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Research

Review of sun exposure guidance documents in Australia and New Zealand

Christina Verma[a], Jessica Lehane[a], Rachel E Neale[b] and Monika Janda[a,c,d]

[a] Centre for Health Services Research, Faculty of Medicine, University of Queensland, Brisbane, Australia
[b] QIMR Berghofer Medical Research Institute, Brisbane, QLD, Australia
[c] Institute of Health and Biomedical Innovation, School of Public Health and Social Work, Faculty of Health, Queensland University of Technology, Brisbane, Australia
[d] Corresponding author: m.janda@uq.edu.au

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Key points

- Effective guidance documents are critical for balancing the risks and benefits of sun exposure
- Among four major themes (sun protection, non-vitamin D benefits of sun exposure, balance between risks and benefits of sun exposure, and sun exposure and vitamin D production) – non-vitamin D health benefits of sun exposure were least covered by guidance documents
- Recommendations about sun exposure and vitamin D production varied between guidance documents
- Reducing inconsistencies and variation across guidance documents could improve consumer certainty and promote healthy behaviours

Abstract

Importance: Exposure to ultraviolet (UV) radiation from the sun has both risks, including skin cancer and premalignant lesions, skin aging and cataracts, and benefits, including the production of vitamin D. Health policies guide informed decision making about balancing these risks and benefits. However variability in advice given by different agencies (e.g. government, health organisations, consumer organisations) may lead to confusion among the general public, resulting in suboptimal health-related behaviours by consumers.

Objective: To review and assess the consistency of recommendations in relevant guidance documents in Australia and New Zealand regarding the risks and benefits of sun exposure.

Study type and methods: A rapid desktop review of publicly available sun exposure guidance documents from government and nongovernment websites was undertaken between February and April 2021. Four major themes and their subthemes were extracted from documents: sun protection; balance between risks and benefits of sun exposure; non-vitamin D benefits of sun exposure; and sun exposure and vitamin D production. We then undertook a more detailed analysis of recommendations regarding sun exposure to maintain sufficient vitamin D status.

Results: Nineteen documents met the inclusion criteria (13 Australian, five New Zealand, and one joint Australian and New Zealand document). Most documents provided extensive advice about sun protection and sun exposure and vitamin D production and their respective subthemes, while only 2/19 documents provided advice regarding the non-vitamin D benefits of sun exposure (benefits for melatonin production and reduction of sleep disorders). Documents varied widely in their recommendations in relation to sun exposure required for vitamin D production. For example, while three documents stated that sun exposure is required on most days of the week for adequate vitamin D production, two stated that sun exposure is required daily. One document advised that people with darker skin require three to six times more

sun exposure than those with lighter skin, while another advised two to three times more sun exposure is required.

Conclusion: Current guidance documents show great variation in the advice for sun exposure and vitamin D production, and little advice is being provided on non-vitamin D health benefits. Extensive variations in the advice provided could be confusing for consumers and result in unhealthy behavioural action. Based on this evidence, better and more consistent guidance and advice about the risk and benefits of sun exposure is required.

Introduction

Australia and New Zealand have the highest and second highest rates of melanoma globally, as a consequence of mostly fair-skinned populations living in areas with high ambient ultraviolet (UV) radiation. In 2017, melanoma was the fourth most commonly diagnosed cancer in Australia, with 14 846 new cases and 1420 deaths that year.[1] Keratinocyte cancers, due to their extraordinarily high incidence, carry a very large economic burden; in 2008–09 they accounted for 8% of all health system spending on cancer in Australia (excluding cancer screening).[2] In addition to skin cancers, exposure to UV radiation causes premalignant skin lesions, photoageing of the skin, and eye diseases such as cataracts and pterygium.

Exposure to solar UV radiation also has benefits, most notably production of vitamin D. Adequate vitamin D status is critical to maintain optimal musculoskeletal health, and there may be other health benefits such as boosting the immune response to infection and reducing the risk of autoimmune diseases such as multiple sclerosis.[3] Despite Australia's high risk of skin cancer, the prevalence of vitamin D deficiency is not trivial; the 2011–12 Australian Health Survey found that overall 23% of Australians were vitamin D deficient (defined as blood levels of 25-hydroxyvitamin D (25(OH)D) <50 nmol/l), and in southern states in winter this was close to 50%.[4]

The UV radiation wavelengths that are the primary drivers of skin cancer and that generate vitamin D overlap to a large extent. This makes balancing the risks and benefits of sun exposure challenging.[5] Policy, guidance and position statement documents are important for informing the population about health topics of relevance.[6] Given the complexity in minimising the risks of sun exposure while avoiding vitamin D deficiency, it is critical that documents providing guidance are evidence based, clear and consistent in order to reduce confusion and increase behavioural action among consumers.[7,8] However, there is currently no information about how many documents include information about balancing the risks and benefits of sun exposure and about the consistency of the advice given.

