Sun exposure and vitamin D - risks and benefits

Position Statement

Key messages and recommendations

Ultraviolet (UV) radiation from the sun has both beneficial and harmful effects on human health. A balance is required between excessive sun exposure which increases the risk of skin cancer and enough sun exposure to maintain adequate vitamin D levels. Vitamin D is essential for bone and musculoskeletal health.

Production of vitamin D from exposure of the skin to sunlight is influenced by a number of factors including age, skin colour, latitude, season and time of day, making it difficult to provide advice to the population as a whole. With these considerations in mind, recommendations for the general Australian population to minimise the risk of skin cancer while maintaining adequate vitamin D levels are listed below.

Given the considerable evidence showing UV to be carcinogenic, skin cancer prevention in Australia must remain as a high public health priority. For this reason, extended and deliberate sun exposure without any form of sun protection when the UV Index is 3 or above is not recommended, even for those diagnosed with vitamin D deficiency.

Recommendations for the general adult population

UV Index 3 or above

During summer in Australia, all states experience long periods during the day when the UV Index is 3 or above (see Table 1 below). During these periods, a combination of sun protection measures (broad brimmed hat, covering clothing, sunscreen, sunglasses and shade) is recommended when outdoors for more than a few minutes. In summer, most Australian adults will maintain adequate vitamin D levels from sun exposure during typical day to day outdoor activities.

In those parts of Australia where the UV Index is 3 or above in the middle of the day in autumn, winter and spring, a combination of sun protection measures is recommended when outdoors for more than a few minutes at those times. In these locations, most Australian adults produce sufficient vitamin D from UV exposure during typical outdoor day to day activities.

UV Index below 3

In late autumn and winter in those parts of Australia where the UV Index is below 3, sun protection is not recommended. During these times, to support vitamin D production it is recommended that people are outdoors in the middle of the day with some skin uncovered on most days of the week. Being physically active while outdoors will further assist with vitamin D levels.

Recommendations for groups at risk of vitamin D deficiency

Some people in Australia may be at risk of vitamin D deficiency (see Box 1 below). It is recommended that people who may be at risk of vitamin D deficiency discuss their vitamin D requirements with their medical practitioner to determine if vitamin D supplementation rather than sun exposure is appropriate.

Balancing harms and benefits of sun exposure

Ultraviolet (UV) radiation from the sun has both beneficial and harmful effects on health. Sun exposure causes significant morbidity and mortality associated with skin cancer. It is the cause of around 99% of non-melanoma skin cancers and 95% of melanomas in Australia (1). However, the sun is also the main natural source of vitamin D which is essential for bone and musculoskeletal health.

A balance is required between excessive sun exposure which increases the risk of skin cancer and enough sun exposure to maintain adequate vitamin D levels.

It should be noted that the benefits of sun exposure may extend beyond the production of vitamin D. Other possible beneficial effects of sun exposure that may not be related to vitamin D include reduction in blood pressure, suppression of autoimmune disease and improvements in mood.

Vitamin D forms in the skin as a result of exposure to the UVB wavelengths in sunlight, but there is limited evidence available on the amount of UVB required to maintain adequate vitamin D levels. On the other hand, there is considerable evidence showing that excessive sun exposure causes skin cancer and eye damage. Research suggests that prolonged sun exposure does not cause vitamin D levels to continue to increase further (2) but does increase the risk of skin cancer (3). Short periods (of a few minutes) of sun exposure may be more efficient at producing vitamin D than long periods (4) and daily exercise also assists the body to produce vitamin D (5).

The harms of UV exposure - skin cancer

Australia has one of the highest rates of skin cancer in the world. Skin cancer accounts for over 80% of all new cases of cancer diagnosed in Australia each year (6).

Skin cancer includes cutaneous melanoma and non-melanoma skin cancer (NMSC). NMSC is the most common cancer in Australia (7). Melanoma is the fourth most common cancer diagnosed in Australia; the third most common in Australian men (after prostate cancer and bowel cancer) and third most common in Australian women (after breast cancer and bowel cancer) (8).

In Australia in 2011, 11,570 people were diagnosed with melanoma (6734 men and 4835 women) and there were 1544 deaths (1074 men and 470 women) (9). While NSMC is not routinely reported to cancer registries, it is estimated that almost 434,000 Australians (equivalent to 2% of the population) were treated for one or more NMSCs in 2008 (7). In Australia in 2011, there were 531 deaths from NMSC (352 men and 179 females) (9).

In Australia, where the UV Index is 3 or above for much of the year, sun protective measures to reduce the incidence of skin cancer must continue to be a high public health priority. People should continue to protect themselves from excessive sun exposure, especially when the UV Index is 3 or above.

