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ARTICLE

Sun protection: a practical guide for health professionals

SUMMARY

Cumulative exposure to ultraviolet radiation drives skin cancer and photo-ageing across all skin types, including people with darker skin. Visible light radiation plays a key role in the pathogenesis of pigmentary conditions. Intense childhood exposure to ultraviolet radiation is a critical risk factor for development of melanoma later in life.

Effective sun protection requires a daily, multifaceted approach when the ultraviolet index is 3 or higher. This includes the correct application of broad-spectrum sunscreen with a sun protection factor of 50+ in conjunction with protective clothing, a broad-brimmed hat, sunglasses, and seeking shade.

Some medicines may be photosensitising and patients using these medicines should be advised to adopt stricter sun protection measures.

There are many myths about sunscreens that may be barriers to sunscreen use, including concerns about endocrine disruption and nanoparticle toxicity.

When counselling patients on sun protection, it is important to offer practical, evidence-based advice that extends beyond sunscreen use alone. The goal is to empower patients to incorporate sun safety into their daily routines.

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Introduction

Cumulative exposure to ultraviolet (UV) and visible light radiation is a well-established driver of sun-related skin damage, contributing to carcinogenesis, photo-ageing and pigmentary disorders. Lifetime cumulative sun exposure contributes to skin cancer risk. Intense sun exposure during childhood poses a particularly high risk for melanoma, as this period represents a critical window of susceptibility to the long-term harmful effects of UV radiation.[1] Despite strong evidence supporting its benefits, sun protection (also known as photoprotection) remains underused and is often misunderstood as a preventive health strategy.[2]

Photoprotection includes a range of measures, especially use of protective clothing, sunscreen, broad-brimmed hats and sunglasses, and limiting sun exposure, to reduce UV and visible light exposure. The importance of these measures is underscored by Australian data showing the impact of sun exposure and prevention. One study estimated that, in 2010, high ambient UV levels were responsible for more than 7000 melanomas and nearly all keratinocyte cancers nationwide.[3] Regular sunscreen use alone was estimated to have prevented over 14,000 squamous cell carcinomas and more than 1700 melanomas in that year, highlighting the significant population-level protection achieved through this single measure.[3] Health professionals are ideally placed to deliver evidence-based advice and dispel misconceptions about sun protection.

Ultraviolet and visible light

Traditional photoprotection strategies have largely focused on blocking UVB and UVA light:[4]

- UVB light (wavelength 290 to 320 nanometres) damages the DNA of epidermal cells, causing erythema, carcinogenic mutations and immunosuppression.
- UVA light (wavelength 315 to 400 nanometres), particularly UVA1 (340 to 400 nanometres), penetrates deeper than UVB and reaches the dermis to induce oxidative stress, collagen degradation and pigmentary changes.

Recent evidence highlights visible light (400 to 700 nanometres) as a key contributor to hyperpigmentation and erythema, especially in people with darker skin types.[5] Visible light activates opsins expressed in melanocytes, upregulating pigment gene expression and exacerbating conditions such as melasma and post-inflammatory hyperpigmentation.[6] Visible light has also been shown to act synergistically with UVA1 to deepen and potentiate hyperpigmentation.[5] These findings challenge the adequacy of conventional UV-only filters, which do not filter visible light, and underscore the importance for broader spectrum sun protection.

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Sun protection is relevant for all skin types

A common misconception is that sun protection is only necessary for fair-skinned individuals. While skin of colour possesses a higher concentration of melanin and is less prone to UVB-induced erythema, people with skin of colour are not immune to the harmful effects of UV or visible light.[5]

Pigmented skin is more susceptible to visible light-induced hyperpigmentation, with melasma and post-inflammatory hyperpigmentation being more prevalent and persistent in these groups.[7] Skin cancers, including acral lentiginous melanoma, which typically occurs on the palms of the hands, soles of the feet and under nails, may present later and with worse prognosis in people with darker skin due to under-recognition.[5]

Health professionals should emphasise that sun protection is not just about preventing sunburn. It aims to mitigate cumulative DNA damage and photo-ageing throughout the lifespan, thereby reducing skin cancer risk across all skin types.

