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Critical Concepts About Sunscreens

A science-based look at broad-spectrum sunscreens with insights on the wide variability of formulas on the market, as well as clinical support for the real-world value of higher SPF formulas.

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The greatest impact of the new FDA Sunscreen Final Rule (effective December 2012) was regarding claims allowed on the package and the standardization of broad-spectrum status. While the changes were made in the spirit of simplifying consumer choice, the new sun protection landscape is anything but simple. Dermatology professionals need to understand the complexity of the science behind sunscreen formulation in order to help their patients make smart choices for optimal photoprotection and overall skin health.

NOT ALL BROAD SPECTRUM SUNSCREENS ARE CREATED EQUAL

Under the Final Rule, sunscreen products must undergo an *in vitro* laboratory test to assess the absorbent spectrum of the sunscreens to determine how broad the protection is for each of the products. For sunscreens to be labeled broad spectrum they must pass a critical wavelength test in which 90 percent of the formula's ultraviolet (UV) absorbance occurs at 370nm.[1] (See Figure 1)

Although all broad-spectrum sunscreens need to pass this test, not all broad-spectrum products are the same. Broad-spectrum sunscreens can vary significantly in the amount of the actual UVB and UVA protection provided at each wavelength. This is possible because critical wavelength measures the breadth of protection—how far it protects into the UVA region—but not the magnitude or height of protection—or how well the sunscreen protects at each wavelength.

For example, take two hypothetical, broad-spectrum, SPF 30 sunscreens as shown in Figure 2. Although they both pass the critical wavelength test, the amplitude of UVA protection varies dramatically.

So how can you tell which are the best broad-spectrum sunscreens? It's impossible to know details about each formula just by looking at the label. I recommend that dermatology professionals call sunscreen manufacturers and ask them for the UVB/UVA ratio of their formulas.

THE ACTION SPECTRA FOR SUNLIGHT

Why are the UVB/UVA ratios important? The classic UV Action Spectra chart shows which UV rays are responsible for causing various types of damage to the skin, including skin cancer, erythema, or elastosis and breakdown of the skin.[2,3,4] (See Figure 3) The majority of damage—nearly 80 percent—is caused by the UVB part

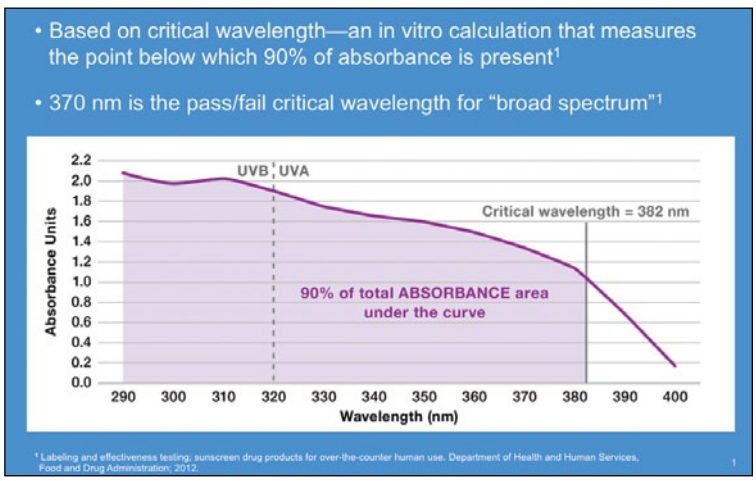


Figure 1. For sunscreens to be labeled as broad spectrum they must pass a critical wavelength test in which 90 percent of the formula's UV absorbance occurs at 370nm.

