; advanced melanoma is usually fatal and causes many deaths each year at young as well as older ages.

Although all these skin cancers can be caused by various environmental factors, the vast majority are caused by sun exposure, or more specifically, the ultraviolet (UV) radiation component of sunlight. The evidence is as follows: 1) skin cancer mostly affects white people with fair complexions who are prone to sunburn and cannot tan easily; 2) rates of skin cancer are highest in people of European ancestry living in sunny countries such as Australia; 3) skin cancer mostly occurs on exposed parts of the body; 4) BCC and SCC are more common in outdoor than indoor workers.

Sun protection is therefore fundamental to preventing skin cancer. The ideal strategy for primary prevention is avoiding direct sunlight by staying indoors, especially during summer and the middle of the day (from around 10 a.m. to 3 p.m.) when UV intensity in the sun's rays is strongest. Seeking shade outdoors also protects the skin, but if this is not possible or not desired, susceptible people in sunny environments must use physical skin protection. Clothing cover is the simplest – wearing a wide-brimmed hat that shades the face (especially nose), ears and scalp (if no hair) is important as these are prime sites for skin cancer, as well as wearing long sleeves to protect the arms.

Applying sunscreen to exposed skin is a common method of sun protection, which should be used along with seeking shade and wearing clothing. Sunscreen prevents sunburn in the short term, and trials have shown that routinely applying sunscreen when out in the sun can substantially lower the risk of SCC and melanoma. It should be applied generously to be fully effective and reapplied after several hours in the sun, or if washed off by sweating or swimming. Sunscreen is intended to decrease the skin's exposure to sunlight, not prolong it. If sunscreen is misused, for example, by sunbathers seeking a suntan, it is unlikely to offer protection.

Ultimately, policy and environmental interventions are necessary to promote sun safety, by setting community standards for sun-protective behaviour and by providing education, support and physical protection such as trees and roofing to provide shade in public places, particularly for vulnerable groups such as children in childcare or at school, and outdoor workers.

The Kigali amendment to the Montreal Protocol: a new chapter in protecting human health

Nigel Paul

Professor of Plant Science, Lancaster Environment Centre, Lancaster University, UK

Since 1987, the Montreal Protocol has served to protect human health by preventing an increase in damaging ultraviolet (UV) radiation that would have resulted from uncontrolled depletion of the ozone layer. With the Kigali amendment, the Protocol will now do even more to protect our health, this time focusing on reducing the effects of climate change.

Protecting human health was a founding principle of the Montreal Protocol. By successfully controlling ozone-depleting substances, the Protocol has protected the ozone layer, prevented large-scale increases in UV radiation and so protected the health of people across the planet[1, 2]. Without the Montreal Protocol, we would have seen several 100 million more cases of skin cancers and many more of cataracts[2, 3]. The Parties to the Protocol should be proud of the success they have achieved since 1987. Looking ahead, the Kigali amendment to the Montreal Protocol is the start of a new chapter in protecting human health.

The main aim of the Kigali amendment is to reduce climate change by controlling the use of hydrofluorocarbons (HFCs)[4]. The amendment builds on the major contribution that the Montreal Protocol has already made to protecting the climate[1]. That has been achieved because many ozone-depleting substances, like CFCs, are also potent greenhouse gases[1]. The links between climate change and health are more complex and perhaps less immediately apparent than those between UV radiation and skin cancer. Climate change will affect human health in many ways, as described in detail by the Intergovernmental Panel on Climate Change[5]. The environmental effects of climate change range from changes in temperature and rainfall, to events such as heat waves, floods, droughts and fires. In fact, it may be these extreme weather events, rather than the change in average temperature, that have the most profound direct effects on human health[5].

Climate change will also affect health indirectly, due to outcomes such as reduced food production, especially in poorer regions[5]. Other outcomes include changes in the distribution of disease-causing microbes, or the organisms responsible for the spread of disease, such as mosquitoes that carry malaria[5]. Extreme weather events can also damage infrastructure, with long-term effects on human health and well-being.

Regardless of the Kigali amendment, changes in exposure to UV radiation are still at the heart of understanding how the Montreal Protocol protects human health. We need to keep a watching brief on all factors that could influence ozone and UV radiation in the future. Climate change can impact both the global ozone layer[1] and human exposure to UV, due to changes in cloud cover and air pollution[1, 6]. It may also change how people behave in the sun. For example, in regions that currently have relatively cool climates, higher temperatures may encourage people to spend more time in the sun. On the other hand, where temperatures are already high, further increases may reduce how much time people spend in the sun. We don't yet understand how these various outcomes will affect people's risks of over-exposure to UV radiation and the associated damage to health.

