



Delaware Valley Dermatology Group, LLC

Sunscreens 101: the basic course (including new 2011 regulations!)
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Most dermatologists would prefer patients avoid the sun when its rays are the strongest, between 10 a.m. and 4 p.m., but for many people, avoiding the sun during these hours is impossible. So the next best thing is regular and frequent sunscreen application. Sunscreens protect the skin from the harmful ultraviolet rays that can cause painful sunburns, wrinkles, premature aging, leathery skin and, and as the preponderance of scientific literature now suggests, skin cancer.

Because sun protection is such an important subject, there has been much consumer education in the media and in the community. Unfortunately, in an effort to make things simple and understandable, significant vital information has been left out. It is interesting to note that although sunscreen use has increased, it is often used incorrectly and we find patients are not always making the best choices when choosing their sunscreen products. In part, this is as a result of the confusing language on sunscreen labeling. The good news is that the US Food and Drug Administration (FDA) has responded to the confusion by issuing new regulations in June, 2011. These will provide the consumer with clear and consistent language, enabling you to more easily make smarter choices once you understand the facts.

Sunscreens 101

Regrettably, there is no getting around the fact that sun protection is a complex subject. If you want to be informed, you will need to be prepared to delve into some pretty technical material. We think, though, that once you've made the effort you'll be glad you did.

So let's begin!

To protect against photoaging (damage and premature aging of the skin caused by chronic repetitive sun exposure) and the development of precancerous and cancerous lesions, the **American Academy of Dermatology (AAD)** recommends the year-round daily use of a broad-spectrum sunscreen on exposed skin. Obviously, when bundled up in cold weather, only the face and sometimes the neck and the backs of the hands are the principal areas of skin that need sun protection. Under these circumstances, a moisturizer with a potent broad spectrum sunscreen would be the most ideal solution.

Broad-spectrum sunscreens contain ingredients that protect the skin from both *ultraviolet A* (UVA) and *ultraviolet B* (UVB) rays. UVA rays are long wavelength rays that penetrate the second layer of skin, or *dermis*, and contribute to visible signs of aging and the probable development of skin cancer. These rays are constant year-round and up to 80% can penetrate clouds and even car windows. UVB rays, on the other hand, are short wavelength – so-called burning rays -- that are more intense during summer months. Both UVA and UVB rays reflect off water, cement, sand and snow, thus intensifying exposure.

Sunscreens are a protective barrier against sun damage

Basically, a sun protection product offers the ability to either absorb or reflect away the sun's UV light, depending on whether it's an absorbing chemical molecule or a reflecting physical particle.

Since 1978, a sunscreen's ability to screen or block harmful ultraviolet rays has been measured by its Sun Protection Factor, or SPF, a ranking system with a range of from 2 to 60 (and soon to be limited to 50+!). Unfortunately, SPF ratings are poorly understood by consumers. To understand what SPF really means, it is necessary to get technical. Know this:

The SPF is merely a measurement of the relative efficacy of a sunscreen in protecting against the development of redness or erythema (the beginnings of sunburn) from intense exposure to UVB light (only). (SPF tells us nothing about any product's ability to offer protection from UVA rays – more about this later.)

The point at which redness begins to develop is called the *minimum erythema dose* or MED. In technical terms, the MED is the amount of time in minutes that it takes for sun exposure to produce at least a visible edge of erythema in at least two corners of a square template placed on unprotected exposed skin. Often, studies will mention an MED being, on average, for example, X number of minutes, at a given time of day, during a given time of year and (and even at a specific altitude and latitude!). Another important aspect in assessing an MED must take into account the amount of sunscreen applied (more on this later). Remember that your MED may be less than the average if you are very fair-skinned.

