

# Sunlight exposure: risks and benefits

NICE guideline

Published: 9 February 2016

[www.nice.org.uk/guidance/ng34](https://www.nice.org.uk/guidance/ng34)

# Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the [Yellow Card Scheme](#).

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should [assess and reduce the environmental impact of implementing NICE recommendations wherever possible](#).

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This guideline is the basis of QS130.

This guideline should be read in conjunction with PH56.

## Overview

This guideline covers how to communicate the risks and benefits of natural sunlight exposure (specifically, the ultraviolet rays UVA and UVB) to help people understand why they may need to modify their behaviour to reduce their risk of skin cancer and vitamin D deficiency.

This guideline should be read with NICE's guideline on vitamin D: supplement use in specific population groups and any recommendations made by the Scientific Advisory Committee on Nutrition (SACN) on vitamin D.

This guideline replaces recommendations 1 to 5 in NICE's guideline on skin cancer prevention.

## Who is it for?

Commissioners, managers and practitioners with public health or social care as part of their remit working within the NHS, local authorities and the wider public, private, voluntary and community sectors.

# Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in [NICE's information on making decisions about your care](#).

[Making decisions using NICE guidelines](#) explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

## At-risk groups

1.1.1 All public health activities related to over- or underexposure to sunlight should focus on:

- Groups of people who should take extra care to avoid skin damage and skin cancer, including:
  - children (particularly babies) and young people
  - people who tend to burn rather than tan
  - people with lighter skin, fair or red hair, blue or green eyes, or who have lots of freckles
  - people with many moles
  - people who are immunosuppressed (that is, they have less resistance to skin problems as a result of a disease or use of particular drugs)
  - people with a personal or family history of skin cancer (even if their natural skin colour is darker than that of the family member who had cancer).
- Groups who spend a lot of time in the sun and so are at increased risk of skin

cancer, such as:

- outdoor workers
- those with outdoor hobbies, for example, sailing or golf.
- Groups with high, but intermittent, exposure to sunlight and who are therefore at increased risk of skin cancer. This includes people who sunbathe or take holidays in sunny countries.
- Groups who have little or no exposure to the sun for cultural reasons or because they are housebound or otherwise confined indoors for long periods. For example, people who are frail or in institutions, or people who work indoors all day. These people are at increased risk of low vitamin D status (for more information see NICE's guideline on vitamin D: supplement use in specific population groups).

## Message content

The following recommendations are for health and social care practitioners.

- 1.1.2 Whenever the opportunity arises make people aware that, although sunlight exposure is a normal part of everyday life and some sunlight is good for health, there are risks from excessive exposure.
- 1.1.3 Communicate consistent, balanced messages about the risks and benefits of sunlight exposure and the groups at risk (for the latter, see recommendation 1.1.1). Include:
- environmental, biological and behavioural factors
  - how to minimise the risks and maximise the benefits of sunlight exposure
  - the strength of sunlight at different times of day
  - advice for children and young people
  - advice according to people's skin type

- approaches to protecting skin (clothing, shade and sunscreen)
- checking for possible signs of skin cancer
- clarifying common misconceptions about sunlight exposure.

See supporting information for practitioners for more details.

- 1.1.4 Follow the principles of behaviour change when conveying sunlight exposure messages (see NICE's guideline on behaviour change: general approaches). This includes ensuring that messages:
- specify the recommended actions
  - explain the benefits of changing behaviour
  - try to enhance people's belief in their ability to adopt the recommended actions.
- 1.1.5 Use existing community health promotion programmes or services to raise awareness of the risks and benefits of sunlight exposure.
- 1.1.6 Offer one-to-one or group-based advice, as appropriate, tailored to the type of risks the person or group faces.
- 1.1.7 Encourage and support people at increased risk of low vitamin D status or skin cancer to contribute to awareness-raising activities.

## Mass media campaigns

The following recommendations are for commissioners of public health campaigns.

- 1.1.8 Develop, deliver and sustain national and local media campaigns to raise awareness of the risks and benefits of sunlight exposure.
- 1.1.9 Campaign messages should:

- Aim to make people aware of the need to think about their daily exposure to sunlight.
- Target at-risk groups (see recommendation 1.1.1) and be consistent (see supporting information for practitioners).
- Address common misconceptions about keeping safe in the sun and the risks and benefits of sunlight exposure.
- Present a balanced picture of the risks and benefits, explaining how to enjoy the sun safely.
- Emphasise how the risks and benefits will vary depending on the individual.
- Relate to leisure activities and holidays as well as daily life.

1.1.10 Campaigns should:

- Use different channels to communicate simple and more complex messages. For example, population-wide messages may focus on sun protection and enjoying the sun safely. More nuanced messages, such as the risk of over- or underexposure for subgroups and individuals, could be included in supporting resources such as leaflets, press statements and websites.
- Be delivered in a way that meets the target audience's preferences. For example, via radio, social media, texts, posters or leaflets.
- Be displayed at prominent locations. For example, airports, schools, pharmacies, travel vaccination clinics, leisure and sporting events, and on travel websites and in magazines.
- Be repeated over time and regularly altered to keep the audience's attention.
- Be timed for maximum effect. For example, so they take place during spring and summer when the risk of sunburn is highest in the UK, or when people are more likely to travel abroad.

1.1.11 Ensure that the format and content of national campaigns are developed and piloted with the target audience. If feasible, do the same for local activities and supporting resources.

- 1.1.12 Ensure that campaigns tackle health inequalities by taking into account cultural, religious and social norms about sunlight exposure. Outline what different groups should do to minimise their risks and maximise their benefits and how this may vary on an individual basis. Messages should also be conveyed in languages spoken locally.
- 1.1.13 Integrate and coordinate campaign messages with existing national and local health promotion programmes or services to keep costs as low as possible. (Examples of initiatives they could be integrated with include Sure Start, Healthier families and community pharmacy public health services.)

## Local strategic approach

The following recommendations are for commissioners and senior managers in local authorities.

