Shedding Light on Questions About Sunscreens

(full update August 2024)

Most skin cancers are preventable by seeking shade, wearing protective clothing, and using sunscreen appropriately.[2-4] Sunscreen is often used incorrectly (or not at all).[4,5] Help your patients use sunscreens correctly and educate them about the known benefits and theoretical risks.[5] Recommend a water-resistant, broad-spectrum sunscreen with SPF of at least 15 to 30 for most people. Patients on medications that cause photosensitivity should be counseled to minimize sun exposure and to use broad-spectrum sunscreens when sun exposure can't be avoided. This chart answers some frequently asked questions about the use and safety of sunscreens.

Clinical Question	Pertinent Information
What's the best general advice on sun protection?	• Use a broad-spectrum sunscreen with an SPF of at least 15 (per FDA) or 30 (per the American Academy of Dermatology and Health Canada).[6-8] • Apply sunscreen **every morning** to face, neck, and hands.[5] • Limit time in the sun, especially between 10AM and 2PM when the sun's rays are the strongest.[6,7] • Apply sunscreen 15 minutes before sun exposure for the best effectiveness.[7,9] • Reapply sunscreen at least every two hours, as well as right after sweating or swimming.[7] • Protect the skin from the sun with long-sleeved shirts, pants, and broad-brimmed hats.[7] • Use a lip balm with SPF 30 or higher to protect the lips.[6]

What's the difference between sunscreen product formulations?	• There are many formulations of sunscreen: creams, gels, lotions, oils, sprays, sticks, oils, pastes, and others.[7]
	• Help patients find a formulation they like, that they find easy to apply, and that feels good on their skin (to improve compliance).[5]
	• Gels might be preferable for hairy areas (e.g., scalp, male chest), a cream for dry skin and the face, and sticks for areas around the eyes.[6]
	• Patients with acne should choose a chemical sunscreen labeled as non-comedogenic.
	• A mineral sunscreen may be preferable in patients with sensitive skin.[11]
	• Some patients may find sunscreen sprays convenient. Educate patients on proper use of sprays:[6]
	  ○ Avoid inhaling sunscreen sprays.
	  ○ Sprays should not be applied directly to the face or head but rather sprayed onto hands and then spread onto the face.
	  ○ Some sunscreen sprays (e.g., those containing alcohol) are flammable. Avoid spraying sunscreen while smoking, near heat sources, or around open flames.

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What do the various terms on sunscreen labels mean?	• **SPF (sun protection factor)**: SPF describes the amount of UVB protection (i.e., protection against sunburn) that a sunscreen provides.[7,13] SPF values are not related to time but rather to the **amount** of UV exposure. UV exposure is harder to judge (compared to time) as it depends on the time of day, cloud cover, and the amount of sunscreen applied. Generally the higher the SPF, the better the protection against sunburn.[7] • **Broad spectrum**. UVB rays cause sunburn, UVA rays cause early skin aging, and both UVA and UVB rays cause cancer. Broad-spectrum sunscreens have proven effectiveness against both UVA and UVB radiation.[8,9] Sunscreens that are **not** broad spectrum are labeled as being able to help prevent sunburn, but NOT skin cancer or early skin aging.[13] • **Water resistant**. Terms such as "waterproof" and "sweat proof" are not permitted on sunscreen labeling. The correct terminology is "water resistant," and the label must indicate whether the sunscreen remains effective for 40 minutes or 80 minutes while a person is swimming or sweating.[9,13] • **Chemical** (also called organic) sunscreens (e.g., avobenzone, octisalate) have UV filters that absorb UV radiation. These must be used in combination to provide UV protection equal to mineral sunscreens.[14] • **Mineral** sunscreens (titanium dioxide and zinc oxide) provide broad-spectrum UV protection by absorbing, reflecting, or refracting UV radiation.[14] These are sometimes called inorganic, natural, or physical sunscreens.
What's the best sun protection for infants?	• Keep infants under six months out of direct sunlight.[6,15] • Use lightweight clothing that covers the arms and legs and brimmed hats to protect them from sun.[15] • The American Academy of Pediatrics suggests a small amount of sunscreen (SPF 15 or higher) may be applied to limited areas of infants under six months **if** there is no way to avoid the sun.[15] Health Canada does not recommend use of sunscreen on infants under six months.[8] • Physical sunscreens (zinc oxide, titanium dioxide) and those labeled for use in children may be less irritating.[6,15]
How much sunscreen should generally be applied on an adult?	• Apply sunscreen **generously** to all exposed skin.[8] Most people apply only one-quarter to one-half of the recommended amount.[5] • The average sized adult should apply a total of about seven teaspoons (35 mL), or about a handful, of sunscreen per full-body application.[10] A total of seven teaspoons can be distributed as about one teaspoon for each of the following: each arm, each leg, the face and neck, front of the torso, the back.[5,10] The total amount should be adjusted based on body surface area (less for children and more for patients who are obese).
When should sunscreens be discarded?	• Expiration of sunscreens is generally up to three years from manufacture. If there is no expiration date on the sunscreen, the date of purchase and a discard date of three years in the future should be written on the bottle.[17] • Discard sunscreens at least by the expiration date on the package.[17] • Keep sunscreens out of direct sunlight and away from heat (e.g., the inside of a parked car).