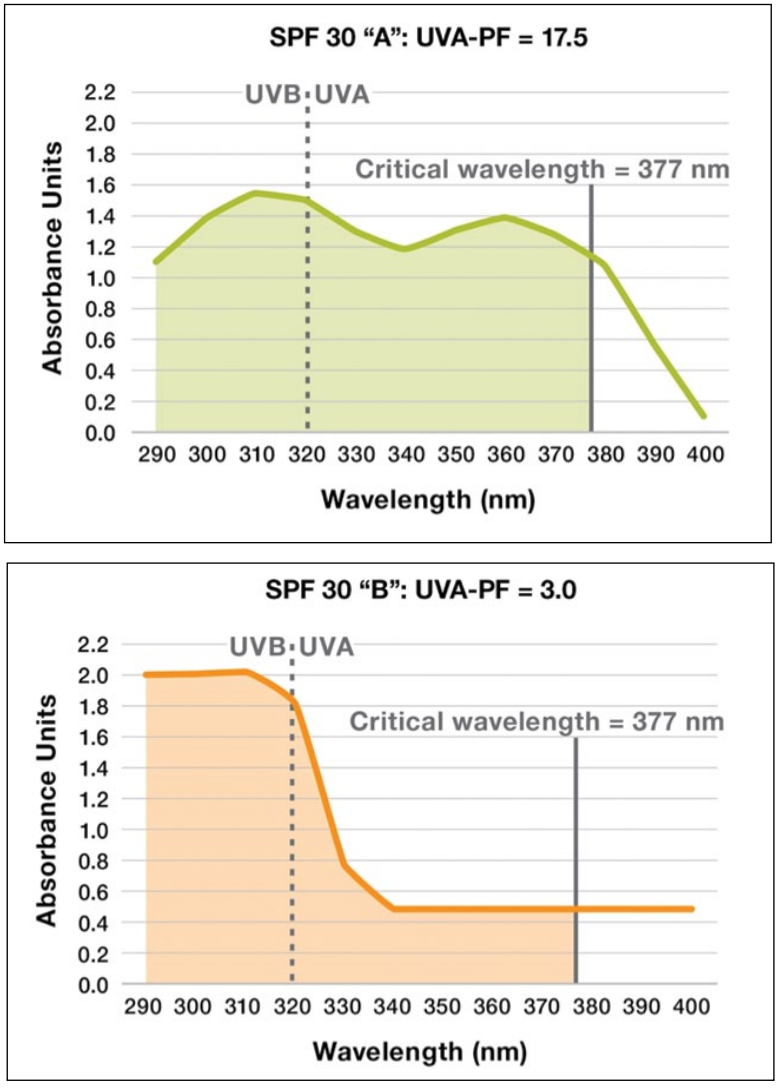


Figure 2. All Broad Spectrum Sunscreens Are NOT Equal

- **Compare the 2 hypothetical, broad spectrum, SPF 30 sunscreens shown above: Both have the same critical wavelength, yet the amplitude of UVA protection varies dramatically[1]**
- **The term "broad spectrum" does not ensure high-amplitude UVA protection**

of the spectrum. UVA also contributes to the damage, and both parts together cause damage deep into the skin on a daily basis.

Given the relative contribution of UVB and UVA to skin damage, an ideal sunscreen should address damage proportionately. The optimal ratio of protection to assure adequate protection in both regions of the UV spectrum is about 3:1 UVB to UVA. You want to have an SPF factor that is no more than three times higher than the UVA protection factor to offer optimum protection across the action spectrum. (See Figure 4) Sunscreen manufacturers should be able to provide you with these details.

IS HIGH SPF VALUABLE?

SPF is popularly described as a measure of a product's protection against UVB. This is not technically accurate, as SPF really measures a product's ability to prevent erythema (largely caused by UVB). Addition of UVA filters to a sunscreen formula can significantly increase SPF—which is why many high SPF formulas provide optimal UVA protection. (See Figure 5)

There is value to higher SPFs, and it is important for dermatology professionals to understand the multi-level value that high SPF formulas provide.

Simply put, an SPF 60 sunscreen blocks 98.3 percent of UV rays and an SPF 30 formula blocks 96.67 percent. However, it's not about what's blocked—it's how much UV radiation actually gets through to the skin that's the important factor. An SPF 60 sunscreen allows only 1.66 percent UV through to the skin, versus 3.33 percent from SPF 30 formulas, or double the amount.