- 1.1.14 Adopt a consistent, multiagency approach. Focus on making at-risk groups aware of the risks and benefits of sunlight exposure (see recommendation 1.1.1).
- 1.1.15 Work with the NHS, council leaders, elected members, public health teams, local businesses and voluntary and community organisations to:
- address local needs, as identified by the joint strategic needs assessment and other local, regional or national data
  - identify local opportunities to increase public awareness about the risks and benefits of sunlight exposure
  - ensure the content of all messages is consistent (see supporting information for practitioners)
  - target health, social care and other practitioners in contact with at-risk groups (see recommendation 1.1.1)
  - carry out culturally appropriate activities (for example, to develop messages that local at-risk groups can relate to)
  - ensure that messages related to skin type are relevant for the target

audience.

- 1.1.16 Work with local and national media to present a balanced view of the health risks and benefits of sunlight exposure.
- 1.1.17 Establish clear, measurable objectives for prevention and awareness-raising activities.
- 1.1.18 Work with practitioners in specific settings such as residential care, schools and workplaces to implement prevention and awareness-raising activities (see implementation).

## Terms used in this guideline

This section defines terms that have been used in a particular way for this guideline. For other definitions, see the NICE glossary or, for public health and social care terms, the Think Local Act Personal Care and Support Jargon Buster.

### Low vitamin D status

Low vitamin D status (sometimes called vitamin D deficiency) is defined by the Department of Health as a plasma concentration of 25 hydroxyvitamin D (the main circulating form of the vitamin) of below 25 nmol/litre (equal to 10 ng/ml).

### Photoageing

Photoageing results from chronic exposure to UV radiation. It may include any or all of the following: dryness, itching, wrinkling, irregular pigmentation, sallowness, irregular blood vessel dilatation, enlarged blackheads, fragility with easy bruising and loss of skin elasticity.

### Suitable clothing

Any covering clothing with close-weave fabrics that do not allow sunlight through.

## Skin type

Six different skin types have been identified:

- Type I: Often burns, rarely tans. Tends to have freckles, red or fair hair, blue or green eyes.
- Type II: Usually burns, sometimes tans. Tends to have light hair, blue or brown eyes.
- Type III: Sometimes burns, usually tans. Tends to have brown hair and eyes.
- Type IV: Rarely burns, often tans. Tends to have dark brown eyes and hair.
- Type V: Naturally brown skin. Often has dark brown eyes and hair.
- Type VI: Naturally black-brown skin. Usually has black-brown eyes and hair.

Further information on determining skin type was completed by the Health Protection Agency and is available from [Cancer Research UK](#).

## Sunburn

Sunburn is pink or red skin caused by sunlight exposure. Sunburn is an indicator of skin damage. For those with naturally dark skin, damage may be indicated by their skin getting hot in the sun and then staying hot afterwards, rather than signs of redness. Note: it is not necessary for the skin to burn to get skin damage and a suntan offers little protection against further skin damage. Furthermore, getting a suntan increases the risk of skin cancer.

## UV index

The UV index indicates how strong the sun's UV rays are and when there may be an increased risk of burning. UV index forecasts for different parts of the UK are available from the [Met Office](#), or by looking at many weather forecasts.

# Supporting information for practitioners

The following information is based on authoritative UK sources and the [British Association of Dermatologists et al. Consensus vitamin D position statement](#). The evidence base underpinning this information has not been systematically reviewed for this guideline. For more details on how it was compiled, see the [expert paper on the overview of sunlight exposure messages](#).

## Risks and benefits of sunlight exposure

### Environmental, biological and behavioural factors

- The intensity of sunlight varies according to:
  - Geographical location: solar UV levels increase nearer to the equator and at higher altitudes.
  - Time of year: from March to October UVB rays help people produce vitamin D, but excessive exposure can also cause [sunburn](#). Solar UV levels are highest during the summer (and most intense in late June).
  - Time of day: solar UV levels are highest around the middle of the day when the sun is highest in the sky.
  - Weather conditions: solar UV levels are reduced by cloud cover but they can still be intense enough to cause sunburn (even if it is not warm).
  - Reflection: sunlight reflects off surfaces such as snow, sand, concrete and water. This can increase the risk of sunburn and eye damage, even in shaded areas.
- UVA penetrates glass (although more weakly than direct exposure) and over long periods of exposure will cause skin damage. However, the vitamin D-inducing UVB does not penetrate glass.
- [Skin type](#) affects the potential risks and benefits from sunlight exposure.
- Increased frequency and time spent in the sun increases the potential risks of sunlight exposure.

## How to minimise the risks and maximise the benefits of sunlight exposure

People need to be aware of the following:

- How daily exposure to sunlight can affect their skin and why it is important to protect it.
- Unless someone has a very dark skin type, they should protect their skin when out in strong sunlight for more than a short period of time, both in the UK and abroad. The UV index provides an indicator of the sun's strength for a given location, date and time. This information, combined with skin type and behaviour, can be used to assess someone's risk of sunburn. The Met Office provides daily information on UV levels in the UK.
- When possible, only a limited amount of time should be spent in strong sunlight. It is preferable to spend more time in the shade.
- People who choose to expose their skin to strong sunlight to increase their vitamin D status should be aware that prolonged exposure (for example, leading to burning or tanning) is unlikely to provide additional benefit.
- Exposing commonly uncovered areas of skin such as forearms and hands, for short periods when in strong sunlight provides vitamin D. (Longer periods of exposure may be needed for those with darker skin.)
- Protection from the sun can be achieved by covering up with suitable clothing, seeking shade and applying sunscreen. Suitable clothing includes: a broad-brimmed hat that shades the face, neck and ears, a long-sleeved top, and trousers or long skirts in close-weave fabrics that do not allow sunlight through. It also includes sunglasses with wraparound lenses or wide arms (to provide side protection) that have the CE Mark (an indication that they meet the relevant European Standard – at the time of publication this was EN 1836:2005).
- Because many young people and adults will have experienced sunburn, they can use this experience to:
  - know what their skin looks like normally and how it reacts to sunlight
  - know how long they can be exposed without risking sunburn and how to protect their skin accordingly.

- Skin that is not usually exposed to sunlight (for example, the back, abdomen and shoulders) is particularly likely to burn, so extra care is needed.

## The strength of sunlight at different times of day

In the UK, sunlight is strongest between 11am and 3pm between March and October.