The SPF number multiplied by your MED (in any given sun exposure situation) lets you know how long you will be protected from redness using that SPF rated product. If a person who normally starts to burn 10 minutes after sun exposure in midday sun during the month of August at the New Jersey shore, applies an SPF 15 sunscreen, he or she will be protected for about 150 minutes, or 2 ½ hours (SPF 15 x 10 minutes = 150 minutes). This calculation is based on ideal circumstances, including the application of a generous even coat of the sunscreen product without any rubbing-off, sweating-off or washing-off upon exposure to water. In reality, this usually falls far short of the ideal and practically speaking, you should probably reapply an SPF 15 sunscreen every hour or, better yet, move to a sunscreen with a much higher SPF rating.

A product's absolute ability to protect does not increase proportionately with higher SPF numbers. According to the AAD, in ideal circumstances, 93% of sun burning rays are absorbed with SPF 15, while an SPF 30 product absorbs 97%. These percentages also vary depending on how generously the sunscreen is applied. So the difference between the effectiveness of a sunscreen with an SPF of 15 versus one with an SPF of 30 is not that significant (only 4% in the above example). The difference between sunscreens that have an SPF of 15, 30 or even a 50 or even higher, is not so much their relative effectiveness in terms of absorbing or blocking the sun burning rays but in their *length* of effectiveness.

There has been a growing debate about the value of high and higher SPF values in terms of their protective effect from sunburns -- so much so, that the FDA has enacted, as of June 2011, specific regulations regarding labeling of all sunscreens sold in the U.S. in which the highest SPF rating will be 50+.

Practicalities

While it is tough enough to convince people to apply sunscreens once daily, the truth is, if you are out in the sun for any extended period of time, you will need to reapply the product. Although sunscreens with high SPF factors last longer, most people staying outdoors most of the day still need to reapply high SPF sunscreens multiple times.

In fact, since we never know our MED for any given situation, a reliable calculation of how often to reapply our sunscreen is impossible. To be safe, we suggest that you choose a product with a high SPF and reapply it no less than every two hours during periods of extended sun exposure and always immediately after swimming. For some people with extremely fair skin, even more frequent application may be needed.

NEW FDA RULES!

In response to all this, on June 14, 2011, the FDA issued its long-awaited Final Regulations on sunscreens. The main issues that have been resolved are UVA protection (the longer wave length from 320-400nm) which is not covered by the SPF factor (which relates only to UVB protection) and Product Labeling.

These changes will hopefully provide an end to a lot of confusion that has plagued the consumer. There are some sunscreens that have been on the market for a long time that offer good broad spectrum protection from both the UVB (as indicated by the SPF factor) and UVA which cannot be graded by a number. (In the case of UVA protection, it is more of an all or none issue.) Some sunscreens in the past have marketed themselves as good sun blocking agents with SPFs as high as 100 but unfortunately these same sunscreens were not truly broad spectrum in their nature, leaving the consumer vulnerable to UVA exposure which may be even more dangerous than UVB, especially in terms of increasing one's risk for melanoma.

Now all sunscreens that are marketed to consumers must abide by the following regulations:

- Sunscreens that are labeled "broad-spectrum" must provide "proportional" protection against both UVB and UVA ultraviolet radiation.
- Only broad-spectrum sunscreens with an SPF of 15 or greater can state that they can reduce risk of skin cancer and premature aging of the skin if used as directed along with other sun protection measures.
- Sunscreens with an SPF of 2-14, and/or, are not broad spectrum will be required to bear a warning label stating that the product has not been shown to reduce the risk of skin cancer or premature skin aging.
- Terms such as "sweat proof" and "waterproof" are no longer allowed on sunscreen labels and those products that claim to be "water resistant" or "sweat resistant" must specify if the product offers 40 minutes or 80 minutes of protection when swimming or sweating, based on standardized testing.
- Products that are not water-resistant sunscreens must include instructions (in their labeling) to use water-resistant sunscreen if swimming or sweating.
- Sunscreens cannot claim to provide sun protection for more than two hours without reapplication, unless the manufacturer provides test results proving that the product offers protection for a longer length of time.

Finally, and perhaps most importantly, the FDA has emphasized the need to go beyond just the application of sunscreens in terms of sun protection, with a comprehensive Sun Protection Regimen including such things as shade-seeking behavior, sun avoidance during the most intense sunlight hours of the day (which varies from season to season) and sun-protective clothing such as long pants and long-sleeve shirts. Such items are now being manufactured so as to be light fitting and tolerable during the hot summer months. Similarly, there are now many choices from diverse companies selling sun protective hats, swimsuits, swim shirts and broad spectrum sunglasses.

