Sun Protection

Traveler Summary

Key Points

- Ultraviolet (UV) radiation is greater at high elevations, in equatorial regions, and during the hemispheric summer months. Water, snow, and sand increase the UV effects due to reflection.
- Sunburn can be treated by taking cool baths or showers, applying topical after-sun creams, calamine lotion, or aloe vera-containing preparations, and taking nonsteroidal anti-inflammatory medications (such as ibuprofen). Severe sunburns may be accompanied by severely reddened skin, dehydration, fever, nausea, and dizziness and may require medical attention.
- Dedicated, lightweight, sunproof clothing with UV protection factor (UPF) 30+ (the most desirable minimum protective level) is available from many vendors; covering head/neck, both arms and legs, and the torso are most desirable. Prevention includes wearing broad-brimmed hats and UV-blocking sunglasses and limiting outdoor activities between 10:00 a.m. to 4:00 p.m., especially when UV ratings are above 6. Seek shade at mid-day.
- Zinc oxide or titanium dioxide, which are believed to reflect and scatter both UVA and UVB radiation, are the most effective and safest sunscreen agents. Modern micronized preparations are nanoparticles that appear clear on the skin in contrast to earlier paste-like preparations.
- Octinoxate, oxybenzone, avobenzone, and mexoryl are commonly available and effective but, of these, only avobenzone is fully broad spectrum. PABA, oxybenzone, avobenzone, and octinoxate photobleach coral reefs and are banned in some areas.
- Lotion formulations are best; 1 to 2 ounces of sunscreen should be applied 30 minutes before leaving accommodations and reapplied every 2 hours or after swimming or strenuous activity. "Water resistant" indicates efficacy of up to 40 minutes in water; "very water resistant" indicates efficacy of up to 80 minutes while swimming or sweating.

Introduction

Sunlight is essential for good health, but sunlight contains ultraviolet (UV; UVA and UVB) rays; excess exposure can harm skin, eyes, and the immune system and can also contribute to heat-related problems. See ***Heat-Related Illness***.

Risk Factors

About 95% of UV radiation reaching the earth's surface is UVA (75% UVA1 and 25% UVA2). UVA2 and UVB typically cause sunburn (with UVB being the most responsible), whereas the entire UVA spectrum contributes to pigment darkening, photoaging, and skin cancers.

UV radiation is greatest near the equator, at high elevations, and during summer months and is enhanced by reflecting surfaces (such as snow, sand, or water) and when the sun is directly overhead. Cloud cover slightly reduces the level of UV radiation; shade reduces it by up to 50%. UV radiation penetrates clear water to a depth of 1 m (3.3 ft).

Certain genetic traits, including fair skin, freckles, blonde or red hair, and blue eyes, predispose individuals to sunburn and skin cancer. Additional factors that contribute to sunburn and increase cancer risk include:

- History of blistering sunburn in childhood
- Rashes and allergic reactions in persons taking certain drugs, such as oral contraceptives, antihistamines, antimalarials, nonsteroidal anti-inflammatories, antibiotics, diuretics, oral diabetic drugs, and altitude sickness preventive drugs
- Local reactions with other substances (such as essential oils and perfumes) that are found in some skin care products (including sunscreen lotions)
- Excessive alcohol consumption

Symptoms

In skin, within 30 minutes of excessive sun exposure, an inflammatory response occurs resulting in redness within 3 to 6 hours, which peaks at 12 to 24 hours and usually resolves in 3 days. Affected areas may have increased sensitivity to heat and touch. Scaling, peeling, and tanning occur 4 to 7 days after exposure. More severe exposures can lead to blisters (which subside in 7 to 10 days) as well as headache, fever, nausea, and vomiting. Fair-skinned persons can develop sunburn after 10 to 15 minutes of unprotected sun exposure, whereas darker skin types usually require higher doses of UV radiation to develop visible symptoms.

In the eye, inflammation may proceed to blindness (arc eye, snow blindness).