- Between 11am and 3pm:
  - Sunburn is most likely.
  - Most people can make sufficient vitamin D by going out for short periods and leaving only areas of skin that are often exposed uncovered (such as forearms, hands or lower legs). Longer periods may be needed for those with darker skin.
- Before 11am and after 3pm:
  - it takes longer to synthesise sufficient vitamin D
  - the risk of sunburn is less.

## Advice for children and young people

- Children under 6 months of age should be kept out of direct strong sunlight.
- Between March and October in the UK, children and young people need their skin protecting. They should cover up with suitable clothing, be encouraged to spend time in the shade (particularly between 11am and 3pm) and wear sunscreen.
- The parents and carers of children younger than 5 should be given advice on vitamin D supplements (see [NICE's guideline on vitamin D: supplement use in specific population groups](#)).

## Advice according to people's skin type

- People with genetically darker skin (skin types V and VI) are at relatively lower risk of burning and, therefore, skin cancer. But they are at higher risk of vitamin D deficiency in the UK. This means:
  - they may need more time in sunlight to produce the same amount of vitamin D as

people with lighter skin

- generally they can be exposed for longer before risking sunburn and skin cancer, but should not get to the point where their skin is likely to burn
  - they need advice on vitamin D supplements (see NICE's guideline on vitamin D: supplement use in specific population groups).
- People with naturally very light skin or fair or red hair or freckles (skin types I and II):
    - do not need much time in the sun (less than the time it takes them to burn) to produce vitamin D
    - are at greater risk of sunburn and skin cancer, including after shorter periods of exposure, than people with darker skins.

## Approaches to protecting skin

- Skin should be protected from strong sunlight by covering up with suitable clothing, seeking shade and applying sunscreen.
- Sunscreen is not an alternative to covering up with suitable clothing and seeking shade, but it does offer additional protection. It can also be useful when other methods of protection are not available, but only if used liberally, carefully and repeatedly on all exposed skin.
- Sunscreen should:
  - Meet minimum standards for UVA protection (the label should have the letters 'UVA' in a circle logo). Preferably, the label should state that it provides good UVA protection (for example, at least '4-star UVA protection').
  - Provide at least sun protection factor (SPF)30 to protect against UVB.
- Because most people do not apply enough sunscreen it is probably helpful to make them aware that:
  - The amount of sunscreen needed for the body of an average adult to achieve the stated SPF is around 35 ml or 6 to 8 teaspoons of lotion.
  - If sunscreen is applied too thinly, the amount of protection it gives is reduced.

- Using SPF30 sunscreen or higher may partially overcome problems with inadequate application. But it does not necessarily mean people can spend more time in the sun without the risk of burning.
- Sunscreen needs to be reapplied liberally, frequently and according to the manufacturer's instructions. This includes straight after being in water (even if it is 'water-resistant') and after towel drying, sweating or when it may have rubbed off.
- If someone plans to be out in the sun long enough to risk burning, sunscreen needs to be applied twice to exposed areas of skin: half an hour before, and again around the time they go out in the sun. This includes the face, neck and ears (and head if someone has thinning or no hair), but a wide-brimmed hat is better.
- Water-resistant sunscreen is needed if sweating or contact with water is likely.

## Checking for possible signs of skin cancer

All adults should be encouraged to check their skin for any possible signs of cancer. Changes to check for include: a new mole, growth or lump, or any moles, freckles or patches of skin that change in size, shape or colour (people should tell their doctor if they notice any unusual or persistent changes). See the section on skin cancers in NICE's guideline on suspected cancer.

## Clarifying common misconceptions about sunlight exposure

It is important to note that:

- Even if it is cool or cloudy, it is possible to burn in the middle of the day in summer. It is also possible to burn at other times of the day and year.
- There is no safe or healthy way to get a tan from sunlight.
- Getting a tan provides little protection against later exposure to sunlight and the resulting skin damage outweighs any later protective effect.
- It is not possible to get enough vitamin D by sitting next to a closed sunny window.
- It is not possible to get enough vitamin D from sunlight between October and March in the UK.

# Who should take action?

The guideline is for commissioners, managers and practitioners with public health or social care as part of their remit working in the NHS, local authorities and the wider public, private, voluntary and community sectors. It is also aimed at:

- people working in and managing early years settings, educational settings (including preschool, primary and secondary schools) and leisure environments
- employers and managers (including public sector organisations)
- managers and practitioners working in residential or day care settings
- others with a duty of care for people.

In addition, it will be of interest to groups at increased risk of low vitamin D status or skin cancer, their families and carers and other members of the public.

# Implementation

This section highlights 3 areas of the guideline that were identified as a focus for implementation. It outlines possible activities and also gives information on resources or practical examples that could support implementation.

## Approaches in different settings

All messages conveyed should be in line with supporting information for practitioners.

### Managers and practitioners with a duty of care

Managers and health, public health and social care practitioners who have a duty of care for others (for example, in the workplace, education, or residential or day care settings) could develop a policy to address the risks and benefits of sunlight exposure. This could:

- Outline the benefits of such a policy. For example, in the case of employers this could be fewer days absence because of sunburn or other adverse effects (Health and Safety Executive Sun protection: advice for employers of outdoor workers).
- Cover the needs of all at-risk groups (see recommendation 1.1.1).
- Tailor advice according to skin type and age.
- Tailor advice according to needs and circumstances. This includes people for whom English is not a first language, from lower socioeconomic groups, with specific cultural needs, or with a disability.
- Encourage people to manage their own risk, for example, by covering up with suitable clothing or seeking shade.

The policy could also state that sun-awareness information should:

- Help people and their carers identify their own potential risks and benefits from sunlight exposure and the protective measures they should take.
- Adopt a balanced approach and avoid scaremongering.

- Be conveyed using a range of approaches, for example, one-to-one as well as in groups.
- Be clearly displayed in communal locations including pharmacies, airports, schools, travel vaccination clinics and appropriate leisure and sporting events.
- Be available in a variety of formats, including formats that are suitable for people with a disability.
- Use skin-type charts. A range of charts are available, such as those produced by Cancer Research UK and the British Association of Dermatologists.

## Early years, education and leisure

Managers and staff in early years, education and leisure environments could develop a policy on how to protect children and young people's skin when they are outside for more than a brief period in strong sunlight. This includes those working in preschool settings, primary and secondary schools.