This review aimed to identify guidance documents regarding the risks and benefits of sun exposure developed by government and nongovernment organisations in Australia and New Zealand, and to review their recommendations in relation to sun protection; non-vitamin D benefits of sun exposure; balance between risks and benefits of sun exposure; and sun exposure to generate vitamin D. Consistency and variation in advice with respect to sun exposure to generate vitamin D across these documents was examined in detail.

Methods

A desktop review of publicly available websites was undertaken between February and April 2021 to identify policies, guidelines or position statements relating to the risks and benefits of sun exposure in Australia and New Zealand. Search terms "sun exposure" AND/OR "vitamin D" were paired with "policy" AND/OR "guideline" AND/OR "position statement".

Inclusion and exclusion criteria

To be included in the review, documents had to provide information about both the risks and benefits of sun exposure and recommendations regarding sun exposure to produce vitamin D production. The review was restricted to documents available on government websites, and those of public health organisations, large clinical organisations (including professional societies or large hospitals) and cancer advocacy organisations. If organisations published more than one relevant document, these were included if directed to different audiences. News and general health information webpages and blog pages were excluded.

Review process

The review aimed to extract broad information under four pre-specified themes: 1) sun protection; 2) non-vitamin D benefits of sun exposure; 3) balance between risks and benefits of sun exposure; and 4) sun exposure and vitamin D production (Table 1). Detailed information was captured for advice about sun exposure and vitamin D production across seven key subthemes: the recommended length/frequency of sun exposure; recommended time of day for sun exposure; types

Table 1. Recommendations included in 19 sun exposure guidance documents

Recommendations	Document reference number[a]																		
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Sun protection																			
Information about harms of sun exposure included	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
UV Index used to underpin recommendations about when sun protection should be used	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y
Sun protection not advised at some times of the day	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N
Sun protection not advised at some times of the year	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N
Length of time outdoors before sun protection required stated	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	N	Y	N	N	Y	Y	N	Y
Sun protection advice for people with darker skin included	N	Y	Y	N	N	Y	N	N	N	Y	Y	Y	N	Y	N	N	Y	N	N
Non-vitamin D benefits of sun exposure																			
Statement that the sun has other benefits included	N	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N
Specific advice about how to obtain other benefits of sun included	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Balance between risks and benefits of sun exposure																			
Advice about balance varies according to risk of skin cancer	N	Y	N	Y	N	N	N	Y	N	Y	Y	N	Y	Y	Y	Y	N	N	N
Advice about balance varies according to risk of vitamin D deficiency	N	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N
Sun exposure and vitamin D production																			
25(OH)D concentration cut-point for deficiency included	N	N	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	N
Information about musculoskeletal benefits of vitamin D included	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y
Information about other health benefits of vitamin D included	N	Y	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	N	N	N	Y	Y
Specific advice about the length of time outdoors needed to make vitamin D included	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
Advice about what time of the day people should be outdoors to make vitamin D included	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
UV Index used to underpin advice about sun exposure for vitamin D production	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y
Advice that the length of time varies according to geography	N	Y	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	Y	Y	Y
Advice that the length of time varies with season	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	N	Y	N	Y	Y	Y	Y	Y
Advice that the length of time varies with skin type	N	N	Y	N	N	Y	N	N	N	N	Y	N	N	N	Y	Y	Y	Y	N

Table 1. Recommendations included in 19 sun exposure guidance documents (continued)

Recommendations	Document reference number[a]																		
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Sun exposure and vitamin D production																			
Specific advice about the amount of skin that should be exposed included	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y	N	N	N	N	N	Y	Y	N
Advice that amount of skin to expose varies with geography	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Advice that amount of skin to expose varies with season	Y	Y	Y	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	Y	N	N
Advice about when supplementation might be required provided	N	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Statement that physical activity supports vitamin D production included	Y	Y	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	N

Y = Included in the document; N = Not included in the document
[a] Document reference number (see full references at end of manuscript):
9 - Cancer Council Australia: Position statement – sun exposure and vitamin D – risks and benefits
10 - Cancer Australia: Lifestyle risk factor – sun exposure
11 - Victoria Health: Vitamin D and sun exposure
12 - Australasian College of Dermatologists: Consensus statement – sun protection and sunscreens
13 - Public Health Association Australia: Skin cancer prevention: policy position statement
14 - Sports Medicine Australia: UV exposure and heat illness guide
15 - New Zealand Government Ministry of Health: Companion statement on vitamin D and sun exposure in pregnancy and infancy in New Zealand.
16 - New Zealand Government Ministry of Health and Cancer Society of New Zealand: Consensus statement on vitamin D and sun exposure in New Zealand
17 - Australian Cancer Network Melanoma Guidelines Revision Working Party: Clinical practice guidelines for the management of melanoma in Australia and New Zealand
18 - Cancer Society of New Zealand: Position statement: the risks and benefits of sun exposure in New Zealand
19 - DermNet NZ: Vitamin D
20 - The Royal Children's Hospital Melbourne: Kids health information. Safety: sun protection
21 - South Eastern Sydney Local Health District: Vitamin D in pregnancy and breastfeeding
22 - Sydney Children's Hospital: Vitamin D therapy
23 - South Australian Health, Government of South Australia: Vitamin D deficiency in Children
24 - Health Navigator New Zealand: Vitamin D and sensible sun exposure
25 - The Royal Children's Hospital Melbourne: Immigrant Health Service. Low vitamin D
26 - Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia and Osteoporosis Australia: Vitamin D and adult bone health in Australia and New Zealand: a position statement
27 - Osteoporosis Australia (Healthy Bones Australia): Vitamin D – consumer guide