Remember:

Under the new labeling regulations, the FDA will allow sunscreens to have 50+ as their highest SPF. So when you're shopping for sunscreens, in the near future, the highest you'll see will only be 50+.

For the best protection, get a sunscreen with an SPF of 50+ that is also labeled "broad spectrum".

Types of Sunscreens: chemical vs. physical and combinations thereof

Chemical sunscreens contain ingredients that absorb the sun's rays before they damage the skin. Used since the 1950s, *para aminobenzoic acid* (PABA) is a chemical sunscreen that filters harmful UV rays. However, PABA fell out of favor decades ago because it can stain clothing and may cause skin irritations. Manufacturers have since created products containing PABA esters or PABA-free filters as chemical alternatives.

Most sunscreen products contain multiple agents each offering its own range of protective benefits. Some agents offer greater protection against UVA light than against UVB and vice-versa. Examples of chemical agents are; benzophenones; cinnamates; salicylates; octocrylene; avobenzone (Parsol 1789); and mexoryl.

Physical sunscreens contain ingredients that form a physical barrier on the skin and thus reflect, block, scatter and/or absorb the sun's rays. *Zinc oxide* and *titanium dioxide* are the two most common physical sunscreens. Since the skin does not absorb physical sunscreens, these products usually do not cause allergic reactions and may be useful alternatives for people who react negatively to chemical sunscreens or for young children with sensitive skin. Zinc oxide, the sticky, white sunscreen often worn by lifeguards, is available in a clear form that has the same broad blocking power.

Despite all the sophistication in product formulation, there remains one very significant complication -- there is NO measurement that tells us anything about the relative effectiveness of a particular sunscreen's UVA component the way the SPF rating does for the UVB portion of the spectrum. And there is a further wrinkle in that even avobenzone (Parsol 1789), a chemical ingredient developed and patented by the French cosmetic manufacturing giant, L'Oreal, which offers both partial UVB and excellent UVA protection, starts to break down as soon as it is exposed to the sun. For this reason an SPF 45 sunscreen containing avobenzone may be very good for protection against UVB wavelengths, the UVA protection will probably not last as

long. This is another important reason to continue to reapply even high SPF broad-spectrum sunscreens.

Another ingredient developed and patented by L'Oreal is Mexoryl SX™, (or ecamsule) which has been available since 1991 in developed countries other than the US. Mexoryl is thought to be best at covering most of the UVB - UVA spectrum, but was not FDA approved until 2007. Over the past 2 ½ years since the FDA approval, L'Oreal, released several sunscreens with and without moisturizers, containing both Mexoryl SX (a water soluble form, which offers no water resistance but is a non-greasy, non-comedogenic formulation suitable for everyday use) and more recently Mexoryl XL (an oil soluble form), ranging for SPF15 to SPF40. Both of these are marketed under L'Oreal's La Roche-Posay brand. Another L'Oreal brand, Lancôme released a moisturizing sunscreen, "UV Expert", with an SPF of 20, also containing Mexoryl SX.

More good choices come from two of Johnson & Johnson's subsidiary companies, Aveeno® and Neutrogena®. These brands have introduced a single new additive in a number of their sunscreens. Called either *Helioplex™* or *Active Photobarrier Complex™*, respectively, they are different trademarks of the same agent. This new agent, simply put, is a photostabilizer, which essentially binds Parsol 1789 (avobenzone), slowing its breakdown upon exposure to the sun, and thereby prolonging its effectiveness --- making it as effective as the prolonged UVA protection that was once found only in Mexoryl.