As the Parties work together to implement the Kigali amendment, the processes and approaches that have underpinned the success of the Montreal Protocol since 1987 will guide and support them. They are united under a universal goal to secure and extend the Protocol's legacy and continue to protect the health of the global population.

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Notes

1. UNEP, 'Synthesis of the 2014 Reports of the Scientific, Environmental Effects, and Technology & Economic Assessment Panels of the Montreal Protocol', 2015, United Nations Environment Programme (UNEP), Nairobi.

2. UNEP, 'The Montreal Protocol and Human Health Ozone Depletion and effects of exposure to Ultraviolet radiation', 2015, United Nations Environment Programme (UNEP).

3. Lucas R. M. et al., 'The human health effects of ozone depletion and interactions with climate change', in 'Environmental effects of ozone depletion and its interactions with climate change: 2014 assessment - 2015': Nairobi, Kenya. p. 49-94.

4. http://www.unep.fr/ozonaction/information/mmcfiles/7876-e-Kigali_FS01_Introduction.pdf

5. Smith, K.R., A.Woodward, D. Campbell-Lendrum, D.D. Chadee, Y. Honda, Q. Liu, J.M. Olwoch, B. Revich, and R. Sauerborn, 2014: Human health: impacts, adaptation, and co-benefits. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel,A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 709-754.

5. Bais A.F. et al., 'Ozone depletion and climate change: impacts on UV radiation', in 'Environmental effects of ozone depletion and its interactions with climate change: 2014 assessment -2015': Nairobi, Kenya. p. 1-47.

UV and skin cancer in South Africa

Caradee Y. Wright

Specialist Scientist, Environment and Health Research Unit, South African Medical Research Council, Pretoria, South Africa

Situated at the southern tip of Africa, South Africa's latitude and clear, sunny skies result in high solar ultraviolet (UV) radiation levels almost all year round. Given the South Africans' love for the outdoors, this means that many people are exposed to excess sunlight during outdoor recreational activities. The sunny climate also poses a risk to workers who work predominantly outdoors.

Excess sun exposure is associated with skin cancer aetiology. There are also other factors that play a part in skin cancer development, such as skin injury in darkly pigmented skin, but sun exposure is the only known modifiable risk factor. Skin cancer was estimated to cost ZAR 92.4 million in 2015[1] – resources that could be better spent on two doses of the human papilloma virus vaccine for 305,000 girls in public schools.

Skin cancer can occur in people of different skin types and skin colours. In South Africa, all population groups, namely black Africans, coloureds (mixed European (white) and African (black) or Asian ancestry), Indians/Asians and whites, can experience skin cancer, however, incidence is highest among white South Africans (Table 1).

Prevalence of several infections in South Africa, in particular HIV, is among the highest in any country in the world. The total number of people living with HIV in South Africa was estimated at around 7 million in 2016. The infections are likely to lead to a change in skin cancer patterns[2] and a possible increase in squamous cell carcinoma among people with compromised immune systems.

Another group particularly at risk of skin cancer is black Africans with oculocutaneous albinism. Due to a lack of melanin, these individuals are susceptible to the harmful effects of excess solar UV rays, including extreme sun sensitivity and skin cancers. In northern parts of the country, albinism prevalence may be as high as one in 2,700.[3]

Occupational sun exposure is a risk for about 1.2 million outdoor workers in South Africa (8.7 percent of the working population). High-risk occupational subgroups include subsistence farmers, fishery workers, and mining, extraction and construction workers. Solar UV-induced skin cancer is recognized as an occupational disease in some countries, however, not in South Africa. For us to register non-melanoma skin cancer as a reportable occupational disease, significant efforts relating to understanding local epidemiology and exposure assessments need to be made.

South Africa can learn from other countries' efforts in skin cancer prevention. Careful legal management and policymaking is required to ensure skin cancer is officially recognized as an occupational disease. Improved health care services are also essential for providing mandatory screening of working populations at highest risk. And national awareness and prevention programmes will require multi-stakeholder dialogues to best develop preventive measures tailored to a population with different skin types.

Notes

1. Gordon et al., 'Modelling the healthcare costs of skin cancer in South Africa', BMC Public Health Services Research, 2016, 16:113

2. York et al.2017 "Primary cutaneous malignancies in the Northern Cape province of South Africa: a retrospective histopathological review". S Afr Med J. 107(1): 83-88.