of activities that are recommended/advised for sun exposure; advice for different skin types; effect of sunscreen use on vitamin D production; recommended skin area for exposure; and advice in relation to vitamin D supplementation (Table 2).

Pre-specified themes were identified by areas of interest to the Sun Exposure Summit hosted by the Australian Skin and Skin Cancer Research Centre in March 2021. Subthemes for the review were also based on pre-specified areas of interest, and the reviewers were also open to additional themes that emerged from the analysis of the documents.

Guidance documents were assessed against the inclusion and exclusion criteria by two reviewers independently and differences of opinion were resolved through consultation. We then mapped which documents contained advice specific to each of the themes and subthemes.

Results

Number of policies identified

We initially identified 25 weblinks to potentially eligible documents. Six of these were not published by eligible organisation types and were therefore excluded. Of the 19 documents that met the inclusion criteria, 13 were Australian, five were from New Zealand, and one served

both Australia and New Zealand; they were published by 17 organisations. Documents were developed by a variety of organisations, including five by government departments, four by hospitals and 10 by peak bodies/colleges/advocacy groups. Some of these organisations developed more than one document.

Seven documents were directed to the general public, seven to clinicians, three to both clinicians and the general public, and two to organisations such as local councils.

Themes and subthemes

Table 1 identifies whether documents provided information in relation to subthemes of the four major themes. Table 2 provides detail about the advice provided in relation to sun exposure and vitamin D production.

Table 2. Variation of vitamin D–specific sun exposure advice/recommendations

Document number	Wording[a] (note: text has been extracted from the respective documents identified in the 'Document number' column)
Vitamin D production: length/frequency of sun exposure time required	
9,10,11,14	Few minutes during UV index 3 or above
9,10,11	On most days of the week when UV index is 3 or above
21	On most days of the week when UV index is below 3
16,15	Daily
27	Sydney, Perth & Canberra: Two to three hours per week between June-July; a few minutes on most days during summer (mid-morning or mid-afternoon)
27	Hobart, Melbourne & Adelaide: Two to three hours per week between May-August; a few minutes on most days during summer (mid or morning afternoon)
27	Darwin: A few minutes on most days
26	Ranging between 5–9 minutes between December and January at 10:00 or 14:00 depending on location
26	Ranging between 9–97 mins at 10:00 or 14:00 and 7–40 mins at 12:00 between July-August depending on location
20	Some sun exposure is necessary for the production of vitamin D
24	15 minutes in direct sunlight (without sunscreen) three times a week is enough for your body to make the vitamin D you need
24	Between September and April (summer months): As little as 6–8 minutes of sun exposure may be enough to produce 1,000 IU of vitamin D.
24	Between May and August (winter months): Head outside for 30 minutes of sunshine in the middle of the day
Vitamin D production: recommended time of day for sun exposure	
19	Deliberate exposure at peak UV times is not recommended during UV level 3 or above
21	Sun exposure encouraged during winter, when UV Index is below 3 without sun protection
9,10,27	Exposure should occur mid-morning or mid-afternoon during UV index 3 or above
9,10	Middle of the day during UV index below 3
11	Exposure should occur during either side of peak UV radiation period of 10.00am to 2.00pm (11.00am to 3.00pm daylight-saving time) during UV level 3 or above during September to April
14	Outside of peak UV times (10am to 3pm) UV levels 3 or above between September to April
16,15	Early morning or late afternoon sun exposure during September and April (between 10am–4pm) and some exposure in hours around noon during May and August is recommended
20	Babies under 12 months should not be exposed to direct sun when UV level reach 3 or higher.
22	Depending on skin colour and latitude, about 20 minutes per day has been recommended to maintain normal vitamin D levels
24	Between September and April (summer months): exposing yourself to gentle early morning or late afternoon sunlight is recommended.
Vitamin D production: type of activities recommended/advised for sun exposure	
16,15	Walk
16,15	Outdoor physical activity
9,27,12,18	Most people will maintain adequate vitamin D levels from sun exposure during typical day to day outdoor activities.