Some of the more protective sunscreens have even combined both physical and chemical sunscreens. Once again, it is L'Oréal that offers such a product through yet another of its subsidiary companies, Ombrelle® (which marketed a sunscreen under the Ombrelle name in the past in the US). Ombrelle stopped being sold in the US a number of years ago because the company started using Mexoryl as a UVA filter, (which was not yet FDA approved) in addition to Parsol 1789, in many of its products. More recently, Ombrelle has combined both chemical and physical sunscreens into some of its products, including one for children, "Ombrelle Kids". They offer a unique blend of agents, including Mexoryl SX and Parsol 1789, as well as octocrylene and micronized titanium dioxide. The products are available in a range of formulations beginning with an SPF 30 and topping out at SPF 60. There is also a version designed specifically for those with sensitive skin. These products are from Ombrelle of Canada and are not yet FDA approved. They can however, be purchased through the internet.

Sunscreens in all shapes, sizes and formulas

Numerous skin-care products, such as moisturizers, foundations and other cosmetics, now contain chemical sunscreen ingredients as a convenience for consumers. People with a tendency to breakout should select an oil-free formula. Keep in mind though that the addition of sunscreens to cosmetic preparations may actually serve their marketer more than the consumer, as hardly anyone would uniformly apply a foundation containing a sunscreen to the entire face, the ears, the lateral aspects of the neck and the V of the neck and chest. For women, it is better to apply a moisturizer with sunscreen, all over the above-mentioned anatomic locations. Then you can apply a foundation or other makeup product (e.g., powder, concealer, blusher, etc) on top. For men, it is a good habit to apply a sunscreen year round, like an aftershave, first thing in the morning.

Sunscreens are available in lotions, creams, gels, towelettes, sprays and sticks, all of which have their own set of advantages and disadvantages. Creams and lotions are less drying, so are especially useful for those with dry skin. Gels often contain alcohol, which can sting, so should not be used near the eyes or by people with eczema or "sensitive" skin. Conversely, acne-prone

individuals may benefit from the alcohol in gel-based products. Towelettes, sprays and sticks offer easier application for active children and fragrance-free sunscreens are less likely to attract stinging insects.

Water resistant sunscreens are more effective for active people because they are more resistant to sweat and water. The ingredient most commonly included in water-resistant (formerly “waterproof” and/or “sweatproof” formulations) is octyl methoxycinnamate, which is insoluble in water. Since waterproof sunscreens may contribute to acne breakouts, people with acne should avoid these products and just reapply a non-waterproof formulation more frequently.

The fact is there may be an element of trial and error in selecting the sunscreen that best meets your needs. Different people respond differently to the various preparations and their individual ingredients. Sunscreens, most commonly those with chemical ingredients, have been known to cause an allergic contact dermatitis. There are also incidents of photoallergic contact dermatitis, which is similar to allergic contact dermatitis, but results not just from contact with the chemical ingredient, but the combination of chemical and sunlight.

People with sensitive skin may find that they get an irritant effect from some ingredients. And acne and aesthetic issues such as a “pasty” look (especially with physical blockers like titanium dioxide) may crop up. Invariably, however, with some effort, everyone can find a sunscreen product that works well for them.

When and how often to apply sunscreen

Sunscreen should be applied 20 to 30 minutes prior to sun exposure. This early application allows the chemicals to begin working and ensures the product remains on the skin. The typical dose for appropriate protection is ½ to 1 ounce of sunscreen for a child and 1 to 2 ounces, on average, for the adult body. It is important to remember to cover the ears, nose, lips and tops of the feet. Any sunscreen’s effectiveness is reduced if it is not applied in adequate amounts or if it is washed-, rubbed-, or sweated-off. For example, if someone applies ½ ounce of SPF 30, the actual protection actually may be the equivalent of applying 1 ounce of an SPF 15 product. So for maximum effectiveness, sunscreen should be applied liberally and frequently, at least every two hours, especially during peak sun hours and after swimming or exercise.

Protection for babies and children

Although the American Academy of Pediatrics now advises that it is not harmful to apply sunscreen to small areas of children younger than six months, the best defense for young infants is still to avoid direct sunlight. When sun exposure is impossible to avoid, a sunscreen especially formulated for babies’ sensitive skin is most appropriate. Generally, these are products whose primary ingredient is one of the physical blocks (like zinc oxide).