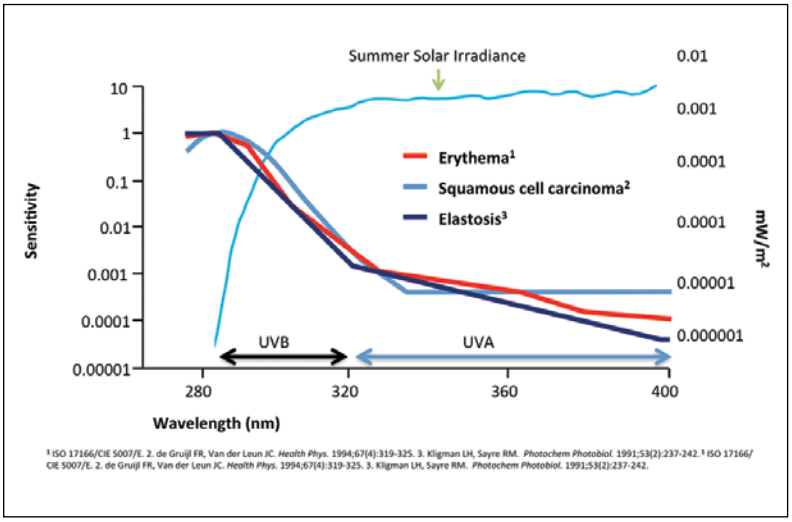
Moving from an SPF 30 to an SPF 60 product, in effect, doubles the length of time that a person can be in the sun before getting to the same level of exposure—and associated damage—as they would with the lower SPF product. Therefore, a patient can stay in the sun twice as long with an SPF 60 sunscreen versus an SPF 30 sunscreen and receive the same exposure.

It is not just about preventing sunburn—it is about stopping the damage that is going to accumulate day after day, every time a person is exposed to the sun.

HIGH SPF: CRITICAL PROTECTION AGAINST CUMULATIVE DAMAGE

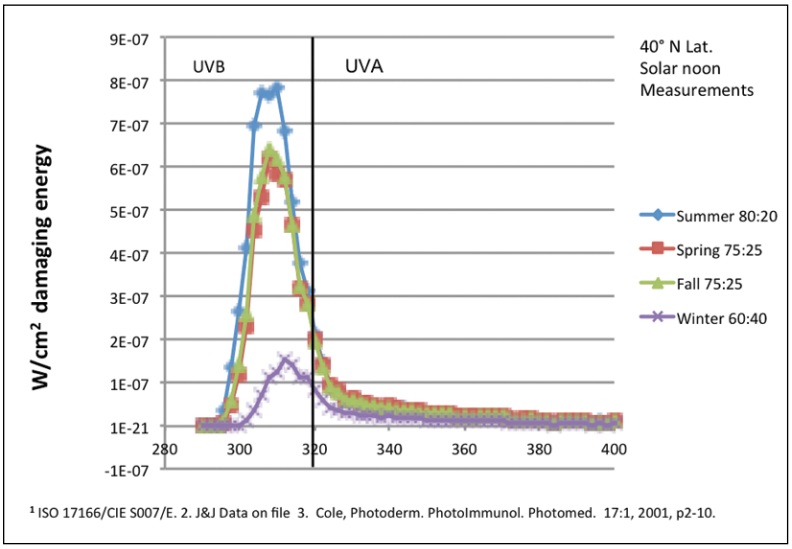
Although daily benefits of high SPF are important, the cumulative benefits over a lifetime can be lifesaving. Higher SPF sunscreens provide an incremental increase in UV blockage and, over time, that incremental difference helps reduce the cumulative damage from UV exposure.

Cumulative damage to the skin builds up over time from both incidental and acute UV exposure. It is typically damage to the deeper parts of the skin—the dermis



¹ ISO 17166/CIE S007/E. 2. de Gruijl FR, Van der Leun JC. *Health Phys.* 1994;67(4):319-325. 3. Kligman LH, Sayre RM. *Photochem Photobiol.* 1991;53(2):237-242. ¹ ISO 17166/CIE S007/E. 2. de Gruijl FR, Van der Leun JC. *Health Phys.* 1994;67(4):319-325. 3. Kligman LH, Sayre RM. *Photochem Photobiol.* 1991;53(2):237-242.

