Potential allergenicity of commonly sold high SPF broad spectrum sunscreens in the United States; from the perspective of patients with autoimmune skin disease

Emily Keyes, BAa,b, Victoria P. Werth, MDb, Bruce Brodb

Corporal Michael J. Crescenz Veterans Affairs Medical Center, Philadelphia, PA
Department of Dermatology, University of Pennsylvania, Philadelphia, PA

ARTICLE INFO

Article history:
Received 9 November 2018
Received in revised form 3 May 2019
Accepted 15 May 2019

Keywords:
dermatology
sunscreen
photosensitivity
allergens
contact dermatitis
autoimmune skin

ABSTRACT

Background: Lack of established criteria for sunscreen product recommendations and potentially allergenic ingredients in sunscreens pose an issue for physicians and patients with autoimmune skin conditions.

Objective: We reviewed popular sunscreens for effectiveness and potential allergenicity for recommendations and use in the autoimmune skin condition population.

Methods: In this cohort study, we selected sunscreens from the bestseller lists of Amazon, Target, and CVS. Of those, sunscreens with sun protection factor of 50 to 99 and 100 that met our effectiveness criteria (52 sunscreens) were analyzed for allergenic ingredients. An allergen list was developed from the North American Contact Dermatitis Group core data and stratified into low-prevalence and high-prevalence allergens.

Results: The allergenicity of popular sunscreens that met our effectiveness criteria are organized in a table by number of tiered potential allergens. Although no sunscreen was allergen-free, several products contained a minimal number of low-prevalence allergens. The most common low-prevalence allergens were chemical sunscreen ingredients avobenzone, octocrylene, and oxybenzone, and the most common high-prevalence allergen was fragrance. A limitation is that not all U.S. sunscreens were analyzed.

Conclusion: With the wide range of sunscreens available, physicians and patients should be aware of the effectiveness and potential allergenicity of sunscreens and make recommendations and consumption choices accordingly.

© 2019 Published by Elsevier Inc. on behalf of Women's Dermatologic Society. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Introduction

The photosensitivity component of lupus erythematosus, dermatomyositis, and other autoimmune skin conditions requires assiduous sun protection, including the use of broad spectrum sunscreens with maximal sun protection factor (SPF). Adequate sunscreen use effectively photoprotects against ultraviolet (UV)-induced lupus (Fulton, 2018; Herzberger et al., 2004; Stege et al., 2000). However, the lack of established criteria for adequately effective sunscreen selection creates confusion when counseling patients on the choice of a sunscreen. Additionally, sunscreens may contain potentially allergenic ingredients, which could cause allergic and photoallergic contact dermatitis and exacerbate symptoms. Overall, the consequences of improper sunscreen selection and usage include inadequate sun protection and allergenic responses to the ingredients in sunscreens. This is particularly important for patients with autoimmune skin conditions. These patients are very dependent on sunscreens as part of their treatment because inadequate sun protection can directly cause a flare up. Additionally, allergic contact dermatitis from allergenic ingredients in sunscreen may be uniquely debilitating to this patient population because an episode of contact dermatitis can be difficult to distinguish from a flare of the autoimmune condition.

The armamentarium of effective sunscreens in the United States faces additional challenges compared with Europe. Currently, 16 approved ingredients in the United States can be used in sun-
screens to filter UV light. Eight other ingredients have been approved outside of the United States but do not have U.S. Food and Drug Administration (FDA) approval. Some are thought to be superior in stability and with a broader absorption spectrum compared with what is currently available on the U.S. market. Further limitations have arisen from environmental concerns on the coral reefs over the use of oxybenzone (benzophenone-3) and octinoxate, which have resulted in legislation to ban their use in Hawaii (Fulton, 2018).

Previous studies have demonstrated that adequate sunscreen use effectively photoprotects against UV-induced lupus (Herzinger et al., 2004; Kuhn et al., 2011; Stege et al., 2000). However, the studies in question did not analyze the wide range of sunscreens available in the United States. Stege et al. (2000) compared different active ingredients in the photoprotection of patients with lupus and found that although all offered some protection, Mexoryl™ (ecamsule) is the most effective. However, ecamsule is only available in L’Oreal products in the United States. Ecamsule-containing sunscreen was effective at preventing UV-induced lupus erythematosus, as was a titanium dioxide–based sunscreen (Herzinger et al., 2004). A broad spectrum SPF-60 sunscreen with active ingredients of titanium dioxide, zinc oxide, and methylene bis-benzotriazolyl tetramethylbutylphenol offered effective photoprotection versus a non-sunscreen control product. These sunscreens do not reflect the active ingredients in commonly used U.S. sunscreens.

We analyzed the most popular sunscreens available through Amazon, Target, and CVS for usefulness in patients with autoimmune skin conditions, with the goal of setting clear standards for sunscreens that meet effectiveness criteria and do not have allergenic ingredients.