The benefits of UV exposure - vitamin D

There is strong evidence that vitamin D is beneficial for bone development and maintaining musculoskeletal health. The human body needs vitamin D to regulate calcium levels for the production and maintenance of healthy, strong bones. Vitamin D may also have an important role in musculoskeletal health beyond bone; low vitamin D levels have been associated with increased risk of falls in the elderly (15). For this reason, it is important to maintain adequate vitamin D levels (≥50 nanomoles per litre (nmol/L)) year round (10).

In addition to vitamin D produced following sun exposure (11), a small amount of vitamin D can be obtained from some foods such as oily fish, eggs and meat, or fortified foods such as margarine and some milks. However, dietary sources of vitamin D are unlikely to contribute more than 5-10% of an adult's vitamin D requirements (12).

Vitamin D production fluctuates seasonally, decreasing in cooler months when the UV Index is typically lower, more time is spent indoors, and clothing that covers the skin is usual when outdoors. The body can rely on tissue stores of vitamin D for between 30 and 60 days, assuming vitamin D levels are adequate (13). For most of the population, any reduction in vitamin D levels experienced when the UV Index is lower can be corrected during those times of the year when the UV Index is higher and more time is spent outdoors. It is still advisable to prevent vitamin D deficiency during periods when the UV Index is lower as fracture rates increase with deficiency, particularly in older adults (14).

Vitamin D requirements

The consensus of current evidence is that a sufficient level of vitamin D to maintain bone health is 50-60 nmol/L Based on current available evidence and to allow for any potential seasonal decrease in vitamin D, it is recommended that vitamin D levels are 60-70 nmol/L at the end of summer or >50 nmol/L at the end of winter (15). At risk groups (see Box 1) should discuss their vitamin D requirements with their medical practitioner.

There is limited research available to determine exactly how much sun exposure is required to maintain adequate vitamin D levels and prevent adverse health outcomes. Production of vitamin D is influenced by a number of factors including age, skin colour, latitude, season and time of day, making it difficult to provide advice to the population as a whole. With these considerations in mind, recommendations for the general Australian population to maintain adequate vitamin D levels, while minimising the risk of skin cancer are listed below.

Sun exposure and the UV Index

The daily maximum UV Index is a measurement of the strength of UV radiation on the ground at solar noon. Table 1 provides guidance as to the average daily maximum UV Index by month for selected Australian capital cities. Please note this may not be representative of the UV Index in other parts of the state. This table highlights (shaded areas) the months of the year when sun protection may not be required (UV Index below 3). At all other times, sun protection is recommended when outside while the UV Index is 3 or above. To check the UV Index for your location, visit www.myuv.com.au or download the free SunSmart app for iPhone, iPad and Android devices. The SunSmart app can send you daily advice about the UV Index to assist with planning your daily sun protection times.

Table 1 Average daily maximum UV Index by month for selected Australian capital cities

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Darwin	12.3	12.6	12.5	11.1	9.2	8.2	8.7	10.2	11.9	12.6	12.4	12.0
Brisbane	11.8	11.2	9.5	6.9	4.8	3.7	4.1	5.4	7.4	8.9	10.5	11.3
Perth	11.8	11.0	8.6	5.8	3.8	2.8	3.0	4.3	6.1	8.1	9.8	11.4
Sydney	10.5	9.5	7.5	5.2	3.2	2.3	2.5	3.6	5.3	7.1	8.7	10.0
Canberra	10.7	7.7	6.9	4.8	2.9	1.9	2.2	3.3	5.0	6.8	8.5	10.6
Adelaide	11.2	10.1	7.8	5.1	3.0	2.1	2.3	3.4	5.2	7.2	9.2	10.7
Melbourne	10.3	9.0	7.0	4.4	2.4	1.6	1.7	2.8	4.3	6.3	8.3	9.8
Hobart#	8	7	4	3	1	1	1	2	3	4	6	7

Table is from Gies et al [16].
Hobart data is supplied from personal communication from the Australian Radiation Protection and Nuclear Safety Agency.

Recommendations for the general adult population

There are times during the day and year when it is safer to go outside without sun protection. At these times there is very little capacity to produce vitamin D due to low levels of UVB. When the UV Index is below 3, such as early morning or late afternoon in summer, or during winter in some parts of Australia, sun protection is not recommended unless outdoors for extended periods. The length of the daily period during which the UV Index is 3 or above varies by latitude and season. It is shorter in the southern parts of Australia and longer in the northern parts; and shorter in winter and longer in summer. Specific advice follows.

UV Index 3 or above

During summer in Australia, all states experience periods during the day when the UV Index is 3 or above (see Table 1 above). During these periods, a combination of sun protection measures (broad brimmed hat, covering clothing, sunscreen, sunglasses and shade) is recommended when outdoors for more than a few minutes to reduce the risk of skin cancer. In summer, most Australian adults will maintain adequate vitamin D levels during typical day to day outdoor activities. For example, a few minutes of mid-morning or mid-afternoon sun exposure to arms and hands (or equivalent area) on most days of the week should be sufficient to maintain adequate vitamin D levels.