As an aside, you may be aware that in 1999 many consumers were warned via e-mail that an ingredient in a waterproof sunscreen caused temporary blindness in a two-year-old boy. This was proven to be false as attested by The American Academy of Ophthalmology; the Poison Control Center; the Food and Drug Administration; the American Cancer Society and numerous sunscreen manufacturers.

However, there is no question that sunscreen is a mild eye irritant. To minimize the likelihood of any eye discomfort, parents can choose sunscreen sticks, which are less likely to run. Additionally,

since children often resist sunscreen application, zinc oxide formulas may be appealing since they are available in several colors.

When to wear a higher SPF

Product cost frequently increases with higher SPF ratings. The higher the SPF, the higher the price. For this reason, it is good to know that many people need only an SPF of 15 for every day use. At the same time, some folks may benefit from a higher SPF all of the time, or a planned activity may warrant the more expensive choice.

According to the AAD, you should increase the SPF coverage if you:

- have a fair skin type (see Fitzpatrick Skin Types below)
- will be out in the sun for more than one hour; in this case, to be safe, it's good to reapply sunscreens every two hours, assuming midday sun, especially during the summer months, regardless of the SPF factor.
- live or plan to visit areas of high altitude or tropical climate (solar radiation in these environments is more intense);
- are taking sun-sensitizing medications, including antihistamines, oral contraceptives, non-steroidal anti-inflammatory drugs, tranquilizers, anti-nausea drugs, sulfa drugs, tetracycline antibiotics and tricyclic antidepressants.

Ultraviolet Index: what you need to know

The Ultraviolet (UV) index provides important information to help you plan your daily sun protection regimen.

Developed with the National Weather Service (NWS) and the Environmental Protection Agency (EPA), the UV index is a daily forecast of the amount of UV radiation expected to reach the Earth's surface when the sun is highest in the sky. The higher the index, the faster the UV radiation causes damage to the skin and the eyes. The index is reflective of the elevation of the sun in the sky, the cloud cover and the amount of ozone in the atmosphere. The index predicts the level of UV exposure on a 0-10+ scale and can be found on radio and TV weather broadcasts during the summer months, as well as in the newspapers. Caution and preparation in planning outdoor activities should be taken when the UV index is moderate to high (See below for more details).

Fitzpatrick Classification of Skin Types

- I - Always burns, never tans (very pale white skin)
- II - Always burns, tans minimally (white skin)
- III - Burns moderately, tans uniformly (light brown skin)
- IV - Burns minimally, always tans well (moderate brown skin)
- V - Rarely burns, tans profusely (dark brown skin)

VI - Never burns, (deeply pigmented dark brown to black skin)

UV INDEX EXPOSURE

Number	Level
0 – 2	Minimal
3 – 4	Low
5 – 6	Moderate
7 – 9	High
10+	Very High

There is no such thing as a safe tan

Tanning has often been associated with good looks and looking healthy but in reality, it simply represents sun damage. When your skin is exposed to the sun, the cells in the skin that produce the pigment melanin, called melanocytes, start producing more and more of this pigment, in an attempt to protect the skin. In dark complected people, who already have a lot of melanin, the skin gets even darker and there is rarely sunburning. However, don't be fooled by the lack of sunburning. Many of these people exhibit sun damage after years and years of exposure. When fair skin is exposed to sun, the skin isn't as fortunate in terms of its content of melanin as in the case of dark-skinned people.

Thus, the scramble to produce more and more melanin by melanocytes becomes futile, resulting in many small areas of pigmentation being spread about the skin surface (freckles). Even in those who tan readily, the protection afforded by "getting a tan" is like a low SPF sunscreen. People who think they can avoid burning and turn to tanning salons to "get a good base" are only fooling themselves. They may get less burned but the tradeoff is intense UVA exposure, the so-called tanning ray used in tanning salons, which delivers much more energy than what is found in natural sunlight. This intense UVA exposure is responsible over time for causing extensive sun damage in the deeper layer of the skin called the dermis, as well as raising one's chances substantially for developing skin cancer. Recently, the World Health Organization (WHO) cited studies showing that first exposure to tanning beds in youth increases melanoma risk by 75%. Additionally in March 2010, the US Food and Drug Administration (FDA) announced that it will be reviewing its Classification on Tanning Beds and may upgrade their status as a medical device from class I –in the same category as elastic bandages and tongue depressors---to either a Class II or III status, which would permit more oversight and more stringent regulations.