Table 2. Variation of vitamin D–specific sun exposure advice/recommendations (continued)

Document number	Wording[a] (note: text has been extracted from the respective documents identified in the 'Document number' column)
Vitamin D production: type of activities recommended/advised for sun exposure (continued)	
19	During summer months: regular, short incidental outdoor UV exposure outside peak UV times.
25, 22	Encourage active outside play or physical activity during and after school/preschool in summer or UV index >=3 and in winter
24	Between September and April (summer months): A daily walk or some other form of outdoor physical activity in the early morning or late afternoon, with your face, arms and hands exposed
124	Between May and August (winter months): You can't get vitamin D by sitting inside by a sunny window – UVB waves do not pass through glass. You need to be in direct sunlight.
Vitamin D production: advice for different skin types	
11	People with naturally very dark skin may need three to six times more exposure than recommended for those with lighter skin when UV level is 3 and above
14	People with naturally very dark skin may need two to three times more exposure than recommended during September to April
26	Exposure times for people with highly pigmented skin would be 3–4 times greater than the document's recommended exposure times
17	Fair skin: 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.
20	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 for children with dark skin
21	In summer in Australia, many people with fairer skins will maintain adequate vitamin D from typical outdoor activities.
25	Adults with dark skin require 2–7 times the amount of UVB compared to people with light skin to produce similar vitamin D levels
25	Pregnant adults, fair skin in summer or UV index >=3: 6–7 minutes with arms (or equivalent area) exposed mid-morning or mid-afternoon most days of the week, avoid sunburn, full sun protection with sunscreen/hat/clothing/shade and sunglasses recommended
25	Pregnant adults, darker colour skin in summer or UV index >=3: 15–50 minutes with arms (or equivalent area) exposed mid-morning or mid-afternoon most days of the week, avoid sunburn, intermittent sun exposure without sunscreen can be tolerated but hat and sunglasses still recommended
25	Pregnant adults, fair skin in winter: 7–40 minutes exposure (depending on latitude) with face arms, and hands exposed at lunchtime most days of the week. If UV index <3, sunscreen not required unless in alpine regions, outside for extended periods or near highly reflective surfaces such as snow/water
25	Pregnant adults, dark skin in winter: Sun protection depends on latitude. Sunscreen not needed in Southern states/ New Zealand unless near highly reflective surfaces such as snow or water. It may not be possible to maintain vitamin D levels through sun exposure alone in southern states of Australia/New Zealand
23	Dark-skinned individuals with increased skin pigment who may require up to six times more sun exposure than light skinned individuals
24	Between May and August (winter months): Having dark skin is associated with decreased rates of vitamin D production and people with darker skin may need 3–6 times more sun exposure to get the same level of vitamin D production as people with lighter skin.
Vitamin D production: sun protection advice	
9	Extended and deliberate sun exposure without any form of sun protection is not recommended, even for those diagnosed with vitamin D deficiency
12	Exposure without sun protection is not recommended when UV index is 3 or above, including for those who are vitamin D deficient
11,13,19	Most people need sun protection
16	Between May and August, sun protection is generally not required unless at high altitudes or near highly reflective surfaces, such as snow or water
13	Sun protection is still required in most cases, when the UV Index reaches 3 or more. Deliberate sun exposure for the purpose of boosting vitamin D levels is not recommended during UV levels 3 or above

Table 2. Variation of vitamin D–specific sun exposure advice/recommendations (continued)

Document number	Wording[a] (note: text has been extracted from the respective documents identified in the 'Document number' column)
Vitamin D production: sun protection advice (continued)	
27	When the UV Index is 3 or above sun protection is required when outdoors for more than a few minutes
11	Sun protection needed except in alpine regions or near highly reflective surfaces, such as snow and water when UV Index level is below 3
11	An area with adjustable shade or deciduous trees can allow direct sunlight from May to August and protected sun exposure (shade, protective clothing and sunscreen) from September to April
21	Use sun protection (such as a hat and sunscreen) in summer
Vitamin D production: recommended skin area for exposure	
9,10	hands and arms (or equivalent area)
11,14,15	face, arms and hands or equal surface
26	Exposure of hands, face and arms to one-third of a minimal erythemal dose of sunlight most days is recommended for adequate endogenous vitamin D synthesis
18	Summer: exposing the face, arms and hands or the equivalent area of skin to a few minutes of sunlight on either side of the peak UVR periods on most days of the week (people with dark skin will require more exposure).
Vitamin D production: vitamin D supplementation	
26	If policy's recommended sun exposure is not possible, then a vitamin D supplement of at least 400 IU (10 µg) per day is recommended.
17	A total lack of sun exposure is not advised without vitamin D supplementation.
19	Wintertime exposure may not be adequate to maintain optimal vitamin levels and additional measures such as supplementation may be required
25	In the absence of sun exposure, recommended vitamin D supplementary intakes are: 1) 12 months - adequate intake (AI) 400 IU daily. 2) 1–18 years - estimated average requirement (EAR) 400 IU daily and recommended dietary allowance (RDA) 600 IU daily.
25,22	In winter and in infants, children and adolescents, it may not be possible to maintain recommended serum 25(OH)D levels through sun exposure alone in southern states of Australia and in New Zealand

UVB/UV-B = ultraviolet B; UVR = ultraviolet radiation

[a] Wording provided in this column is not a representation of full advice and may be linked to complementary or tandem advice about length/frequency of exposure time required, as detailed elsewhere in the table.