In those parts of Australia where the UV Index is 3 or above in the middle of the day in autumn, winter and spring, a combination of sun protection measures (broad brimmed hat, covering clothing, sunscreen, sunglasses and shade) is recommended when outdoors for more than a few minutes at those times. In these locations, most Australian adults produce sufficient vitamin D from UVB exposure during typical outdoor day to day activities.

Sunscreen use should not put people at risk of vitamin D deficiency. When sunscreen is tested in laboratory conditions it is shown to limit the effectiveness of vitamin D production, however, population studies have shown that regular use of sunscreen has little effect on vitamin D levels (17).

UV Index below 3

In late autumn and winter in those parts of Australia where the UV Index is below 3 through most of the day (see Table 1 above), sun protection is not recommended. During these times, to support vitamin D production it is recommended that people be outdoors in the middle of the day with some

skin uncovered on most days of the week. Being physically active while outdoors will further assist with maintaining vitamin D levels. A brisk walk at lunchtime or gardening are examples of being physically active outdoors.

Outdoor workers have extended periods of sun exposure and therefore it is unlikely that vitamin D deficiency is an issue for this professional group. It is recommended that outdoor workers use sun protection measures throughout the year regardless of the UV Index, as they have an increased risk of skin cancer.

Sun protection and vitamin D

While some sun exposure is necessary for the production of vitamin D, it is important to keep in mind that all sun exposure carries a risk of skin and eye damage and skin cancer, especially for people with light skin colour. Extended and deliberate sun exposure without any form of sun protection when the UV Index is 3 or above is not recommended, even for those diagnosed with vitamin D deficiency.

Vitamin D deficiency

In the 2011-12 Australian Health Survey 23% of Australian adults were vitamin D deficient (<50nmol/L). This included 17% who were mildly deficient (30-49 nmol/L), 6% who were moderately deficient (13-29 nmol/L) and less than 1% who were severely deficient (<13nmol/L) (18). Vitamin D levels varied considerably by season with deficiency less common in summer (14%) than in winter (36%). While there was little variation between the states and territories in summer, in winter vitamin D deficiency was more common in Victoria (49%), ACT (49%) and Tasmania (43%), but remained low in Queensland (15%) and the Northern Territory (17%). Vitamin D deficiency was more common among those living in major cities (27%) compared with those living in regional (16%) and remote areas (9%) (18).

Severe vitamin D deficiency leads to osteomalacia (softening of bones) in adults (19), and rickets in children (20), along with muscle weakness. Low vitamin D levels in children and adults may have no obvious symptoms.

Severe vitamin D deficiency is a medical condition requiring medical advice and supervised therapy; oral vitamin D_3 supplementation – rather than reliance on sun exposure – may be necessary. Supplements may also be beneficial for some people where even very short periods of sun exposure increases the risk of skin cancer (e.g. individuals who have had skin cancer, have received an organ transplant, are immune suppressed or are highly sun sensitive).

Factors affecting vitamin D levels

Environmental, physical and behavioural factors affect vitamin D production. The amount of UVB in sunlight changes with latitude, season and time of day. Physical characteristics can also affect vitamin D production, for example people with darker skin types produce less vitamin D (21). Vitamin D deficiency can be a problem in the frail, housebound elderly, chronically ill, or institutionalised children and adults. All are related to low levels of sun exposure (22). Obese people have lower vitamin D levels, which may be due to less sun exposure or more storage of vitamin D in fat tissue (23). Some medications can interact with vitamin D metabolism or cause the skin to be more sensitive to the sun and leading to sun avoidance, thus increasing the risk of developing vitamin D deficiency.

An Australian study found that the latitude was the best predictor associated with vitamin D levels (24). Among the modifiable behavioural factors, the most important factor contributing to vitamin D levels was the amount of skin that people exposed while outdoors. The findings suggest that reducing clothing cover would be a more effective way of increasing vitamin D levels than increasing duration of sun exposure (24).

People, especially women, who wear concealing clothing for religious or cultural reasons are at increased risk of vitamin D deficiency because of very small areas of skin exposed to sunlight (25). Women who wear concealing clothing, especially those with naturally very dark skin, who are pregnant or planning pregnancy should see their medical practitioner regarding their vitamin D requirements.

Box 1. Groups at risk of vitamin D deficiency

- Those with previous skin cancer or at high risk of skin cancer
- People who wear covering/concealing clothing
- Naturally very dark skinned people
- People who spend long hours indoors, including housebound or institutionalised Australians
- Older adults
- Obese people
- Babies and infants of vitamin D deficient mothers

Recommendations for at risk groups

It is recommended that people who may be at risk of vitamin D deficiency discuss their vitamin D requirements with their medical practitioner to determine if dietary supplementation, rather than sun exposure is appropriate.

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