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	• Discard sunscreen if it's been exposed to high temperatures or if there are changes in its color or consistency.[17]
Are sunscreen recommendations different for patients with different skin colors?	• **Everyone** needs sunscreen to prevent cancer, regardless of their skin color or tone.[18] • Patients with the darkest skin tones may have a natural SPF of up to 13; however, the recommendation for sunscreen of at least 15 (per FDA) or 30 (per the American Academy of Dermatology and Health Canada) applies to all skin tones.[18,19] • Patients with darker skin tones do not sunburn as quickly as those with lighter skin tones; however, they do have the same risk for skin damage (e.g., sun spots, premature aging, cancer).[19] • Patients with dark skin tones have lower rates of skin cancer compared to lighter skin tones; however, they have higher mortality rates from skin cancer (potentially due to later diagnosis).[19] • Tinted or sheer products with invisible drying are often preferable in patients with dark skin to improve acceptance. Some products specifically target darker skin tones.[18]
How well does clothing protect against sun?	• Tightly woven, dark, dry clothes reflect almost all UV rays.[20] • If light passes through an item held up to the sun, UV rays will also pass through to skin.[20] • Wet clothes allow about half of UV rays to pass through to skin.[20] • Clothing labeled with a UPF (ultraviolet protection factor) rating indicates that it's protective against UV rays.[20] The Skin Cancer Foundation (US) recommends a UPF of at least 30, and describe a UPF of 30 to 49 as very good protection and a UPF of 50+ as excellent protection. European standards recommend a UPF of at least 40.[2,20]

What if a sunscreen and another topical product (e.g., insect repellent, moisturizers) are both needed?	• Use separate sunscreen and **insect repellent** products.[22]
	  o Sunscreen must be applied more generously and more frequently than insect repellent.[22]
	  o Apply sunscreen first, allow it to dry (about 30 minutes), then apply the insect repellent.[22,23]
	• Most **topical medications** (e.g., diclofenac solution) should be applied first (~15 to 30 minutes before sunscreen) and allowed to dry thoroughly before applying sunscreen. Consult the topical medication's product labeling. There are some topical meds (e.g., fluorouracil) that recommend limiting/avoiding sun exposure and others (e.g., diclofenac gel) that recommend avoiding sunscreen on areas treated with the topical med.[24]
	• Evidence is lacking as to whether **moisturizers** should be applied before or after sunscreen. Generally, apply the sunscreen last, about 15 to 30 minutes later. Always allow the first product to dry prior to applying the next to avoid diluting the products.[25]