Of the 19 documents included, all provided some information about the harms of sun exposure[9-27] and 14 gave recommendations about use of sunscreen.[9-17,20-22,25,26] Although the UV index was frequently used to underpin recommendations about when sun protection is required (N = 16)[9-22,25,27], some documents specified times of the day[9-11,14-20,22,24-26] or year[9-11,15-22,24-26] when sun protection was not required, while some gave information about the length of time outdoors before sun protection was required.[9-11,14,16-19,21,24,25,27] Only eight documents provided sun protection advice for people with darker skin.[10,11,14,18-20,22,25]

The lack of recognition of diversity was also evident in advice about balancing the risks and benefits of sun exposure. Only nine documents recognised that the balance varies according to an individual's risk of skin cancer[10,12,16,18,19,21-24] and only two of these also reflected that risk of vitamin D deficiency needs to be considered.[10,18]

There was considerable variation between documents regarding their advice about the frequency, duration and timing of sun exposure needed to maintain vitamin D levels. In terms of frequency, four documents suggested most days[9-11,21], and two advised daily exposure.[15,16] Four of these documents used the UV index to underpin advice.[9-11,14] Regarding duration of time outdoors, in seven documents this varied according to time of day[11,15,16,22,24,26,27] and seven provided advice according to season[11,14-16,24,17,26], with five providing advice according to both season and time of day.[11,15,16,22,24,27] The advised time outdoors varied. For example, advice for exposure time in summer varied from 5 to 9 minutes per day, while advice for winter months was 30 minutes to 3 hours per day, with the difference not underpinned by skin type.

There was similar variability in the advice about the time of day optimal for time outdoors to make vitamin D in the body. For example, three documents recommended that exposure should occur mid-morning or mid-afternoon when the UV index was 3 or above[9,10,27], while two suggested early morning or late afternoon sun exposure between September and April[15,16], even though there is

minimal ultraviolet B radiation available at these times to support vitamin D production.

Of the 19 documents, eight provided advice about recommended exposure times according to different skin types.[11,14,17,20,21,23-26] Within these, the recommendations about how much more time outdoors is needed for people with darker compared with lighter skin varied. One document stated that people with naturally dark skin will need three to six times more exposure than those with light skin[11], while another stated that two to three times more exposure is required for those with darker skin.[14] One document provided considerable detail about the exact amount of sun exposure needed to generate vitamin D according to skin colour.[25] One stated that extended and deliberate sun exposure without any form of sun protection when the UV index is 3 or above is not recommended for children with naturally dark skin, even for those diagnosed with vitamin D deficiency.[20]

Thirteen documents provided advice in relation to vitamin D production and sun protection.[9-16,18,19,21,26,27] Two documents noted that wearing covering clothing can lead to vitamin D deficiency due to limited UV radiation reaching the skin[22,24], while with respect to sunscreen, three documents commented on whether sunscreen application prevents vitamin D production.[9,12,16] Of these, two suggested that sunscreen used in a real-life setting will not influence vitamin D production[12,16], while one suggested the opposite.[9]

Five documents provided advice about the amount of skin that should be exposed to promote vitamin D production. Of these, two recommend hands and arms or equivalent area should be exposed[9,10], while three policies recommend face, arms and hands or equal surface area.[11,15,16]

Of the five documents that gave advice about vitamin D supplementation, three gave advice targeted to children[20,25], and three to adults.[17,19,26] Most of these documents were targeted to clinicians and as they tended to be more focused on clinical care.[17,22,26] One document recommended that lack of sun exposure is not advised without vitamin D supplementation[17], and two suggested that supplementation may be required for those months when the UV index is below 3, particularly for people who are vitamin D deficient.[18,19] Another document stated that people who are at high risk for vitamin D deficiency may require supplementation.[20] Two documents specifically stated that darker-skinned children cannot maintain vitamin D levels during winter time in the southern states of Australia and New Zealand, but did not recommend a specific supplement dose.[22,25]

Only two documents stated that exposure to the sun confers benefits in addition to generating vitamin D.[10,18] These were melatonin production and reduction of sleep disorders. Neither document gave specific advice about behaviours necessary to obtain these sun exposure benefits.