Epidemiologic studies are starting to show an increase in melanoma in young women in their twenties and thirties, as a result of chronic artificial tanning. The WHO has declared UVA a carcinogen.

Approximately thirty million people in the US are regular artificial tanners with seventy percent of them being women, generally between the ages of 20 and 40 years of age. Many of these women are mothers and daughters who frequent tanning salons together.

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Sunscreens and Skin Cancer: a connection or just a myth?

One in five Americans will develop some form of skin cancer during their lifetime. As the melanoma rate continues to rise every year, the chances of getting this type of skin cancer are more common. The lifetime risk for melanoma in Americans as of 2006 is 1 in 18. Research has already established that at least UVB light (and probably UVA as well) can induce atypical moles (or melanocytic proliferations) and melanoma in human skin. Thus, there appears to be growing evidence of a connection between sun exposure and skin cancer. Approximately 60-80% of one's lifetime of sun exposure may occur before the age of 18, so it is important for parents to establish a daily routine of applying sunscreens to children.

Randomized controlled trials have demonstrated that regular sunscreen use prevents squamous cell carcinoma (SCC) of the skin. Case-controlled studies on the use of sunscreens in the prevention of melanoma have showed conflicting results in the past. However, in a randomized controlled trial conducted in Queensland, Australia, published earlier this year in the Journal of Clinical Oncology (January, 2011), follow-up results after the completion of an initial five year treatment period showed a reduction in the incidence of new primary melanomas during a subsequent 10-year follow-up period with regular use of a broad spectrum sunscreen.

We may infer from this landmark follow-up Australian study that sunscreens may reduce the risk of developing melanoma in those people who use broad spectrum sunscreens. The follow-up period in this study lasted for ten years after an active treatment period of five years. One might also speculate that the protective effect with the regular use of sunscreens may not last forever but possibly continue provided continued diligent use of sunscreens continued throughout one's life.

What about the vitamin D dilemma?

Because insufficient vitamin D levels have been linked in epidemiologic studies to various ailments, including decreased physical performance, cardiac health, autoimmune disease, neurologic disorders, colorectal and breast cancer, as well as overall mortality, health authorities are reviewing the available data and trying to establish recommendations regarding optimal levels of this vitamin. Sunlight is a natural source for the conversion of vitamin D precursors in the skin to the active form of the vitamin. As such it is a contributor to meeting vitamin D requirements, in addition to dietary or daily oral vitamin D supplementation, with or without calcium. Some studies have suggested a possible link between a highly protective sunscreen and a vitamin D deficiency.

Although sun exposure may provide an additional vitamin D source for most people, especially adult women, dietary/oral vitamin D supplementation is very important. This is especially true

during winter months. Oral supplementation is also a more efficient way of boosting measurable levels of vitamin D, even assuming some UV exposure during the summer months will lead to increased vitamin D levels. Although drinking and eating dairy products such as milk and cottage cheese may be a source, it is more pragmatic to take an oral vitamin D supplement.

There are no definitive recommendations as to optimal levels of vitamin D, but more and more data suggest that most people are not getting enough, especially women. In a recent study at the University of Manchester, volunteers were given narrow band UVB exposure from an artificial source (based on recommended sunlight exposure to generate more active vitamin D from skin) for several weeks during the winter months in order to mimic conservative sun exposure without sunscreen protection. Although the results showed improvement in vitamin D levels with the artificial source of sun exposure, there was still only a minority of people who achieved proposed optimal levels of vitamin D. Given these observations, it seems that the ideal approach to optimal levels of vitamin D would be best achieved through oral supplementation. For this reason, it is unnecessary and unwise to avoid sunscreen use for fear of adversely affecting adequate vitamin D levels.