Consequences

Sunburn can lead to permanent brown spots in fair-skinned persons. The irritation to skin and eyes can lead to early skin aging, cataracts, and cancers.

Treatment and Need for Medical Assistance

Sunburn is usually a self-limiting condition. If sunburn occurs, take the following actions:

- Relieve the discomfort of mild sunburn by bathing in cool water or applying cool compresses to affected areas.
- Apply calamine lotion, a moisturizing lotion containing aloe vera, or an after-sun cream. Neither topical nor oral steroids are recommended to treat sunburn; data are lacking to indicate any benefit in ameliorating symptoms or accelerating the healing.
- Take oral anti-inflammatory drugs (such as ibuprofen, 400 to 800 mg) with food 3 to 4 times per day to help reduce redness and discomfort as soon as symptoms appear and continue for 24 to 48 hours. However, rigorous studies on the effect of anti-inflammatory drugs are lacking.
- Drink extra water to maintain good hydration.
- Clean blisters with mild soap and water, dress with sterile bandages, and allow them to heal unopened.

Severe sunburn, manifested by dehydration, presents with severely inflamed or reddened skin, disorientation, dizziness or fainting, nausea, chills, high fever, and headache. Hospitalization for intravenous rehydration and narcotic analgesics for pain relief may be required in these extreme cases and sometimes for treatment of infection; children younger than 1 year require immediate medical attention.

Check skin annually for any changes. See a dermatologist if any changes, growths, or bleeding on the skin are observed. Skin cancer is treatable when caught early.

Prevention

Consult local or online weather sources for forecasted UV levels (see UV Index). Although fair-skinned persons need greater skin protection at lower UV levels than do persons with darker skin, everyone is at risk for skin cancer and solar eye damage. Children and babies are even more susceptible to environmental threats, including sunburn; children younger than 6 months should be kept out of direct sunlight. The five S's of sun safety (especially important for children) are:

1. Slip on clothing.
2. Slop on broad-spectrum sun protective factor (SPF) 30+ sunscreen.
3. Slap on a broad-brimmed hat designed to protect the eyes, face, as well as front and back of the neck.
4. Slide on UV protective sunglasses.
5. Seek shade.

Additional measures include using lip protection with broad-spectrum SPF ≥ 15 sunscreen, wearing a shirt while swimming (especially photoprotective clothing), and checking medication labels or consulting heath care providers regarding possible associations with sun sensitivity, especially medications noted above under Risk Factors.

Table: UV Index

Less than 2: Low risk for the average person	• Wear sunglasses on bright days. • For persons who burn easily, cover up and use broad spectrum SPF 30+ sunscreen.
3 to 5: Moderate risk	• Stay in shade near midday • If outdoors, wear protective clothing, a wide-brimmed hat, and UV-blocking sunglasses.
6 to 7: High risk	• Reduce time in the sun between 10:00 a.m. and 4:00 p.m. • If outdoors, seek shade and wear protective clothing, a wide-brimmed hat, and UV-blocking sunglasses.
8 to 10: Very high risk	• Minimize sun exposure between 10:00 a.m. and 4:00 p.m. • If outdoors, seek shade and wear protective clothing, a wide-brimmed hat, and UV-blocking sunglasses.

11 or more: Extreme risk	• Try to avoid sun exposure between 10:00 a.m. and 4:00 p.m. • If outdoors, seek shade and wear protective clothing, a wide-brimmed hat, and UV-blocking sunglasses.
For moderate and higher risk (3 to 11 or more), also do the following:	• Generously apply broad spectrum SPF 30+ sunscreen every 2 hours, even on cloudy days and after swimming or sweating. • Be aware of reflecting surfaces, such a snow, sand, or water, which reflect UV radiation and increase exposure.

Sunscreens

Sunscreens work by absorbing or reflecting UV radiation and are classified as organic (formerly chemical sunscreens) or inorganic (formerly physical sunscreen). Broad-spectrum sunscreens are combinations that absorb both UVA and UVB rays. Sunscreen benefits everyone, but light-skinned persons receive the greatest benefit.