Sunscreens

Types of sunscreens: chemical vs physical filters

Sunscreens are typically composed of chemical (organic) and/or physical (inorganic) filters:

- Chemical filters (e.g. avobenzone, oxybenzone) absorb UV radiation and convert it to heat. They are often preferred for their lightweight formulations, which are absorbed into the skin, leaving little to no visible residue. There are currently 7 chemical filters approved by the Therapeutic Goods Administration (TGA) that are present in sunscreens sold in Australia.[8]
- Physical or mineral filters (e.g. zinc oxide, titanium dioxide) work by reflecting and scattering UV radiation. They offer immediate protection and are generally well tolerated. However, they may leave a white cast. The thicker texture may be better suited for use in sports or when water resistance is needed.[4]
- Tinted sunscreens contain added pigments (e.g. iron oxide and pigmentary titanium dioxide) that have a protective effect against visible light. These are recommended for the management and prevention of visible light-induced dermatoses, such as hyperpigmentary conditions.[9]

Many modern sunscreen formulations combine both chemical and physical filters to enhance cosmetic effect and minimise the appearance of a visible residue on the skin.[4]

Patients should be encouraged to choose a formulation that suits their skin type, exposure settings, specific activities and cosmetic preferences, for example using thicker mineral sunscreens in high-sweat environments and lighter chemical formulations for everyday use. Ultimately, the most effective sunscreen is the one that patients will use consistently.

Sunscreen spectrum and gaps in protection

Australian sunscreens are required to provide broad-spectrum protection, against both UVA and UVB, but do not include protection against visible light unless they are tinted. In addition, a gap in protection exists for the longer UVA1 spectrum (380 to 400 nanometres). Filters like zinc oxide provide protection only up to approximately 380 nanometres. Newer filters providing protection up to 450 nanometres are approved in the European Union but are not yet available in Australia.[10]

Regulation of sunscreens

In Australia, sunscreen products with the primary purpose of UV protection, and some products with UV protection as a secondary purpose (e.g. moisturising products that contain sunscreen with sun protection factor [SPF] above 15), are regulated by the TGA as listed medicines.[11] It is a requirement that a sponsor of a TGA-listed sunscreen product holds evidence that supports the claimed SPF.[11] Cosmetic sunscreens are not considered to be therapeutic goods and are not regulated by the TGA.

Currently, determining the SPF of a sunscreen relies primarily on erythema as the endpoint, using human subjects.[11] This approach has inherent variability. A 2025 report from the consumer advocacy group CHOICE highlighted potentially inaccurate SPF labelling on listed sunscreens.[12] As a result, the TGA is reviewing SPF testing requirements.[13] The TGA also reviews the safety and efficacy of sunscreen ingredients sold in Australia and may set maximum concentrations.[8]

When and how to use sunscreens

Sun protection should be practised according to daily UV exposure and not only on sunny days. The UV index is a standardised measure predicting the intensity of skin-damaging UV radiation based on factors such as latitude, time of year, ozone levels, elevation and cloud cover.[14] In Australia, the UV level in summer often exceeds 12 (extreme) and can reach up to 16 to 17 in northern regions. Daily sunscreen use is recommended when the UV index reaches 3 (moderate), irrespective of season or weather.[2]

Sunscreen efficacy is measured by its SPF, which quantifies the level of protection against UVB radiation.[15] SPF indicates how much longer it takes for UVB radiation to cause erythema on sunscreen-protected skin compared with unprotected skin. An SPF15 sunscreen blocks 94% of UVB, SPF30 blocks about 97%, and SPF50 blocks around 98%.[15]

Patients should be advised to:

- apply an SPF50+ broad-spectrum sunscreen 20 minutes before sun exposure
- use the teaspoon rule for adequate sunscreen coverage: one teaspoon (5 mL) to each arm, each leg, the front of the torso, the back of the torso, and the face (including the neck and ears), thus at least 35 mL to cover the entire body[16]
- reapply sunscreen every 2 hours, and after swimming or sweating.

Common myths about sunscreen

There are many myths surrounding the use of sunscreens that may lead to avoidance or underuse of sunscreen products. Common myths, and evidence debunking them, are summarised in Box 1.