Remember:

Tanning beds may stimulate more vitamin D production but this benefit is far outweighed by the immunosuppressive nature of chronic UV exposure and the effect it has on significantly promoting the development of skin cancer, especially melanoma.

What about protective clothing?

Some people with very fair skin, particularly those with a history of skin cancer, may wish to purchase clothing that is specially treated or manufactured to offer protection similar to a sunscreen. Such clothing should not be considered a substitute for sunscreens but as an additional precaution, like wearing a hat, sitting under an umbrella and protecting the eyes with a good pair of sunglasses. The FDA advocates not only the use of sunscreens but other strategies, as described earlier, as part of the ideal Sun Protection Regimen.

For additional information, please visit the following websites:

- www.aad.org (the official website of the American Academy of Dermatology)
- www.asds.net (the official website of the American Society for Dermatologic Surgery)
- www.skincancer.org (the skin cancer foundation)
- www.cancer.gov/skin (the national cancer institute, with special reference to skin cancer)
- www.nih.gov/niams (the national institute of arthritis and musculoskeletal and skin diseases)
- www.nws.noaa.gov (the national weather service home page – search for uv index)
- www.solumbra.com (one of the original sun protection clothing manufacturers –aad award winning)
- www.sunprecautions.com (one of the better sites for buying sun protective clothing and sunscreens)
- www.coolibar.com (another good site for buying sun protective clothing and sunscreens)

References:

1. Atillasoy ES, et al. UVB induces atypical melanocytic lesions and melanoma in human skin. *Am J Pathol* 1998;152:1179-1186.
2. Robinson JK and Bigby M. Prevention of Melanoma with Regular Sunscreen Use. *JAMA*. 2011; 306(3): 302-303
3. International Agency for Research on Cancer (IARC). Sunscreens. Lyon, France: IARC; 2001. IARC Handbook of Cancer Prevention; vol. 5.
4. Green, A, Williams G, Neale R, et al. Daily sunscreen application and betacarotene supplementation in prevention of basal-cell and squamous-cell carcinomas of the skin: a randomized controlled trial. *Lancet*. 1999;354(9180): 723-729.
5. Dennis LK, Beane Freeman LE, VanBeek MJ. Sunscreen use and the risk for melanoma: a quantitative review. *Ann Intern Med*. 2003;139(12):966-978.
6. Huncharek M, Kupelnick B. Use of topical sunscreens and the risk of malignant melanoma: a meta-analysis of 9067 patients from 11 case-control studies. *Am J Public Health*. 2002;92(7):1173-1177.
7. Green AC, Williams GM, Logan V, Strutton GM. Reduced melanoma after regular sunscreen use: randomized trial follow-up. *J Clin Oncol* 2011;29(3):257-263.
8. Naylor, MF and Rigel, DS. "Current Concepts in Sunscreens and Usage", in *Cancer of the Skin* (eds, Rigel, DS, et al) Elsevier Saunders, 2005; 1:6:71-83.
9. Russak, JE, Chen, T, Appa, Y and Rigel, DS. A Comparison of sunburn protection of high-sun protection factor (SPF) sunscreens: SPF 85 sunscreen is significantly more protective than SPF 50. *JAAD* 2010; 62:2: 348-349.
10. Sage,RJ and Lim, HW. Therapeutic Hotline: Recommendations on Photoprotection and Vitamin D. *Dermatologic Therapy* 2010; 23: 82-85.
11. Reddy, KK and Gilchrist, BA. What is all the commotion about vitamin D? (Editorial) *2010 J Invest Dermatol*; 130: 321-326.
12. Rhodes, LE, Webb, AR, Fraser, HI et al. Recommended Summer Sunlight Exposure levels Can Produce Sufficient (≥ 20 ng ml⁻¹) but Not the Proposed Optimal (≥ 32 ng ml⁻¹) 25 (OH) D Levels at UK Latitudes. *2010 J Invest Dermatol*; 130(5): 1411- 1418

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