A comprehensive policy would:

- Encourage children and young people to cover up with suitable clothing (including a wide-brimmed hat), to spend time in the shade and to wear sunscreen to protect themselves when the sun is strong.
- Encourage parents and carers to provide children and young people with suitable clothing, as well as sunscreen. Make it clear that spending time in the shade and wearing suitable clothing are as important as using sunscreen.
- Be consistent with child protection and safeguarding policies, for example, by specifying who should help children and young people cover up with suitable clothing or apply sunscreen, and when.
- Outline the need to take children and young people's individual characteristics, for example, their skin type, into account. A range of charts are available, such as those produced by Cancer Research UK or and the British Association of Dermatologists.
- Raise awareness of the risks and benefits of sunlight exposure among children and young people, their parents and carers. For example, by making it clear that children and young people should never be allowed to burn and should be made aware of how

important it is to protect their skin.

- Provide children and young people, their parents and carers with timely information (for example, during the spring and summer holiday season) on the risks and benefits of sunlight exposure in play and leisure environments. For detail on how the information should be displayed see [recommendations 1.1.8 to 1.1.13](#).

Managers and staff might also want to think about using practical, classroom-based activities, for example, in personal, social, health and education lessons covering health or diversity. A range of organisations provide information for schools, such as [Cancer Research UK](#) and the [Personal Social Health and Economic Association](#).

## Workplaces

Employers, managers and relevant practitioners in the public, private, voluntary and community sectors could:

- Implement a policy on sunlight exposure to help meet their responsibilities under the [Health and Safety at Work Act](#). Note: sunlight exposure is an occupational hazard for people working outdoors.
- Incorporate information on sunlight exposure into routine practice and health and safety training.
- Provide advice according to people's occupation and role.
- Train employees to understand the risks and benefits of sunlight exposure and encourage basic self-checks for mole or skin changes.
- Use existing resources for the target audience where available. For example, the [Institution of Occupational Safety and Health](#) has developed a sun-safety film for construction workers.

## Residential and day care services

Managers and practitioners who work in residential or day care settings could:

- Develop, implement and monitor activities to address the risks and benefits of sunlight exposure.

- Provide advice to children, young people, adults and their carers on protecting their skin and enjoying the sun safely.
- Provide advice on vitamin D supplements as necessary (see [NICE's guideline on vitamin D: supplement use in specific population groups](#).)

## Training

Health Education England, Public Health England, clinical commissioning groups and local authorities could work together to consider the training needs of health, public health and social care practitioners in relation to sun exposure. This could be part of their registration and post-registration training and continuing professional development. Training could cover:

- The health risks and benefits of sunlight exposure. This includes the impact of a range of variables including environmental, biological and behavioural factors (see [supporting information for practitioners](#)).
- The importance of conveying consistent, tailored messages to the public (see [supporting information for practitioners](#)).

## Evaluation

Public Health England and directors of public health could:

- Evaluate policies, strategies and media campaigns (local and national) to protect the public from over- or underexposure to sunlight. This includes the effect of both one-to-one and group-based prevention activities. This could be done by working with commissioners and senior managers in local authorities and the NHS, council leaders, elected members, public health teams, local businesses and voluntary and community organisations.
- Use a range of measures of knowledge, attitudes, awareness and behaviour (see [NICE's guideline on behaviour change: general approaches](#)).

## Need more help?

[Further resources](#) are available from NICE that may help to support implementation:

- annual indicators for use in the Quality and Outcomes Framework (QOF) for the UK
- uptake data about guideline recommendations and quality standard measures
- shared learning case studies.

## Other guidance and policies

The guideline should be implemented alongside other guidance and regulations:

- Department of Health and Social Care Equity and excellence: liberating the NHS
- Department of Health and Social Care Healthy lives, healthy people: our strategy for public health in England
- NHS England Achieving world class cancer outcomes: a strategy for England 2015 to 2020
- Department of Health and Social Care Public health outcomes framework for England 2013 to 2016
- Scientific Advisory Committee on Nutrition (SACN) Update on vitamin D

# Context

## Introduction

Sunlight comprises infrared, visible and ultraviolet (UV) rays. This guidance focuses on the balance of risks and benefits from the UV rays, specifically the UVA and UVB rays that reach the earth's surface. Exposure to artificial UV light (such as from sunbeds) is beyond the remit of this guideline.

Sunlight exposure offers people a number of health benefits, but excessive exposure can also cause health problems.

Vitamin D is essential for skeletal growth and bone health. The major natural source of vitamin D is from skin synthesis following exposure to sunlight. It is also obtained from dietary sources (see [NICE's guideline on vitamin D: supplement use in specific population groups](#)).

The immediate risk from overexposure to the UV rays from sunlight (both UVA and UVB) is damage to the skin's DNA and inflammation associated with sunburn. The main long-term risk of DNA damage (for which sunburn is a proxy) is skin cancer, either built up gradually over a lifetime or due to short bursts of high exposure.

Communicating the risks and benefits of sunlight exposure is challenging. On the one hand, people have been advised to protect their skin from the sun to avoid skin cancer. On the other hand, they have been advised to expose themselves to sunlight to ensure that they get enough vitamin D.

Unless carefully interpreted, the evidence on the role of sunlight in preventing [low vitamin D status](#) can conflict with sun protection messages. In the UK, 25 nmol/litre of serum 25-hydroxyvitamin D concentration is currently used as the lower threshold for vitamin D adequacy. Below this level there is an increased risk of rickets and osteomalacia and people are considered to have vitamin D deficiency. However, the SACN is currently reviewing this threshold. (see [review 2 Synthesis of effectiveness and cost effectiveness evidence from NICE's guideline on skin cancer prevention](#)).

## Overexposure

Overexposure to sunlight can result from spending long periods in the sun on a habitual basis. This is known as chronic exposure and can occur, for example, among people who work outdoors. Overexposure can also occur among people who, for example, spend little time outdoors and then experience short, intense bursts (intermittent exposure). This could occur during occasional holidays, weekends away or even during a sunny lunchbreak.

Chronic exposure is linked more to squamous cell carcinoma. Intermittent exposure is linked to sunburn, basal cell carcinoma and melanoma. Sunlight exposure is also responsible for some common eye diseases, for example cataracts ([Yam and Kwok, 2013](#)). Overexposure can also age the skin leading, for example, to premature wrinkling.