Discussion

Although communicating the risks and benefits of sun exposure is challenging, it is important that policy documents provide consistent evidence-based recommendations to their target audience. In this review, we found considerable variation in the extent and emphasis of advice provided in the 19 guidance documents assessed. While there could be many factors contributing to this, the differences in advice given could cause confusion and reduce the likelihood of positive health-related behavioural action among the target populations.

The UV index is recognised internationally as the best method of communicating the intensity of UV radiation, and therefore the times when sun protection is required. Despite this, it was not mentioned in several documents, which either gave no information or used other methods to communicate this information.[28] Recent studies have shown that communication about the UV index is suboptimal and its impact on sun exposure behaviours remains low.[29] Ensuring that it is routinely included in all documents advising about sun exposure and protection may lead to greater awareness and use.

The advice about sun exposure needed to generate vitamin D varied markedly. The intensity of UV-B radiation, needed to generate vitamin D, varies according to latitude, season and time of day making it challenging to communicate advice at a broad public health level. Although some documents were very specific about the length of time, time of day, and amount of skin that needed to be exposed, others provided more general advice. This variation could reflect a number of factors including the intent of the guidance document, the organisation developing the document, and the uncertainty in the literature about how much UV radiation is required to maintain adequate vitamin D status. In particular, the clinical focus of documents prepared by hospitals resulted in a greater emphasis on supplementation and more technical advice than those targeted towards the general public. This confusion suggests that greater clarity might be needed in policy and guidance documents to avoid both over- and under-exposure.

The majority of the documents targeted their advice towards people with pale white to light brown skin colour, perhaps reflecting the organisations from which the documents emanated, which were often focused on cancer prevention. However, this has resulted in limited advice for people with darker skin types, for whom specific advice was lacking in most documents. The US Preventive Services Taskforce (USPSTF) emphasises the importance of communicating skin colour-specific sun exposure recommendations.[30] Australia has a very diverse population, and it is important that advice regarding sun protection and vitamin D account for this diversity moving forward.[31]

While the variability in the advice given may reflect the different target audiences or focus of the organisation, it is also likely that the controversy in the literature about the relative importance of vitamin D has contributed to the discrepancies. The lack of agreement in the literature about the 25(OH)D concentration that indicates vitamin D deficiency is a challenge that needs to be resolved.[32] Irrespective of the cause, the consequences of the variable advice is reflected in surveys which suggest that the general public and clinicians are uncertain about how to balance the risks and benefits of sun exposure. Studies undertaken in Australia have found that almost 50% of people believe that using sun protection limits the ability to produce vitamin D, people are confused about using sunscreen, and very little guidance is provided by health professionals in relation to balancing the harms and risks of sun exposure.[33,34] This emphasises that sun exposure messaging and policies should be refocused to clearly communicate both the risks and benefits of sun exposure to improve overall health outcomes.[35]

Spending time outdoors confers benefits beyond those related to vitamin D. Some of these may be induced by the UV-B wavelengths, but others, particularly those related to circadian rhythm, are likely to be mediated by other wavelengths. Advice to spend time outdoors early in the morning may achieve these benefits but is unlikely to result in any UV-B–mediated benefits; this wavelength dependence was not well reflected by the policies.

Previous studies have shown that lack of consistency in advice can result in people ignoring the guidance or being confused.[36-37] Varying recommendations relating to the harms and benefits of sun exposure and vitamin D production poses the question about whether guidance documents across Australia and New Zealand are currently effective in clearly articulating and communicating the relevant evidence-based information (or lack thereof) to the general public, clinicians or health professionals.[38] Policy communicators should be encouraged to align documents to government-endorsed recommendations or highlight areas where more research is needed before such recommendations can be made. This will reduce the risk of inconsistency, confusion and miscommunication of recommendations/advice. This will require collaboration between governments, researchers, policy makers, health promotion professionals and consumers in developing, endorsing and communicating clear and relevant recommendations.

This study has some limitations. It was undertaken using a rapid desktop review approach, and some relevant documents may have been missed. The complexity of language variations and the structure of recommendations, particularly those relating to how to maintain adequate vitamin D through time outdoors, may have influenced the way in which recommendations have been grouped in themes/subthemes. The exclusion criteria may also be considered a limitation as the manuscript does not explore documents that identified only risks or benefits of sun exposure.

Conclusion

This review identified considerable variability in the advice about the risks and benefits of sun exposure, both in the actual advice and in the wording used to convey the recommendations. The lack of recognition of diversity in how to balance the risks and benefits of sun exposure is a notable gap. Key stakeholders need to work together to increase the consistency and, if necessary, highlight the need for further research before evidence-based guidelines to inform clinicians and the general public can be provided. Such documents are key to support informed decisions about how to balance the well-known risks of skin cancer against the benefits of sun exposure.

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None declared.

Author contributions

CV was responsible for the analysis of data, drafting and editing the manuscript and design of manuscript. JL was responsible for the analysis of data, and drafting and editing the manuscript. RN and MJ were responsible for providing analytical advice, reviewing and editing the manuscript and contributing to the design of the manuscript.