Organic filters are compounds that absorb UV radiation and convert it to heat that is harmless to humans. UV type specific filters are:

- UVB: cinnamates and salicylates
  - Octinoxate is most common
  - Benzophenones absorb UVB and UVA2
  - Mexoryl SX and Mexoryl XL are available in Europe; Mexoryl SX is available in the US in combination with avobenzone and octocrylene
- UVA: Oxybenzone (benzophenone-3) is most common
- UVA1: Avobenzone; photolabile and needs a stabilizer such as octocrylene
- Broad-spectrum: Tinosorb M and Tinosorb S are available in Europe

Inorganic filters are mineral compounds, such as zinc oxide and titanium dioxide, which are believed to reflect and scatter UV radiation. Modern micronized preparations (nanoparticles that appear clear on the skin in contrast to earlier paste-like preparations) absorb UV radiation; current evidence suggests low risk from these products. Zinc oxide and titanium dioxide provide broad-spectrum protection.

SPF is a laboratory-derived value signifying the potency of a product and the ratio of the minimal dose of solar radiation (primarily UVB) that produces visible redness on sunscreen-protected skin compared to unprotected skin. Specific standards for labeling:

- Broad-spectrum sunscreens must pass FDA testing to be labeled as such.
- Only sunscreens with an SPF of ≥ 15 can claim to reduce the risk of premature skin aging and skin cancer.
- SPF level is capped at 50, above which the label would be SPF 50+.
- "Water resistant" indicates efficacy of up to 40 minutes in water; "very water resistant" indicates efficacy of up to 80 minutes while swimming or sweating.
- "Waterproof," "sweatproof," or "sunblock" are prohibited labeling terms.

General recommendations include:

- Use 6 to 9 teaspoons of SPF 30+ sunscreen per total body application and reapply every 2 hours.
  - Broad-spectrum products with UVA1, UVA2, and UVB are preferred; only avobenzone, zinc oxide, and titanium dioxide provide UVA1 protection.
  - Lotions and creams are oil-in-water emulsions; lotions are less messy and thinner than creams and preferred for large areas.
  - Sprays, liquids, and gels are ethanol/oil-based, but may leave a film and are less consistent in performance.
- Avoid sunscreen in children younger than 6 months, although minimal amounts of SPF 15 sunscreen applied to small areas may be considered. Preferred products are oil-based inorganic filters (i.e. zinc oxide, titanium dioxide).
- When both an insect repellent and sunscreen are used, apply the sunscreen first, let it dry completely, then apply the repellent. Very limited data suggest that DEET-containing repellents reduce a sunscreen's stated SPF UVB protection by as much as one-third, requiring more frequent sunscreen application. Sunscreens do not appear to reduce the efficacy of insect repellents (DEET or picaridin) but may increase the absorption of DEET (but not picaridin) through the skin, even when the sunscreen is applied first as recommended. Never use a combination sunscreen/insect repellent product (e.g., Avon Skin Soft Bug Guard, Bull Frog Mosquito Coast Sunscreen with Insect Repellent, or Sunsect).

Photoprotective Clothing

Ultraviolet protection factor (UPF) is a widely used standard denoting a fabric's effectiveness at blocking UV radiation and the degree of protection provided by clothing. The UPF depends on composition of the yarns, tightness of weave (improved ratings with tighter weave; most important factor), color (improved ratings with darker colors), stretch (reduced ratings with more stretch), moisture (reduced ratings when wet for many fabrics), condition (reduced ratings when worn), and finishing (improved ratings with UV-absorbing chemicals). Protection increases as the UPF number increases:

- Good: 15 to 24
- Very good: 25 to 39
- Excellent: 40 to 50

In general, dedicated lightweight sunproof clothing with UPF 30+ (most desirable minimum protective level) is available from many vendors; covering head/neck, both arms and legs, and the torso are most desirable.

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