3. Wright, Norval and Hertle, 'Oculocutaneous Albinism in Sub-Saharan Africa: Adverse Sun-Associated Health Effects and Photoprotection, Photochemistry and Photobiology, 2015, 91:27-32

4. Adapted from Norval, Kellet and Wright, 'The incidence and body site of skin cancers in the population groups of South Africa', Photodermatol, Photoimmunol, Photomed, 2014, 30:262-265

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Table 1. Annual incidence of skin cancers per 100,000 persons among the different population groups in South Africa[4]

Skin cancer	Black African	Indian/Asian	Coloured	White
Basal cell carcinoma				
Male	3.0	7.7	59.2	198.3
Female	1.7	5.3	26.5	112.8
Squamous cell carcinoma				
Male	3.0	4.3	26.1	69.5
Female	1.6	2.7	15.4	31.8
Cutaneous melanoma				
Male	1.0	0.7	5.9	20.5
Female	1.2	1.1	4.1	16.5

NB: Figures represent the mean, age-standardized annual incidence per 100,000 persons calculated using data from 2000 to 2004

Outdoor environments for children must offer sun-protected areas

A joint statement from the Nordic radiation protection authorities

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Fisheye photography, taken from beneath a sun sail construction in a Norwegian pre-school. This construction provides a protection factor of about four, based on modelling the UV index for the open versus shielded area and for clear sky conditions.

T. Christensen, L.T. Nilsen, B. Johnsen, National Radiation Protection Authority, Norway
R. Pastila, T. Toivonen, Radiation and Nuclear Safety Authority, Finland
J. Gulliksson, Swedish Radiation Safety Authority

Although most skin cancers are preventable, skin cancer incidence is high and on the increase in the Nordic countries. Of further concern is the fact that this serious disease has started to occur at even younger ages. Frequent sunburn during childhood can increase the risk of developing skin cancers later in life. Preventive measures regarding children's sun exposure should therefore be prioritized and given more attention.

The risk of developing skin cancer is related to excess exposure to ultraviolet (UV) radiation derived from the sun. Reducing sun exposure has therefore been proven to be an effective way of reducing the risk of skin cancer and its incidence rate. Children's exposure to UV can easily be reduced by providing shade in outdoor areas. Ideally, sun protection should be incorporated into the planning process of new areas, but can easily and inexpensively be implemented in existing areas as well.

Measures to Provide Sun-Protected Areas

The choice of sun protection depends on the local climate. In areas with high outdoor temperatures, shades are the best way to protect children against excess UV radiation, while also providing respite from the heat. Examples of these so-called 'cold shadows' are:

- Natural structures, terrain, vegetation
- Man-made structures: parasols, sun sails, roofs

Alternatively, in moderate climates, so-called 'warm shadows' created by semi-transparent, UV-filtering, overhead structures made from materials such as polycarbonate or glass will be more suitable.

The degree of protection offered by the proposed measures should be assessed. This can be done by:

- measuring UV protection (e.g. UV index for open vs shielded area)
- modelling UV utilizing solar elevation, sky view, action spectrum and weather conditions (see Figure 1)

Studies have shown that physical structures and UV-absorbing materials can significantly reduce UV exposure. Furthermore, outdoor environments providing UV protection have also been shown to promote healthy physical activities in pre-school children.

Nordic Advice

With this background, the Nordic radiation protection authorities have published a joint statement advising municipal administrations, urban planners and those responsible for children in pre-schools, schools and outdoor recreational settings to incorporate measures that improve sun protection for children. These measures should be in accordance with international recommendations:

→ Increase the availability of shade in outdoor environments in pre-school and school playgrounds, public parks and recreational areas

Children should have access to outdoor environments that provide both sunny and shaded areas, as these offer a combination of sun protection, daylight and comfortable temperatures. Municipalities, urban planners, and sports and leisure organizations, among others, should incorporate shade planning when designing facilities and in land-use development.

→ Provide children and those looking after them with the information needed to make informed and healthy choices regarding UV exposure from the sun

Increasing people's knowledge increases their confidence in making healthy choices. Children and those looking after them require tailored information regarding risk situations and suitable sun protection measures. Pre-school and school administrations as well as managers of outdoor sports and leisure activities should integrate sun safety into health education and promotion programmes.

→ Establish sun protection policies

Important sun protection strategies include timing of outdoor activities to avoid peak hours, seeking shade, wearing protective clothing, hats and sunglasses, and generously applying and reapplying sunscreen. Pre-school and school administrations as well as managers of outdoor sports and leisure activities should include aspects relating to sun protection in their policies and planning.

The complete Nordic statement can be found at http://www.nrpa.no/dav/29527b37f0.pdf

OzonAction SCOOP

Shamila Nair-Bedouelle
Head OzonAction
1, rue Miollis
75015 Paris - France

Available online at: www.unep.org/ozonaction

Publication manager: Anne-Maria Fenner
Design/layout: Anna Mortreux

Please send comments to:
Anne-Maria Fenner
+33 1 44 37 14 54
Anne.Fenner@unevironment.org