References

1. Australian Institute of Health and Welfare. Cancer data in Australia. Canberra: AIHW; 2021 [cited 2022 Feb 16]. Available from: www.aihw.gov.au/reports/cancer/cancer-data-in-australia/data?page=5
2. Australian Institute of Health and Welfare. Skin cancer in Australia. Canberra: AIHW; 2016 [cited 2022 Feb 14]. Available from: www.aihw.gov.au/getmedia/0368fb8b-10ef-4631-aa14-cb6d55043e4b/18197.pdf.aspx?inline=true

3. Martineau AR, Jolliffe DA, Hooper RL, Greenberg L, Aloia JF, Bergman P, et al. Vitamin D supplementation to prevent acute respiratory tract infections: systematic review and meta-analysis of individual participant data. BMJ. 2017;356:i6583.
4. Australian Bureau of Statistic. Australian Health Survey: biomedical results for nutrients. Canberra: ABS; 2013 [cited 2022 Feb 23]. Available from: www.abs.gov.au/statistics/health/health-conditions-and-risks/australian-health-survey-biomedical-results-nutrients/latest-release
5. Lucas RM, Ponsonby A-L. Considering the potential benefits as well as adverse effects of sun exposure: can all the potential benefits be provided by oral vitamin D supplementation? Prog Biophys Mol Biol. 2006;92:140–9.
6. Wild C, Weiderpass E, Stewart B. World cancer report: cancer research for cancer prevention. Lyon: International Agency for Research on Cancer; 2020.
7. Bauman AE, King L, Nutbeam D. Rethinking the evaluation and measurement of Health in all policies. Health Promot Int. 2014;29 Suppl 1:i143-51.
8. World Health Organisation. Health in all policies. Geneva: WHO; 2013 [cited 2022 Feb 14]. Available from: www.who.int/healthpromotion/hiapframework.pdf
9. Cancer Council Australia. Position statement – sun exposure and vitamin D – risks and benefits. Sydney: Cancer Council Australia; 2016 [cited 2022 Feb 14]. Available from: wiki.cancer.org.au/policy/Position_statement_-_Risks_and_benefits_of_sun_exposure
10. Cancer Australia. Lifestyle risk factor – sun exposure. Sydney: Australian Government Cancer Australia [cited 2022 Feb 16]. Available from: lifestylerisk.canceraustralia.gov.au/app/uploads/pdf/hl_printable-pdf_sun-exposure.pdf
11. Victoria Health. Vitamin D and sun exposure. Melbourne: Victoria Health [cited 2022 Feb 16]. Available from: www2.health.vic.gov.au/ageing-and-aged-care/dementia-friendly-environments/strategies-checklists-tools/vitamin-d-sun-exposure
12. Australasian College of Dermatologists. Consensus statement: sun protection and sunscreens. Sydney: Australasian College of Dermatologists; 2020 [cited 2022 Feb 15]. Available from: www.dermcoll.edu.au/wp-content/uploads/2020/12/ACD-Position-Statement-Sunscreen-December-2020.pdf
13. Public Health Association Australia. Skin cancer prevention: policy position statement. Canberra: PHAA; 2018 [cited 2022 Feb 15]. www.phaa.net.au/documents/item/2832 [link no longer active]
14. Smartplay, Sunsmart. UV exposure and heat illness guide. Melbourne: Sports Medicine Australia; 2010 [cited 2022 Feb 15]. Available from: sma.org.au/sma-site-content/uploads/2010/02/UV-Exposure-and-Heat-Illness-Guide.pdf
15. New Zealand Government Ministry of Health. Companion statement on vitamin D and sun exposure in pregnancy and infancy in New Zealand. Wellington: Ministry of Health; 2020 [cited 2022 Feb 15]. Available from: www.health.govt.nz/system/files/documents/publications/companion-statement-vitamin-d-sun-exposure-pregnancy-infancy-nz-dec20.pdf
16. New Zealand Government Ministry of Health and Cancer Society of New Zealand. Consensus statement on vitamin D and sun exposure in New Zealand. Wellington: Ministry of Health; 2012 [cited 2022 Feb 15]. Available from: www.health.govt.nz/system/files/documents/publications/vitamind-sun-exposure.pdf
17. Australian Cancer Network Melanoma Guidelines Revision Working Party. Clinical practice guidelines for the management of melanoma in Australia and New Zealand. The Cancer Council Australia, Australian Cancer Network, Ministry of Health, New Zealand; 2008 [cited 2022 Feb 15]. Available from: www.health.govt.nz/system/files/documents/publications/melanoma-guideline-nov08-v2.pdf
18. Cancer Society of New Zealand. Position statement: the risks and benefits of sun exposure in New Zealand. Wellington: Cancer Society of New Zealand; 2008 [cited 2022 Feb 15]. Available from: sunsmartschools.co.nz/PS_RisksBenefits_SunExposureSept08.pdf
19. DermNet NZ. Vitamin D. Hamilton, NZ: DermNet New Zealand Trust; 2005 [cited 2022 Feb 15]. Available from: dermnetnz.org/topics/vitamin-d
20. The Royal Children's Hospital Melbourne. Kids health information. Safety: sun protection. Melbourne: Royal Children's Hospital Melbourne; 2019 [cited 2022 Feb 15]. Available from: www.rch.org.au/kidsinfo/fact_sheets/Safety_Sun_protection/
21. South Eastern Sydney Local Health District. Vitamin D in pregnancy and breastfeeding. Sydney: NSW Government; 2020 [cited 2022 Feb 15]. Available from: www.seslhd.health.nsw.gov.au/sites/default/files/groups/Royal_Hospital_for_Women/Mothersafe/documents/VitaminDpregbreastdec2020.pdf
22. Sydney Children's Hospital. Vitamin D therapy. Sydney: Sydney Children's Hospital; 2015 [cited 2022 Feb 15]. Available from: www.schn.health.nsw.gov.au/_policies/pdf/2015-7004.pdf
23. South Australia Health. South Australian paediatric clinical practice guidelines. Vitamin D deficiency in children. Adelaide: Department for Health and Ageing, Government of South Australia; 2020 [cited 2022 Feb 15]. Available from: www.sahealth.sa.gov.au/wps/wcm/connect/cbc97f0040d0445297b1bf40b897efc8/Vitamin+D+Deficiency+in+Children_Paed_v3_1.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-cbc97f0040d0445297b1bf40b897efc8-nxyZfKY
24. Health Navigator New Zealand. Vitamin D and sensible sun exposure. Health Navigator New Zealand; 2020 [cited 2022 Feb 15]. Available from: www.healthnavigator.org.nz/health-a-z/v/vitamin-d-and-sensible-sun-exposure/