Studies have shown that most people are aware of the risks of overexposure to the sun but need to be frequently reminded to protect themselves (Cancer Research UK Trends in awareness and behaviour relating to UV and sun protection: 2003 to 2013). Generally, a significant disparity exists between knowledge and behaviour ([Hiom 2006](#)). This may reflect the fact that:

- the sun can have a positive effect on psychological wellbeing
- many people like to have a sun tan
- there is a time lag between exposure and the development of skin cancer and features of photoageing, including wrinkling.

In addition, people may not understand the specific risks they face. For example, they may incorrectly assume that they only need to protect their skin while abroad. Or they may incorrectly assume that skin cancer can easily be treated.

## Vitamin D

Between October and March in the UK, sunlight contains very little of the ultraviolet B (UVB) wavelength the skin needs to make vitamin D. So people rely on body stores from sunlight exposure in the summer and dietary sources to maintain vitamin D levels ([SACN update on vitamin D 2007](#)).

Dietary sources of vitamin D are natural foods, fortified foods and supplements. Natural

food sources are very limited and are mostly of animal origin (such as oily fish, red meat and egg yolk). Fortified foods include: formula milks for infants and toddlers, some breakfast cereals and fat spreads (margarines).

The [National Diet and Nutrition Survey](#) found that many adults in Britain have a low vitamin D status (23% aged 19 to 64 years and 21% aged 65 years and over). It also found that 14% of children aged 4 to 10 years, and 22% of children aged 11 to 18 years, had a low vitamin D status.

Low vitamin D status has been associated with musculoskeletal conditions – rickets, osteomalacia, falls and lack of muscle strength and function (SACN update on vitamin D – 2007). There have been reports that rickets, caused by lack of vitamin D, is re-emerging among children in the UK ([Pearce and Cheetham, 2010](#)).

Low vitamin D status may also be associated with other non-musculoskeletal conditions such as diabetes and some cancers. However, there is limited evidence on this and the findings are inconsistent ([SACN draft report on vitamin D 2015](#)).

Some people may not be exposed to enough sunlight because of cultural reasons, or because they are housebound or otherwise confined indoors for long periods. Some may be overzealous in the way they protect their skin ([World Health Organization meeting report on Solar ultraviolet radiation: global burden of disease from solar ultraviolet radiation; Misra et al. 2008](#)).

## Skin cancer

Excessive exposure to UV rays is an important and avoidable cause of skin cancer.

Skin cancer incidence rates (melanoma and non-melanoma) have increased rapidly in England in the past 30 years. There are likely to be a range of reasons for this, but it may include the desire for a tan or increased travel to sunnier countries (Him, 2006).

In 2012, 11,281 newly diagnosed cases of melanoma were registered in England ([Office for National Statistics Cancer registration statistics England 2012](#)). In the same year, 102,628 cases of non-melanoma skin cancer were registered in the UK, although the actual number is estimated at over 250,000 ([Cancer Research UK Skin cancer statistics](#)).

In 2012, 1,920 people died from melanoma in England and Wales (Office for National

Statistics Mortality statistics: deaths registered in England and Wales (Series DR) 2012. Over 600 (638) died from non-melanoma in the UK ('Skin cancer statistics').

Melanoma is the second most common cancer in those aged 15 to 34 in the UK. But the risk of all skin cancers increases with age, with people aged 65 and older most commonly diagnosed with late-stage melanoma.

In 2008/09, it cost the NHS in England an estimated £105.2 million to treat skin cancer (Vallejo-Torres et al. 2013). This is predicted to rise to more than £180 million in 2020.

Primary care spending on treatments for low vitamin D status rose from £28 million in 2004 to £76 million in 2011 (GP online Treating vitamin D deficiency to cost £100m a year by 2013, Health and Social Care Information Centre Prescription cost analysis England 2011).

# The committee's discussion

This section describes the factors and issues the Public Health Advisory Committee considered when developing the recommendations. Please note: this section does **not** contain recommendations. (See [recommendations](#).)

## Background

The committee agreed that sunlight offers risks and benefits according to the population group and a range of other variables. It also agreed that the order of the words 'risks and benefits' does not imply a hierarchy but is used to ensure consistency throughout the document, in line with NICE's house style.

Determining and quantifying the contribution sunlight makes to vitamin D status (and how high-protection sunscreen may reduce this) was beyond the remit of this guideline.

Committee members were aware that the Independent Advisory Group on Non-ionising Radiation (AGNIR) was considering the links between sunlight and vitamin D during development of this guideline. Any new findings from the AGNIR report will be taken into account when this guideline is updated. In addition, the committee noted that NICE has published a guideline on how to increase vitamin D supplement use among at-risk groups. Members hoped that these 3 pieces of work will provide the basis for clear, consistent advice to reduce the risk of low vitamin D status among all at-risk groups.

The causal relationship between vitamin D status and musculoskeletal health is well established. However, the nature of the association between vitamin D levels and other chronic diseases, such as cancer and multiple sclerosis, is unclear. The committee was aware that the Scientific Advisory Committee on Nutrition (SACN) was reviewing vitamin D and health outcomes, and the recommendations in this guideline should complement SACN's final conclusions.

The committee considered SACN's draft report on vitamin D when it was issued for consultation, towards the end of the guideline development process. SACN indicated that sunlight is the major source of vitamin D for most people. But it could not quantify how much exposure people need in the summer to maintain vitamin D levels in winter. SACN did not, therefore, include sunlight in calculations to establish a reference nutrient intake (RNI) for vitamin D. In its draft report, SACN proposes an RNI of 10 ug per day for the general UK

population as a precautionary approach, to take account of variable exposure to sunshine and diet. To reach this proposed RNI, people would need to take a daily supplement of vitamin D. The committee noted that not everyone will choose to take a supplement or make a point of consuming (natural or fortified) dietary sources of vitamin D. Furthermore, some people may prefer to get their vitamin D from sunlight. Members concluded that there is still a need to provide clear advice on how to safely get vitamin D from sunlight, regardless of SACN's final recommendations.