Protective clothing

UPF rated clothing: a powerful but underutilised tool

Purpose-designed sun protective clothing offers consistent physical UV protection. The UV protection factor (UPF) rating indicates a fabric's ability to block the full spectrum of UV light (both UVA and UVB), whereas SPF primarily quantifies a sunscreen's protection against UVB rays.[25] A garment with a UPF of 50 blocks over 98% of UV rays and, unlike sunscreen, does not require reapplication, and is not affected by sweating or water contact. UPF clothing is a useful strategy for children, outdoor workers, and individuals who may not consistently use sunscreens.[26]

Non–UPF rated clothing

Everyday clothing can also provide significant UV protection; however, the level of protection depends on several factors including:

- fabric and weave: densely woven fabrics offer greater UV protection than loosely woven materials. Polyester has the highest UPF, wool offers moderate protection, while cotton, nylon, silk, rayon and linen generally have lower UPF values[25]
- colour: darker colours tend to provide more UV protection than lighter shades, as bleaching removes pectin and waxes that can refract UV radiation.[26] Plain white cotton T-shirts provide limited UV protection, often less than that of sunscreen with an SPF of 15[27]

Box 1 Myths about sunscreens and evidence debunking them

Myth: Sunscreen is only for fair-skinned people

Evidence:[17]

- UV exposure is a leading modifiable risk factor for skin cancer and photo-ageing across all skin tones.
- Visible light drives pigmentary disorders more severely in darker skin tones.
- UVA1 exposure promotes dermal degradation in all skin types, regardless of the level of existing skin pigmentation.

Myth: Sunscreens are endocrine disruptors

Evidence:[17,18]

- Evidence for endocrine disruption is limited to in vitro experiments or studies using supra-physiological doses; findings that are not clinically significant in humans.

Myth: Nanoparticles present in sunscreen are toxic and carcinogenic

Evidence:[19]

- UV filters such as zinc oxide and titanium dioxide are commonly used in sunscreens in nanoparticle form. Extensive reviews by regulatory bodies, including the Therapeutic Goods Administration, have found that these particles are unlikely to cause harm, as they penetrate only minimally into the stratum corneum and pose a very low risk of systemic absorption or toxicity.

Myth: Sunscreen causes vitamin D deficiency

Evidence:[20,21]

- Although sunscreen can theoretically reduce vitamin D synthesis due to overlapping UV action spectra, most observational studies and randomised trials, including 2 Australian trials, have shown little to no significant impact on serum vitamin D levels. This suggests that any impact of sunscreen use on vitamin D levels is likely to be minimal.

Myth: Homemade sunscreens are safe and effective

Evidence:[22]

- Homemade sunscreens do not provide reliable and sufficient protection against UV radiation, with SPF50+ sunscreen providing superior protection across all measured parameters of sun damage. Achieving the correct concentration and even distribution of UV filter particles in homemade mixtures is not feasible. Additionally, such preparations have unknown shelf lives and lack formal testing for safety and efficacy.

Myth: Sunscreens are toxic to the environment

Evidence:[23,24]

- Current evidence linking UV filters to coral reef damage is inconclusive. A recent literature review highlighted significant limitations in study design and quality across existing research, concluding that the available data are insufficient to establish a causal relationship. Robust, long-term ecological studies are needed to clarify any potential environmental impact.
- While this causal link between sunscreen ingredients and coral reef damage is complex and subject to ongoing research, this potential environmental impact may worry individuals. Opting for non-nano physical sunscreens can be a practical choice for those who wish to minimise their potential environmental footprint.

- fit and coverage: loose-fitting clothing is preferable because tight garments can stretch, allowing more UV radiation to pass through the fibres and thereby reducing their effectiveness.[26]

Drug-induced photosensitivity

Certain medications can increase the skin's sensitivity to UV radiation, an effect known as drug-induced photosensitivity. Photosensitivity can manifest as 2 types of reactions:[28]

- phototoxicity: a process caused by direct cellular damage from a photoactivated compound. Photosensitising drugs distribute to light-exposed tissues, absorb UV radiation, and enter an unstable, high-energy state. This results in generation of reactive oxygen species in the surrounding tissue, triggering the release of inflammatory mediators. Symptoms occur minutes to hours after exposure to sunlight
- photoallergy: a type-IV (delayed) hypersensitivity reaction that develops after initial sensitisation to a drug. UV radiation transforms the drug into a hapten which then binds to a carrier protein, forming a photoantigen. The photoantigen is recognised by the immune system, leading to sensitisation. Upon re-exposure to the drug and sunlight, memory T-cells become activated, migrate to the skin, and induce an inflammatory response. Symptoms typically occur 24 to 48 hours after sun exposure.