25. The Royal Children's Hospital Melbourne. Immigrant Health Service. Low vitamin D. Melbourne: The Royal Children's Hospital Melbourne; 2020 [cited 2022 Feb 15]. Available from: www.rch.org.au/immigranthealth/clinical/Low_Vitamin_D/

26. Working Group of the Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia and Osteoporosis Australia. Vitamin D and adult bone health in Australia and New Zealand: a position statement. Sydney: Australian and New Zealand Bone and Mineral Society; 2005 [cited 2022 Feb 15]. Available from: anzbms.org.au/downloads/VitaminD_position_2005.pdf

27. Osteoporosis Australia (Healthy Bones Australia). Vitamin D: consumer guide. Osteoporosis Australia; 2016 [cited 2022 Feb 15]. Sydney: Healthy Bones Australia. Available from: www.theendocrinologyspecialist.com.au/resources/bone/oa_consumer_vitd_ed3_09-16(1).pdf

28. World Health Organization, World Meteorological Organization, United Nations Environment Programme, International Commission on Non-Ionizing Radiation Protection. Global Solar UV Index: a practical guide. Geneva: WHO; 2002 [cited 2022 Feb 15]. Available from: www.who.int/uv/publications/en/UVIGuide.pdf

29. Italia N, Rehfuess EA. Is the Global Solar UV Index an effective instrument for promoting sun protection? A systematic review. Health Educ Res. 2012;27:200–13.

30. Robinson JK, Jablonski NG. Sun protection and skin self-examination and the US Preventive Services Task Force recommendation on behavioral counseling for skin cancer prevention. JAMA. 2018;319:1101–2.

31. Samanek AJ, Croager EJ, Gies P, et al. Estimates of beneficial and harmful sun exposure times during the year for major Australian population centres. Med J Aust. 2006;184:338–41.

32. Stokes CS, Lammert F. Vitamin D supplementation: less controversy, more guidance needed. F1000Res. 2016;5.

33. Tabbakh T, Wakefield M, Dobbinson SJ. Concerns about vitamin D and sun exposure behaviour among Australians. Health Promot J Austr. 2021;32:399–406.

34. Janda M, Kimlin M, Whiteman D, Aitken J, Neale R. Sun protection and low levels of vitamin D: are people concerned? Cancer Causes Control. 2007;18:1015–19.

35. Youl PH, Janda M, Kimlin M. Vitamin D and sun protection: the impact of mixed public health messages in Australia. Int J Cancer. 2009;124:1963–70.

36. Peeters A, Backholer K. How to influence the obesity landscape using health policies. Int J Obes (Lond). 2017;41:835–9.

37. Vermeir P, Vandijck D, Degroote S, Peleman R, Verhaeghe R, Mortier E, et al. Communication in healthcare: a narrative review of the literature and practical recommendations. Int J Clin Pract. 2015;69:1257–67.