The committee acknowledged that people at risk of overexposure to sunlight and those at risk of not having enough vitamin D may be in different groups. So it recommended the need to adapt messages for different groups and individuals. But members also noted that consistent universal messages will help change attitudes and behaviour. The committee aligned messages in this guideline with national advice from NHS Choices to achieve some consistency.

It is not possible to provide a simple definitive message telling different groups how often and how long they can be exposed to sunlight to ensure minimum risk but maximum benefit. That is because the amount of UV someone gets from sunlight depends on a range of biological, environmental and behavioural factors. But the committee agreed that advice on preventing both skin cancer and low vitamin D status can be combined. It heard (from expert papers 4 and 5) that short (less than the time it takes for skin to redden or burn), frequent periods of sunlight exposure are best for vitamin D synthesis. In addition, this type of exposure is less likely to result in skin cancer.

Advice on sunlight exposure is available from many organisations and sources (as summarised in expert paper 7). However, the information given is often inconsistent and potentially confusing. PHAC considered that this was likely to be due to a lack of consensus in the evidence. The committee agreed that if a consensus could be achieved on the approaches and messages needed, it would minimise public confusion and increase the likelihood of behaviour change. It would also minimise the duplication of effort by different organisations. The committee also agreed that a central source of messages on sun exposure would be helpful.

The committee noted that both practitioners and the public find it difficult to judge 'skin type I–VI'. To overcome this problem, the recommendations refer to both skin types and 'lighter and darker' skin.

The committee acknowledged the importance of adults or young people 'knowing their

own skin'. Ideally, nobody should experience sunburn, but many young people and adults will have done so in the past (albeit inadvertently). Members agreed that, in such cases, people could use the experience to understand how their skin reacts in sunlight and to adequately protect themselves in future. Members hoped that children would never experience sunburn and therefore would not need to learn from such an experience.

## Approaches to skin protection

The committee emphasised the need to use suitable clothing, shade and sunscreen in combination. Members did not want any of these methods to be promoted individually as the 'main' way of providing protection.

Members viewed advice on how to use sunscreen as particularly important because often it is not applied effectively— and people overestimate the protective effect. The committee acknowledged that the use of sunscreen may encourage people to spend a long time in the sun and that will, in turn, increase the risk of sun damage.

Expert testimony confirmed that frequent, liberal use of high-protection sunscreen may prevent vitamin D synthesis. But this is only true under research conditions. Evidence suggests that it is unlikely to be the case in practice. This is because people may inadvertently miss some areas of skin and they also tend to apply much less sunscreen than the manufacturers recommend.

The committee debated whether to recommend SPF15 or 30 sunscreen. If SPF15 is applied liberally, according to the manufacturer's instructions, it should offer adequate protection in most cases. However, this level of coverage is difficult to achieve. Using SPF30 or higher may partially overcome problems arising from inadequate application. But it does not mean people can spend longer in strong sunlight without risking burning. Therefore the committee did not want advice about choice of sun protection factor to be separated from practical advice on sunscreen application.

The committee recognised that a range of sunscreen products are available at different costs. However, members were concerned that the cost of sunscreen or specialist protective clothing could be off-putting for some people and limit their ability to protect their skin.

## Behaviour change

The committee was aware that cultural context may influence whether or not people respond to public health messages. Information is usually a necessary precursor to behaviour change, but information alone is not always enough. Members agreed that the best outcome from information provision is a change in behaviour. But they also felt there was some value in using information to alter attitudes for example, towards tanning, because this may eventually lead to behaviour change.

Report 1 on Communicating the benefits and risks of ultraviolet light to the general population: a qualitative documentary analysis of UK newspapers and magazines (print and online) highlighted a generally positive portrayal of sun tanning in the media. For example, images of sunbathing are usually accompanied by references to a 'healthy tan' and the value of 'escaping to the sun'. The committee recognised that it is a challenge to change people's knowledge, attitudes and behaviour towards tanning.

The degree to which people believe they can change their level of risk plays a role in their decision-making process. The time-lag between sunlight exposure and the development of skin cancer and wrinkling also play a part. Members agreed that there is a need to help people more accurately determine how they can achieve vitamin D synthesis while not damaging their skin.

The committee recognised the importance of making children aware of the risks and benefits of sunlight. It also discussed the importance of helping children establish life-long health-promoting behaviours when they are most susceptible to habit-forming advice.

The risk-benefit ratio of sunlight exposure will vary depending on how dark or light someone's skin is. The committee was particularly concerned about the risks and benefits for darker skinned people because much of the evidence and existing advice is focused on those with lighter skin (as outlined in expert paper 5).

## Evidence

The evidence base underpinning the content of safe sunlight exposure messages was not systematically reviewed for this guideline because the content of these messages was beyond the remit of the guideline. The advice from NHS Choices was the nearest that could be achieved to a consensus, following a trawl of existing authoritative sources.

A large volume of evidence suggests sunlight may provide protection against chronic diseases such as cancer, heart disease and diabetes. However, the relationship is associative rather than causative that is, it has not been proven (SACN is currently considering the relationship between vitamin D and a range of health outcomes). Sunlight is also associated with improved mental wellbeing. (But this is to do with the visible rather than the UV component.)

The balance of published evidence suggests that skin with darker pigmentation needs longer sunlight exposure than lighter skin to produce equivalent levels of vitamin D. But further research is needed. In the meantime, the committee was clear that people of all skin types should not risk burning their skin.

The evidence on the effectiveness of strategies to communicate complex messages was very limited.

The review of effectiveness identified a number of interventions that have changed behaviours in the sun, or reduced the incidence of sunburn. But none of the studies focused on delivering a complex message that conveyed both the risks and benefits. The committee also noted that the interventions in the review tended to have small sample sizes, small effect sizes and measured only short-term outcomes.

Most studies identified in the evidence reviews were based in countries with a very different climate from the UK (for example, Australia and the US). The committee also felt that it would be difficult, for example, to transfer evidence from Australia to the UK context because Australian campaigns have been in place for longer and are better funded than in the UK. The committee was also aware that studies on people at risk of low vitamin D status would need to be judged in light of whether the study took place in a country that fortifies food with vitamin D. (Because this would result in the population having higher baseline levels of vitamin D.)