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Are chemical sunscreen ingredients (e.g., oxybenzone, octinoxate) safe?	• Oxybenzone is highly photoallergenic.[5] • *In vitro* and animal studies (using [often oral] doses "unrealistic and unattainable" in humans) suggest that some chemical sunscreens could be associated with endocrine, reproductive, or neurological adverse effects.[21] o Animal data suggest there may be estrogenic effects of **orally** administered **oxybenzone**. However, an estimated 35 to 277 years of daily **topical** exposure in humans would be needed to reach the same levels.[5,26] No estrogenic effects have been reported in humans since oxybenzone was introduced in the US in 1978.[5] o The American Academy of Pediatrics suggests parents consider oxybenzone-free sunscreen for children due to its "mild hormonal properties".[31] • Some pregnant women may prefer to use physical sunscreens that are not absorbed (e.g., titanium dioxide, zinc oxide) rather than chemical sunscreens. o The use of oxybenzone-containing products has been associated with the birth defect Hirschsprung disease (a lack of nerve development in the bowel).[32] • Studies report some absorption of chemical sunscreens, but no evidence of negative health effects.[21,27-29] o Two small randomized controlled trials (n=24 and n=48) showed absorption of sunscreen ingredients (avobenzone, oxybenzone, octocrylene, homosalate, octisalate, octinoxate) exceeding FDA's upper limit for waiving toxicology studies.[28,29] ▪ These results do not indicate that these ingredients are unsafe or that they should necessarily be avoided, only that they must undergo additional toxicological studies.[3,27-29]
Are nanoparticle formulations safe?	• Physical sunscreens (titanium dioxide or zinc oxide) containing **micronized** particles can be hard to apply, may leave a white residue and stain clothing, and are comedogenic.[39] Smaller, **nanoparticles** (range of 1 to 100 nm) were designed to overcome some of these problems.[39] • The nanoparticles in sunscreens are coated to prevent their degradation to reactive oxygen species (i.e., free radicals, which are cytotoxic and carcinogenic).[21,39] o Free radicals generated from non-coated or improperly coated nanoparticles in sunscreens are believed to be inactivated by the skin's natural antioxidant protections.[33-35] • Nanoparticles should **not be inhaled** (i.e., a risk with sunscreen sprays) or ingested due to effects on lungs and the GI tract.[34] • Nanoparticles do not appear to penetrate the skin.[21] • The benefits of using a sunscreen (even with nanoparticles) to reduce skin cancer risk far exceeds any potential risks of nanoparticles.[39]

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	• The only way to avoid nanoparticles in sunscreens is to choose a chemical sunscreen. Manufacturers are not required to label particle size on sunscreens which makes it hard to avoid using nanoparticles in physical sunscreens.[39] Sunscreens labeled "non-nano" are unregulated and may be misleading.[34]
What sunscreens are best for using when swimming near coral reefs?	• The country of Palau (an island in the South Pacific ocean) became the first to ban the sale and use of ten chemicals found in sunscreens (e.g., oxybenzone) which have been shown in a lab setting to have potential detrimental effects on coral reefs.[37] • Hawaii has a similar ban of oxybenzone- and octinoxate-containing sunscreens.[14] US Virgin Islands have banned oxybenzone, octinoxate, and octocrylene.[36] Other countries and cities (e.g., Aruba, some beaches in Mexico) also ban certain chemical sunscreens.[36] • There are many chemical sunscreens available that do not contain oxybenzone or octinoxate. o Oxybenzone is only found in about 13% of non-mineral sunscreens available in the US.[47] o Many sunscreens are now labeled as "reef safe"; however, keep in mind that this term is not regulated. Up to half of sunscreens labeled "reef safe" do not meet the National Oceanic and Atmospheric Administration criteria.[16,21] • Climate change (with rising water temperatures) has the largest impact on the bleaching of coral reefs.[5,14,21] However, oxybenzone and other chemicals found in sunscreens have also shown potential associations with coral bleaching.[21,38] • There is also concern that **nano-sized** particles (less than 100 nanometers) of zinc oxide and titanium dioxide sunscreens may contribute to coral bleaching.[21,38,40]
Does sunscreen protect against melanoma (the skin cancer with the highest mortality rate)?	• Over 8,000 Americans (1,300 Canadians) are projected to die of melanoma in 2024.[1,30] • Regular use of sunscreen helps prevent melanoma and squamous cell carcinomas.[1] o Regular use of an SPF 16 sunscreen for five years reduced the risk of melanoma over the subsequent ten years by about 50% (22 cases in the control group [sunscreen use at their discretion] to 11 cases in the treatment group [daily application and regular reapplication]) [Evidence Level A-1].[41,42]
Does sunscreen prevent a person from getting enough vitamin D?	• Most people get at least some of their vitamin D through exposure to sunlight.[43] It has been suggested that five to 30 minutes of sun exposure (without sunscreen) between 10 AM and 4 PM daily (or at least twice per week) to the face, arms, legs, or back will generally provide adequate vitamin D-producing UV rays.[43] • Sunscreen with an SPF of 8 or more seems to block UV rays that produce vitamin D. However, most people do not apply enough sunscreen to all exposed skin often enough to block all vitamin D-producing UV rays.[43] • People with very little sun exposure (e.g., those in the more northern latitudes in winter, homebound patients) must include good sources of vitamin D in their diet or take a supplement to achieve recommended intake.[6,43]