Sun protection factor

Photosensitivity plays a significant role in exacerbating symptoms and manifestations of many autoimmune skin conditions. Although the American Academy of Dermatology recommends sunscreens with an SPF of at least 30, an optimal sunscreen for photosensitive patients will have an SPF of at least 50. We used the cutoff of SPF 50 because it offers more sun protection than SPF 30 (blocks >98% of UV-B rays rather than 97%), which likely has a particular benefit for our photosensitive population. However, studies have proven that sunscreens that claim SPF protection >50 are significantly more effective than SPF-50 sunscreens in preventing sunburn (Ou-Yang et al., 2012; Russak et al., 2010; Williams et al., 2018), so special preference is given to high-SPF sunscreens.

Broad spectrum

The sunscreens reviewed in this study had to offer broad spectrum coverage (i.e., adequately blocks both UV-A and UV-B rays). FDA guidelines now require that sunscreens pass an in vitro broad spectrum test to demonstrate that the products absorb a critical wavelength region of the UV-A and UV-B regions of the spectrum (FDA, Center for Drug Evaluation and Research, 2018a). Both rays can induce photosensitive lesions in lupus erythematosus and dermatomyositis, so coverage against both types of radiation is necessary.

Water resistant

Both the American Academy of Dermatology and FDA recommend using sunscreens that are water resistant (i.e., retain their stated SPF value for a certain number of minutes [40 or 80 minutes]) while swimming or sweating. The FDA requires that rigorous water-resistance testing be done on sunscreens and be clearly stated on the label (FDA, Center for Drug Evaluation and Research, 2018a) to ensure proper protection in a range of daily conditions.

Cost

Patients with autoimmune skin conditions will use a large quantity of sunscreen for an indefinite period of time, making total cost of usage significant. The FDA recommends applying at least 1 oz of sunscreen per application, with a reaplication every 2 hours (FDA, Center for Drug Evaluation and Research, 2018b). That equates to a considerable amount of sunscreen every day and therefore a considerably significant cost.

Physical versus chemical sunscreens

Chemical sunscreens contain active ingredients that absorb UV rays, whereas physical sunscreen ingredients block or deflect UV rays. Physical sunscreens are often preferable for this population because their ingredients are less likely to cause allergic reactions or skin irritation; several chemical blocker active ingredients are classified by our metric as low-prevalence allergens, but physical blockers are not allergens.

Medium of application

Sunscreens come in a variety of application media (e.g., cream, lotion, stick, gel, spray, wipes). Sprays are generally the least preferable method because they are often not applied in adequate amounts evenly on the body and should not be sprayed near the face or mouth due to the risk of inhalation (American Academy of Dermatology, 2018). We did include sprays in our analysis, but consideration should be given to their increased risk of potential airborne contact dermatitis and inefficacy compared with other vehicles.

Allergens/harmful ingredients

Some ingredients in sunscreens, both active and inactive, can cause allergic and irritant contact dermatitis in patients with autoimmune skin conditions. This population of patients is especially susceptible to inflammation, so preemptive avoidance of sunscreens with certain ingredients might prevent contact dermatitis. Several case reports have demonstrated that lupus can be exacerbated by contact dermatitis (Barnett, 1990; Shimakawa et al., 2008; Trindade et al., 2004; Van Aerde et al., 2016). Additionally, a study by Güner et al. (2013) in which patch testing was applied to both patients with lupus and controls found a statistically significantly higher percentage of positive reactions in the lupus group. This suggests an increased sensitivity to allergens in this population. That increased sensitivity, coupled with the risk of disease exacerbation from dermatitis, requires greater care to avoid allergens in this population.

Methods

We examined sunscreens available from online retailers Amazon, Target, and CVS. The top 30 bestsellers were selected from Amazon, the top 20 from Target (after elimination of duplicates), and the top 10 from CVS (after elimination of duplicates). The decreasing numbers from each distributor reflect the elimination of duplicates. Additionally, all SPF-100 sunscreens available from Amazon, Target, and CVS were analyzed further (14 additional sunscreens). The purpose of this approach was to capture the sunscreens people are most likely to use to make the analysis as
Additionally, triethanolamine and panthenol were included in the list because rare but relevant case reports exist of allergic contact dermatitis to these ingredients in sunscreens (Chu and Sun, 2001; Clerens and Goossens, 2017). Although not on the NACDG list, jojoba was included because it is an emerging allergen and is on the American Contact Dermatitis Society core baseline series (American Contact Dermatitis Society, 2018). Retinyl palmitate was considered for inclusion because the Environmental Working Group, an American non-profit group that researches and advocates against potentially harmful ingredients in various consumer products, considers it a “controversial agent”; however, no reports exist of allergic contact dermatitis involving retinyl palmitate in sunscreen, and only one case report exists of any allergic contact dermatitis involving the ingredient. Thus, retinyl palmitate was not included in the list (Clemmenson et al., 2007; Environmental Working Group, 2018).

Total allergens were counted and recorded from the product’s active and inactive ingredient list and further stratified into total low-prevalence allergen count and total high-prevalence allergen count.