There is growing interest in the use of new technology, including phone and tablet apps, to deliver behaviour change interventions. But the committee noted a lack of formal evaluations of effectiveness. In addition, although currently there is no evidence to show text messages are cost effective, members were aware that this may change. They suggested that any such change could be captured in an update of this guideline.

Photoageing interventions were not found to be cost effective at the time of publication, so they were not recommended for NHS settings. But the committee acknowledged that

this did not mean they were not effective.

The committee did not look at evidence on the risks and benefits of artificial sources of UV rays because it was beyond the remit of the guideline. The absence of any recommendations on these sources should not be taken as a judgement on whether they are beneficial, cost effective or pose any risks.

The committee recognised that it is not easy to understand how to use information from the UV index to assess the risks and benefits people face from sunlight. They agreed that the information it provides is only useful if combined with someone's own skin type and behaviour.

## Health inequalities

The recommendations stress the need for tailored individual advice to back up the universal messages. The committee noted that universal interventions could result in adverse effects for some groups and so increase health inequalities. For example, universal messages about protecting the skin from sunlight exposure may inadvertently lead to a reduction in the amount of skin exposed to sunlight among groups at risk of low vitamin D status.

Many people have photosensitive skins, for various reasons, which means that sunlight exposure has particular implications for their health. The committee did not discuss the particular needs of these groups for this guideline.

## Health economics

The committee noted that there was limited and inconsistent evidence from the review of cost-effectiveness. It was not possible to include the health conditions caused by low vitamin D status in the economic model because of insufficient effectiveness evidence. So the model focused on the risks of sunlight exposure.

The economic evidence review did not identify any studies applicable to the UK so a bespoke economic model was developed, based on the effectiveness evidence. The interventions included: an information programme for schoolchildren; photoageing; tailored messaging; text messages; and a mass media campaign. The comparator used was 'no intervention' because it was not possible to establish current practice. The outcome

measures modelled were: sunburn, basal cell carcinoma, squamous cell carcinoma and malignant melanoma. The incremental cost-effectiveness ratio (ICER) of the information programme for schoolchildren, photoageing and text messages were: £312,744, £316,968 and £65,945 per quality-adjusted life-year (QALY) gained, respectively. Tailored messages had an estimated ICER of £14,249 per QALY gained. The mass media campaign was cheaper and more effective than no intervention because it avoided future expenditure on treatment and the cost saving outweighed the cost of the intervention. The committee noted that the uncertainties were explored in sensitivity analyses.

A lack of sunlight exposure is associated with vitamin D deficiency. The lack of evidence on interventions aimed at delivering a complex message covering both the risks and benefits of sunlight exposure meant that the economic model could not assess the cost effectiveness of any such intervention. As a consequence, conditions associated with vitamin D deficiency are not included in the model. This is because it is not possible to quantify the impact of any of the interventions on the prevalence of vitamin D deficiency.

The committee heard evidence on the links between sunlight exposure and cataracts. But members acknowledged that the effects could not be modelled because of a lack of suitable data.

The committee discussed differences between the economic model used for this guideline and the economic model used for NICE's guideline on skin cancer prevention. The model for this guideline used the effectiveness evidence to calculate the relative risks of sunburn. In addition, it used epidemiological evidence to link the use of any kind of protection with the incidence of sunburn. This was important because several interventions showed significant reductions in the incidence of sunburn and these reductions were captured in the economic model.

It was difficult to link behavioural changes to health outcomes in the economic model because of a lack of relevant evidence. The committee discussed uncertainties about the duration of effects and how often an intervention needed to be repeated to maintain the size of effect. It also discussed whether assumptions used in the economic model to link study outcomes with health outcomes and healthier behaviours were reasonable, given the lack of evidence. However, the associated uncertainties were sufficiently explored in the sensitivity analyses.

Assuming a cost-effective threshold of £20,000 per QALY, tailored messages should cost a maximum of £5.89 per person and a mass media campaign should cost no more than

£2.15 per person. Generally interventions must be cheap to be cost effective. For example, messages delivered as part of practitioners' routine practice could be cost effective.

Members noted that the information for the economic evaluation was drawn from single studies for each type of intervention.

## Economic modelling

Overall, tailored messages and mass media campaigns were cost effective. Information programmes for schoolchildren, photoageing and text messaging interventions were not cost effective.

Cost-effective estimates for the different interventions were wide ranging. The incremental cost-effectiveness ratio (ICER) of tailored messages was £14,249 per quality of life year gained (QALY).

The mass media campaign is less costly and more effective. The ICERs of information programmes for schoolchildren, photoageing and tailored interventions ranged from £65,945 to £316,968 per QALY gained.

All input values used in the model were subject to a degree of uncertainty. Uncertainties associated with the assumptions made were explored in a range of deterministic sensitivity analyses. The one-way sensitivity analysis revealed that the key drivers of cost-effectiveness were the cost of implementing the intervention and its effectiveness.

The specific scenarios considered and the full results can be found in the economic modelling report.

## Evidence reviews

The guideline recommendations are based on the best available evidence. Listed below are the evidence statements that provide the best available evidence and are directly linked to the recommendations. The evidence base underpinning the sun exposure messages has not been systematically reviewed for this guideline. The section on supporting information for practitioners is based on sun exposure messages from a range of authoritative sources.

## How the evidence and expert papers link to the recommendations

Details of all the evidence discussed are in evidence reviews, reports and papers from experts.

The evidence statements are short summaries of evidence. Each statement has a short code indicating which document the evidence has come from.

**Evidence statement number 1.1** indicates that the linked statement is numbered 1 in review 1. **Evidence statement number 2.1.3** indicates that the linked statement is numbered 1.3 in review 2. **ER1** indicates that expert report 1 'Sunlight exposure: communication the benefits and risks of ultraviolet light to the general population: a qualitative documentary analysis of UK newspapers and magazines' is linked to a recommendation. **EP1** indicates that expert paper 1 'Key topics in risk communication' is linked. **EP2** indicates that expert paper 2 'The Independent Advisory Group on non-ionising radiation' is linked. **EP3** indicates that expert paper 3 'Ultraviolet radiation and the eye' is linked. **EP4** indicates that expert paper 4 'Achieving adequate sun protection with adequate vitamin D status' is linked. **EP5** indicates that expert paper 5 'Sunlight and vitamin D' is linked. **EP7** indicates that expert paper 7 'Overview of sunlight exposure messages' is linked.