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Do higher SPFs offer more protection?	• As SPF values increase, the difference in protection gets smaller. SPF 15 sunscreens filter about 93% of UVB rays, SPF 30 filter about 97%, and SPF 50 filter about 98%.[44] • Small studies have indicated a potential increase for benefit in reducing sunburn with 100+ SPF sunscreens; however, data are still lacking to recommend these high SPF sunscreens [Evidence Level B-1].[45,46] o One study (n= 199) in adults showed more sunburn (higher erythema scores) on skin protected with a sunscreen with an SPF of 50+ compared to skin protected with sunscreen with an SPF of 100+.[45] o Another small study (n=55) showed that with repeat sun exposure over five days, patients using a sunscreen with SPF of 100+ had less sunburn than those using a sunscreen with an SPF of 50+.[46] • Due to a lack of data that sunscreens with SPF over 60 provide any clinically meaningful benefit, FDA proposes a sunscreen labeling cap of 60+.[12] Canada's labeling cap is 50+.[9]
Is indoor tanning safer than tanning in the sun?	• Indoor tanning is NOT safer than tanning in the sun.[48] • UV tanning beds and booths are considered carcinogenic to humans, similar to tobacco and asbestos.[48] • Indoor tanning exposes individuals to UVA and UVB rays similar to tanning in the sun but often at a higher rate which can make it more dangerous than the sun.[48] • Indoor tanning is not recommended for those under 18 years. Many states and provinces have banned indoor tanning for those under the age of 18 years.[49,50] • Sunless tanners (as lotions, creams, sprays) give skin a tanned look without exposure to the sun. They are generally considered a safer alternative to tanning in the sun.[51] The "tan" from a sunless tanner **does not** protect against skin damage from the sun. Advise individuals to continue to use sunscreen.[52]
Are oral "sunscreens" effective?	• Oral "sunscreens" (e.g., *Heliocare*, *SunPill*) are typically classified as dietary supplements as they contain vitamins, antioxidants, and other ingredients.[53] • They might help reduce skin damage from sun exposure, but they are NOT a substitute for topical sunscreens.[53,54] • The FDA has issued repeated warnings for these dietary supplements that make unproven claims of protection from the harms of sun exposure (e.g., premature aging, sunburn, and cancer).[54]

Users of this resource are cautioned to use their own professional judgment and consult any other necessary or appropriate sources prior to making clinical judgments based on the content of this document. Our editors have researched the information with input from experts, government agencies, and national organizations. Information and internet links in this article were current as of the date of publication.

Levels of Evidence

In accordance with our goal of providing Evidence-Based information, we are citing the **LEVEL OF EVIDENCE** for the clinical recommendations we publish.

Level	Definition	Study Quality
A	Good-quality patient-oriented evidence.*	1. High-quality randomized controlled trial (RCT) 2. Systematic review (SR)/Meta-analysis of RCTs with consistent findings 3. All-or-none study
B	Inconsistent or limited-quality patient-oriented evidence.*	1. Lower-quality RCT 2. SR/Meta-analysis with low-quality clinical trials or of studies with inconsistent findings 3. Cohort study 4. Case control study
C	Consensus; usual practice; expert opinion; disease-oriented evidence (e.g., physiologic or surrogate endpoints); case series for studies of diagnosis, treatment, prevention, or screening.	

***Outcomes that matter to patients** (e.g., morbidity, mortality, symptom improvement, quality of life).

[Adapted from Ebell MH, Siwek J, Weiss BD, et al. Strength of Recommendation Taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. Am Fam Physician 2004;69:548-56. https://www.aafp.org/pubs/afp/issues/2004/0201/p548.html.]

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