

1 Prevention

Exposure to ultraviolet (UV) radiation in sunlight is the primary cause of most melanomas.¹ Intermittent pattern sun exposure, such as recreational exposure, confers higher risks of melanoma than more continuous pattern sun exposure, such as occupational sun exposure.^{2,3} Sun exposure in childhood appears to be associated with a higher relative risk of melanoma than is sun exposure in later life.³ Childhood sun exposure is also associated with the development of melanocytic naevi (moles), which are a risk factor for melanoma.⁴

The UV wavelengths in sunlight that cause melanoma are not known; only a few studies on relevant animal models have been performed.⁵ Solaria (tanning or sunbeds) emit mainly ultraviolet A (UVA) radiation. A review of the health effects of using solarium in an Australian context has recently been reported⁶ and an Australian Standard for solarium for cosmetic use⁷ has been produced. The later document suggests age restrictions for young people under 15 years, written parental permission forms for those under 18 years old and restrictions from use for those people with a type I skin (pale skin, with freckles and inability to tan).

From a systematic review and meta-analysis of 19 studies⁸ there was a borderline significant but minor increase in relative risk (RR) of developing melanoma with 'ever use' compared with no use of sunbeds overall (RR 1.15; 95% CI 1.00–1.31). The increase in RR was greater and was significant, however, when restricted to studies of people exposed to sunbeds prior to 35 years of age (RR 1.75; 95% CI 1.35–2.26 from seven studies). Overall, in those eight studies where adjustment was made for confounders related to sun exposure and sun sensitivity, no firm conclusion about the association of melanoma and sunbed use could be reached (RR 1.19; 95% CI 0.33–4.30). In addition, when the data were limited to four studies with sufficient information about the amount of exposure from sunbeds, there was no clear dose–response relationship between sunbed use and melanoma. Problems with significant heterogeneity, which may be related to various factors, including differences in assumed lag-time, differences in exposures from earlier ultraviolet B (UVB)-rich versus later UVA-rich sunbeds and lack of control of certain confounders, make robust conclusions difficult at this time, though the data suggest that exercising caution with exposure to sunbeds early in life is warranted.

UVB radiation in sunlight is responsible for cutaneous production of the prohormone vitamin D, which is converted into the hormone 1,25-dihydroxyvitamin D (calcitriol). The skin is the main source of vitamin D in the absence of supplements, since natural food sources are very limited. Infants obtain vitamin D from trans-placental transport, depending on their mother's vitamin D status. Breast milk does not contain significant amounts of vitamin D.⁹ Adequate vitamin D is essential for mineralisation of the skeleton and preservation of bone mass and is also important for muscle function and to reduce the risk of falls in older individuals.^{10,11} There is increasing but not conclusive evidence that adequate vitamin D may reduce the incidence of and mortality from some internal cancers as well as the likelihood of some autoimmune diseases and other diseases such as hypertension and type 2 diabetes, and may increase innate immunity.^{10–12} There is even increasing though low-level evidence that sun exposure and/or higher activity of the vitamin D system may reduce mortality from melanoma.^{13,14}

Skin type, latitude, season, time of day, cloud cover and age will all affect synthesis of vitamin D.¹⁰ Obesity will affect blood levels achieved. At present there are insufficient data to clearly recommend the duration, body surface area and frequency of sun exposure required to maintain adequate vitamin D levels. Continued exposure to sunlight causes vitamin D breakdown in the skin, so shorter exposures may be more efficient at maintaining vitamin D levels. Exposure to as little as one-third of a sunburning dose of UVB to 15–18% body surface (hands, arms and face or legs) can produce significant amounts of vitamin D.¹⁵ This can be achieved for fair individuals in around 6–8 minutes just before 10am or just after 2pm in summer in most of Australia and New Zealand, but in winter takes around 30–50 minutes at these times in Southern parts of Australasia but still under 10 minutes in the North.⁹ Although sunscreens reduce vitamin D synthesis in the laboratory,¹⁶ there is conflicting evidence about whether they reduce vitamin D levels in practice.