Patients using medicines listed in Table 1 should be advised about the risk of photosensitivity reactions, emphasising the need for diligent sun protection. Note that not all medicines associated with photosensitivity pose the same level of risk. Pharmacovigilance data indicate that a limited group, which includes amiodarone, chlorpromazine, doxycycline, hydrochlorothiazide, naproxen, piroxicam, tetracycline, thioridazine, vemurafenib and voriconazole, is most consistently linked with clinically significant photosensitivity reactions.[29] Clinicians should emphasise targeted counselling for patients prescribed any of these medications.

Counselling patients about sun protection

When counselling patients about photoprotection, it is important to offer practical advice that extends beyond sunscreen use alone. The goal is to empower patients to incorporate sun safety into their daily routines. Key messages that should be communicated to patients are:

- Sun protection is a year-round health behaviour for reducing the risk of skin cancer and premature ageing, not just a seasonal precaution.
- Sun protection is necessary whenever the UV index is 3 or above, not only on hot or sunny days.

Table 1 Medicines that may increase sensitivity of the skin to UV radiation[28]

Drug class	Examples
Antibiotics	• tetracyclines (e.g. doxycycline, minocycline) • fluoroquinolones (e.g. ciprofloxacin, levofloxacin) • sulfonamides (e.g. trimethoprim+sulfamethoxazole)
Nonsteroidal anti-inflammatory drugs	• ibuprofen, naproxen, celecoxib, piroxicam, aspirin
Cardiovascular drugs	• amiodarone • hydrochlorothiazide • furosemide • amlodipine
Psychotropic drugs	• antipsychotics (e.g. olanzapine, chlorpromazine, clozapine) • selective serotonin reuptake inhibitors (e.g. sertraline, escitalopram) • tricyclic antidepressants (e.g. amitriptyline)
Retinoids	• oral retinoids (e.g. isotretinoin, acitretin) • topical vitamin A derivatives
Antifungals	• azole antifungals (e.g. ketoconazole, voriconazole) • griseofulvin
Antineoplastic agents	• methotrexate • 5-fluorouracil

- The daily UV index and sun protection recommendations can be monitored with various apps such as Cancer Council Victoria's SunSmart app and the Bureau of Meteorology's BOM Weather app.
- Clothing is a primary defence against UV radiation and should be combined with other strategies, as described in Cancer Council Australia's '**Slip** [clothing], **Slop** [sunscreen], **Slap** [a broad-brimmed hat], **Seek** [shade] and **Slide** [sunglasses]' campaign.[30,31]
- Sunscreen needs to be reapplied every 2 hours, or more often after swimming or sweating.
- Sunscreen use is not recommended for infants under 6 months due to increased absorption of any chemical applied to infant skin compared with adult skin, although no adverse effects related to sunscreen absorption have actually been documented in infants to date.[32] Shade and protective clothing are preferred.
- Regular skin self-examination should be undertaken to identify skin changes, which should be flagged with a health professional.[33]
- People at average or increased risk of skin cancer should undergo opportunistic skin checks by a health professional, while those identified as high risk should be encouraged to have 6-monthly skin surveillance including total body photography and dermoscopy.[34]

Patients can be directed to trusted resources, such as:

- the Australasian College of Dermatologists' Skin Cancer Resources[35]
- Cancer Council Australia's Sun Safety website.[36]

Conclusion

Effective sun protection requires a daily, multifaceted approach when the UV index is 3 or higher. Health professionals can help to reduce the burden of UV-related skin disease by providing informed and practical photoprotection advice and addressing common misconceptions with clear, evidence-based guidance. Visible light protection should also be highlighted, particularly in patients with darker skin types or pigmentary conditions. ≺

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