Figure 3. Action spectra from sunlight are very similar and highest in the UVB. Ideal sunscreens should address damage proportionately.



¹ ISO 17166/CIE S007/E. 2. J&J Data on file 3. Cole, Photoderm. PhotoImmunol. Photomed. 17:1, 2001, p2-10.

Figure 4. Damage spectra show the need for high UVB protection and proportional UVA protection. A ratio of SPF:UVA protection of 3:1 is optimal to assure adequate protection in both regions of the UV spectrum.

and the epidermis—where the recovery is never complete. The UV exposure received during the day can't simply be washed off at night. When you think about the damage caused by the amount of UV exposure that reaches the skin every day, you can appreciate the value of incremental protection.

There's another reason to consider higher SPF sunscreens. Most people apply only 25 to 50 percent of the recommended amount of sunscreen and, therefore, are not getting the SPF protection stated on the package. Sunscreen SPF value is based on an application of 2 milligrams per square centimeter—or about one ounce over the body. If patients under-apply, they are in danger of receiving a sub-optimal level of protection.

In fact, a recent study in the *Journal of the American Academy of Dermatology* showed there is a linear relationship between the actual SPF of a product and the amount of sunscreen applied (Figure 6).[5] If a patient applies half the recommended amount of an SPF 50, they are receiving only SPF 25; if they apply a quarter of the recommended amount, that protection drops to SPF 12. Because of this phenomenon, and because we know people regularly under apply, the use of high-SPF sunscreens can provide a margin of safety to ensure minimum levels of protection.[5]

By using a product with a higher SPF regularly, patients can significantly reduce the cumulative damage to their skin over a lifetime of UV exposure and can reduce the risk of skin cancer and premature aging.

Comprehensive broad-spectrum sunscreen use is also particularly important for high-risk groups, including high-sensitivity individuals (phototypes I and II, individuals with photosensitive conditions, patients on immunosuppressive drugs), individuals who need to limit further photodamage, and individuals with prior history of skin cancers.

PRACTICAL GUIDELINES FOR SUNSCREEN RECOMMENDATIONS

According to a study reported in *Journal of the American Medical Association*, dermatologists recommend sunscreen at less than two percent of office visits.[6] This needs to change if we're ever to stop the rising epidemic of skin cancer. Protection over a lifetime against skin cancer and photoaging is a critical consideration in sun safe behavior. Sunscreen is relevant for every patient, every age group, and for patients of all skin colors. Daily sunscreen application should be as routine for patients as brushing their teeth. For recreational protection at the beach or during outdoor sports, patients need to ensure they understand

best practices in choosing and applying sunscreens.

When you recommend sunscreen to your patients, there are several things to keep in mind:

- Recommend patients look for broad spectrum sunscreens that offer comprehensive sun protection with high SPF that covers both parts of the spectrum that cause damage to the skin.
- Tell patients to choose a formula that is photostable and can maintain that protection over a long period of time.
- Applying the proper amount is key. The FDA standard is based on 2 mg/cm^2 coverage on the skin. This translates into 1 ounce of lotion for the body. For spray products, patients should spray their skin until it glistens and then spread it to make sure all spots are covered. It is recommended that patients spray in sheltered areas to avoid the sunscreen from blowing away. For sunscreen sticks, patients should apply at least three to four passes over the area to obtain the recommended coverage.
- Patients should re-apply regularly (at least every two hours) to assure proper application level, to hit "missed spots," and after toweling or wiping off. Re-application after two hours is mandatory labeling by the FDA, but photostable sunscreens do not wear out and will continue to protect as long as they are on the skin.[7]