Sunscreens have been shown to reduce the incidence of both premalignant skin lesions (actinic keratoses)¹⁷ and squamous cell carcinoma.¹⁸ As yet there is no conclusive evidence that sunscreens reduce the risk of basal cell carcinoma¹⁸ or melanoma.¹⁹ The level of protection provided by sunscreens is determined not only by their labelled sun protection factor (SPF) but also by the amount of product applied and its conditions of use. The effectiveness of sunscreens is dramatically reduced by inadequately applying product, failing to reapply product frequently, and loss of product through perspiration, swimming and friction from clothing. Skin damage can occur below the sunburn threshold²⁰ and sunscreens should not be used as a means of intentionally prolonging sun exposure.

The Cancer Council Australia, the Cancer Society of New Zealand and the Health Sponsorship Council of New Zealand recommend the following approach to sun protection.

1. Minimising direct sun exposure when the UV indexⁱ is 3 or greater through the use of shade, broad-brimmed or Legionnaire's-style hats, sunglasses that meet the Australia/New Zealand standard, and tightly woven clothing that covers the arms, legs and trunk (physical protection). This is particularly important during peak UVR periods. These occur in Australia between 10am and 2pm standard time and in daylight saving time between 11am and 3pm. In New Zealand the peak UVR period is between 11am and 4pm during daylight savings months.
2. Sunscreens should be used to complement physical sun-protection measures rather than as the sole or primary means of sun protection. Sunscreen should be used on exposed skin (such as the face) that cannot otherwise be fully covered. Broad-spectrum SPF30+ products (offering some protection from UVA as well as UVB) should be recommended, and should be applied before going outside and reapplied every 2 hours.

i. The UV Index scale, found in the weather section of most Australian daily newspapers, provides a simple representation of solar UV levels. Each point on the scale is equivalent to 25 mW/m² of UV radiation. An index of 2 or less is considered low; 3–5 is moderate, 6–7 is high, 8–10 very high and 11 or higher represents extreme UV irradiance.

3. Correct application of sunscreens includes application of liberal amounts to clean, dry skin at least 20 minutes before going outside. It is recommended that an average-size adult use one teaspoon of product on each arm and leg, on the back and on the torso. Half a teaspoon should be applied to the face and neck including the ears and the back of the neck. Sunscreen should be reapplied every two hours.
4. Infants under six months of age should be kept out of the sun when the UV index is 3 or greater. If this is not possible, protection should include clothing and hats. Sunscreen should only be applied to areas such as the face, ears and hands if these areas cannot be protected with clothing or wraps. Infants of mothers with inadequate vitamin D levels, especially exclusively breast-fed infants of women who are dark skinned and/or wear clothing that covers most of the body, are likely to be vitamin D deficient and likely to need vitamin D supplementation.

Evidence summary	Level	Reference
Environmental melanoma risk is most strongly associated with an intermittent pattern of sun exposure, as in recreational exposure, and may be more potent in causing melanoma when received in childhood and adolescence than in later life	III-3	2
While robust conclusions are difficult at this time, the use of sunbeds and tanning booths is associated with a small increase in melanoma risk. This risk may be more significant when exposure occurs before age 35	II	8
Incidental brief sun exposures (for fair skinned individuals 6–8min in summer but 6–50min in winter depending on latitude) to around 15–20% body surface, most days are needed to maintain vitamin D levels, so total sun avoidance should not be practised without vitamin D supplementation	III-3	10
Although sunscreens can reduce the risk of some non-melanoma skin cancers, they have not conclusively been shown to reduce the risk of melanoma	III-3	17, 19

Recommendations

	Grade
1. Sunburn be avoided and UV protection (physical methods complemented by sunscreens) adopted	B
2. Sunscreens be used to complement but not to replace physical methods of UV protection	C
3. Risks associated with exposure to tanning booths and sunbeds be explained	C
4. As brief sun exposures are needed to maintain vitamin D levels, total lack of sun exposure is not advised without vitamin D supplementation	C

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