If a recommendation is not directly taken from the evidence statements, but is inferred from the evidence, this is indicated by **IDE** (inference derived from the evidence).

If the Public Health Advisory Committee considered other evidence, it is linked to the appropriate recommendation below.

**Recommendation 1.1.1:** evidence statements 1.1.3; EP2, EP3, EP4, EP5; IDE

**Recommendation 1.1.2:** evidence statement 2.13; IDE

**Recommendation 1.1.3:** economics report; EP2, EP3, EP4, EP5, EP7; IDE

**Recommendation 1.1.4:** evidence statements 2.1.3, 3.6, 3.20; IDE

**Recommendation 1.1.5:** evidence statement 2.1.3; IDE

**Recommendation 1.1.6:** evidence statements 2.1.3, 3.6, 3.10, 3.27; economics report

**Recommendation 1.1.7:** evidence statements 2.13, 3.6, 3.20; IDE

**Recommendation 1.1.8:** evidence statement 3.6, 3.7, 3.8, 3.9, 3.10, 3.14, 3.16, 3.22, 3.23, 3.27; economics report; EP1; IDE

**Recommendation 1.1.9:** evidence statements 2.1.3, 3.6, 3.7, 3.8, 3.9, 3.10, 3.14, 3.16, 3.22, 3.23, 3.27; ER1; economics report; EP1; IDE

**Recommendation 1.1.10:** evidence statements 2.1.3, 3.6, 3.7, 3.8, 3.9, 3.10, 3.14, 3.16, 3.22, 3.23, 3.27, ER1; economics report; EP1; IDE

**Recommendation 1.1.11:** evidence statements 2.1.3, 3.6, 3.7, 3.8, 3.9, 3.10, 3.14, 3.16, 3.22, 3.23, 3.27; ER1; EP1; IDE

**Recommendation 1.1.12:** evidence statements 2.1.3, 3.6, 3.7, 3.8, 3.9, 3.10, 3.14, 3.16, 3.22, 3.23, 3.27; ER1; EP1; IDE

**Recommendation 1.1.13:** EP1; IDE

**Recommendation 1.1.14:** IDE

**Recommendation 1.1.15:** IDE

**Recommendation 1.1.16:** IDE

**Recommendation 1.1.17:** IDE

**Recommendation 1.1.18:** IDE

**Supporting information for practitioners:** evidence statement 3.18; EP2, EP3, EP4, EP5, EP7; IDE

## **Implementation**

**Duty of care:** evidence statements 2.1.3, 3.10, 3.16, 3.27; IDE

**Early years and education:** evidence statements 2.1.1, 2.9.1, 3.12, 3.18, 3.19, 3.21, 3.28, 3.29

**Workers:** evidence statements 2.8.10, 3.2, 3.22

**Residential or day care:** IDE

**Training:** IDE

**Evaluation:** IDE

## Gaps in the evidence

The Public Health Advisory Committee identified a number of gaps in the evidence related to the programmes under examination based on an assessment of the evidence and expert comment. These gaps are set out below.

1. There is a lack of good quality evidence on the effectiveness of different approaches to communicating, disseminating and presenting risk information. (Source: Review 1)
2. There is a lack of good quality evidence on the effectiveness of risk communication among different subpopulations. (Source: Review 1)
3. There is a lack of evidence on how health and social care practitioners and policy makers should convey messages about the risks and benefits of sunlight exposure, particularly in the UK. (Source: Review 2)
4. There is a lack of evidence on how messages about the risks and benefits of sunlight exposure can be effectively tailored for different groups. In particular, there is a lack of evidence on tailoring messages for: people who are non-English speaking or whose first language is not English, people from different religious or cultural backgrounds, and people with dark skin, or people who have low or no exposure to the sun. (Source: Reviews 2 and 3)
5. There is a lack of epidemiological evidence linking sunlight exposure to the incidence of cataracts. (Source: Economic modelling report 1)
6. There is a lack of evidence on interventions aimed at increasing sun-exposure among groups at risk of low vitamin D status. (Source: Review 3)

# Recommendations for research

The guideline committee has made the following recommendations for research.

The committee recommends that the following research questions should be addressed. See also the recommendations for research in NICE's guideline on vitamin D: increasing supplement use in specific population groups. It notes that 'effectiveness' in this context relates not only to the size of the effect, but also to cost effectiveness and duration of effect. It also takes into account any harmful or negative side effects.

All the research should aim to identify differences in effectiveness among groups, based on characteristics such as socioeconomic status, age, gender and ethnicity.

## 1 Sunlight exposure for different populations

How can factors that contribute to the balance of health risks and benefits of sunlight exposure for different populations be quantified? What factors should be included in tailored messages for people with different characteristics and levels of exposure to the sun, including skin colour, age, occupation and lifestyle?

## 2 Complex risk messaging around over- and underexposure to sunlight

What are the most effective ways of conveying complex risk messages and influencing behaviours in relation to over- and underexposure to sunlight? In particular, what are the most effective ways of using social and digital media? Consideration should be given to the following: how does effectiveness vary according to communicator, message, audience and medium? How does this vary at individual, group and population level in the UK? How does this vary for black and minority ethnic groups in the UK?

## 3 Identifying and targeting at-risk individuals

What are the most effective methods of identifying and targeting individuals and groups at risk of either over- or underexposure to sunlight?

## 4 Interventions around sunlight exposure

What combinations of interventions are most effective at helping people to reduce their risks of, and benefit from, sunlight exposure? How much does this vary according to the type of intervention for example, the communicator, message, audience and medium?

# Finding more information and committee details

To find NICE guidance on related topics, including guidance in development, see the [NICE topic page on sunlight exposure](#).

For full details of the evidence and the guideline committee's discussions, see the [evidence reviews](#). You can also find information about [how the guideline was developed](#), including [details of the committee](#).

NICE has produced [tools and resources to help you put this guideline into practice](#). For general help and advice on putting our guidelines into practice, see [resources to help you put NICE guidance into practice](#).

# Update information

## Minor changes since publication

**April 2023:** We updated the supporting information for practitioners on the minimum sun protection factor needed to protect against UVB, to bring it into line with current practice.

ISBN: 978-1-4731-1658-0