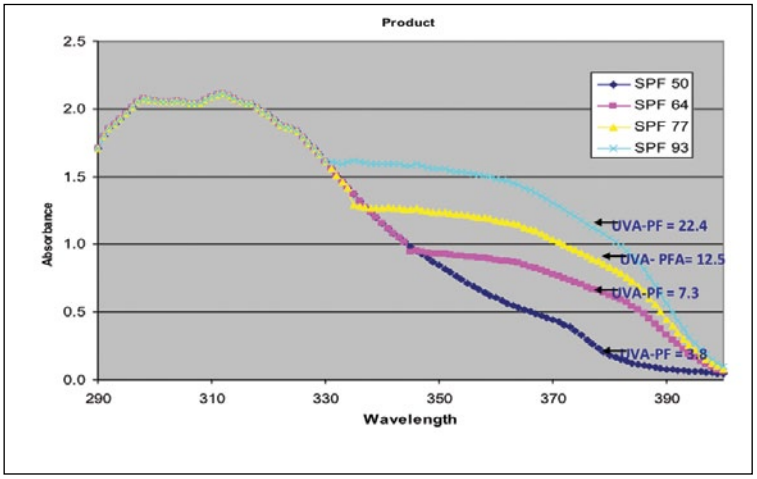


Figure 5. Addition of UVA can significantly increase SPF. SPF does not *just* measure UVB protection.

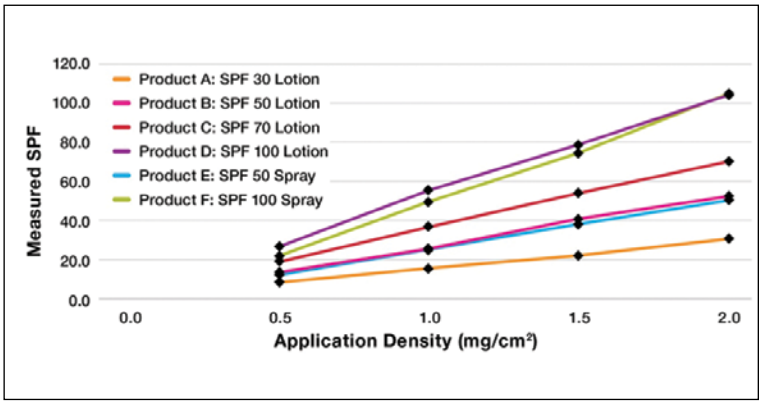


Figure 6. High SPF offers margin of safety.[5] SPF protection is directly and linearly proportional to the application quantity. Use of high-SPF products can provide meaningful proection that low-SPF products may not when underapplied

COMPLIANCE IS KEY

Patients should be encouraged to experiment with different forms of sunscreen to identify what is best for them—lotion, sprays, sticks, sensitive skin formulas, etc., or a combination. The aesthetics of a formula are an important factor in compliance. Patients can find sunscreens that are non-greasy, lightweight and fast-absorbing, leaving skin feeling smooth. Most important, dermatology professionals can determine the best broad-spectrum sunscreen for their patients by asking manufacturers for the full information on the products, including the level of the UVA protection that's actually in the formula as well as the critical wavelength details.

In today's environment, it's important to understand the complexity of sunscreens in making smart recommendations for skin health to your patient community.

1. Labeling and effectiveness testing; sunscreen drug products for over-the-counter human use. Department of Health and Human Services, Food and Drug Administration; 2012.

2. ISO 17166/CIE S007/E.

3. de Gruijl FR, Van der Leun JC. Estimate of the wavelength dependency of ultraviolet carcinogenesis in humans and its relevance to the risk assessment of a stratospheric ozone depletion. Health Phys. 1994;67(4):319-325.

4. Kligman LH, Sayre RM. An action spectrum for ultraviolet induced elastosis in hairless mice: quantification of elastosis by image analysis. Photochem Photobiol. 1991;53(2):237-242.

5. Ou-Yang H1, Stanfield J, Cole C, Appa Y, Rigel D. High-SPF sunscreens (SPF ≥ 70) may provide ultraviolet protection above minimal recommended levels by adequately compensating for lower sunscreen user application amounts. J Am Acad Dermatol. 2012;67(6):1220-1227.

6. Akamine KL, Gustafson CJ, Davis SA, Levender MM, Feldman SR. Trends in sunscreen recommendation among US physicians. JAMA Dermatol. 2014;150(1):51-55.

7. Wright M, Wright S, Wagner F. Mechanisms of sunscreen failure. J Am Acad Dermatol. 2001;44:781-784.