### Results

All sunscreens in the initial analysis from the Amazon, Target, and CVS bestseller lists (74 total) were broad spectrum. Of the 22 products eliminated from further analysis because they did not meet the effectiveness criteria, two were not water resistant and 20 were below SPF-50.

Overall, no sunscreens were completely allergen free. However, several had zero high-prevalence allergens and low numbers of low-prevalence allergens. Notable low-allergenicity brands in the SPF-50 to 99 category are ThinksportTM, BabyganicsTM, Australian GoldTM, the Banana Boat Simply ProtectTM line, and the CVS Clear ZincTM line (Table 2). In the SPF-100 category, notable brands are the Banana Boat KidsTM line and Banana Boat SportTM line (Table 3).

The most common high-prevalence allergen was fragrance (present in 30 of the 52 sunscreens analyzed). Other prevalent high-prevalence allergens were propylene glycol (found in 8 of 52 sunscreens) and methylisothiazolinone (7 of 52). The most common low-prevalence allergens were avobenzene (41 of 52), octocrylene (40 of 52), and oxybenzone (36 of 52) chemical blocking sunscreen ingredients. Interestingly, all SPF-100 sunscreens use chemical blockers (Tables 2 and 3).

Cost did not correlate in any significant fashion with the number of allergenic ingredients, nor did it correlate with SPF value.

### Discussion

Sunscreen usage is vital in patients with autoimmune skin conditions. These patients need higher SPFs and more consistent protection because even a small amount of light can exacerbate the disease. Allergic ingredients are particularly harmful to patients with autoimmune skin conditions because these patients can be more sensitive to allergic ingredients and have a higher risk of contact dermatitis. Thus, selection of a sunscreen with appropriate efficacy but minimal allergenic ingredients is important. Our analysis evaluated sunscreens along these parameters.

The high frequency of the low-prevalence allergens avobenzene, octocrylene, and oxybenzone as chemical sunscreen blockers suggests that physical blocker–based sunscreens may be preferable to chemical sunscreens in allergy-prone patients as a pre-emptive avoidance strategy (Hill et al., 2016). Additionally, recent legislation in Hawaii has banned oxybenzone and octinoxate (another chemical blocker, present in 6 of 52 analyzed sunscreens). Together, the higher risk of allergenicity and potential lack of availability of some
## Table 2

Sunscreen analysis of sun protection factor 50 to 99

| Sunscreen                        | Sun protection factor | Type of blocker | Total L | Total H | L allergens            | H allergens | Cost per ounce |
|----------------------------------|-----------------------|-----------------|---------|---------|------------------------|-------------|----------------|
| Thinksport Kids Safe Sunscreen Lotion | 50+                   | Physical        | 1       | 0       | jojoba                 | None        | $3.46          |
| Thinksport Sunscreen Lotion      | 50                    | Physical        | 1       | 0       | Jojoba                 | None        | $3.66          |
| Neutrogena Sunscreen Lotion      | 50                    | Physical and chemical | 2       | 0       | Helianthus annuus (sunflower) seed oil, jojoba | None        | $1.63          |
| Banana Boat Simply Protect Sport Sunscreen Spray | 50 | Physical | 3       | 0       | Phenoxethanol, tocopheryl acetate, panthenol | None | $1.05          |
| Australian Gold Botanical tinted face Sunscreen Mineral Lotion | 50 | Physical | 3       | 0       | Helianthus annuus (sunflower) seed wax and oil, ethylhexylglycerin, jojoba | None | $1.87          |
| Babyganics Mineral Based Baby Sunscreen Lotion | 50 | Physical | 3       | 0       | Helianthus annuus (sunflower) seed oil, ethylhexylglycerin, phenoxyethanol | None | $1.05          |
| Banana Boat Simply Protect Kids Spray | 50 | Chemical  | 3       | 0       | Avobenzene, octocrylene, phenoxyethanol | None | $1.82          |
| CVS Health Clear Zinc Broad Spectrum Sun Lotion | 50 | Physical and chemical | 3       | 0       | Octocrylene, parabens, phenoxyethanol | None | $1.82          |
| Coppertone Ultra Guard Sunscreen Lotion | 70 | Chemical | 4       | 0       | Avobenzene, octocrylene, oxybenzone, benzyl alcohol | None | $1.12          |
| Up&Up Sport Sunscreen Stick | 55 | Chemical | 5       | 0       | Avobenzene, octocrylene, oxybenzone, beeswax (Apis mellifera), phenoxyethanol | None | $1.59          |
| Banana Boat Sunscreen Sport Lotion | 50 | Chemical | 7       | 0       | Avobenzene, octocrylene, oxybenzone, phenoxyethanol, parabens, tocopheryl acetate, coco-glucoside | None | $0.82          |
| Neutrogena Pure and Free Baby Mineral Sunscreen Stick | 60+ | Physical | 0       | 1       | None                     | Propylene glycol | $10.85         |
| EltaMD UV Sport Sunscreen Lotion | 50 | Physical and chemical | 1       | 1       | Tocopheryl acetate      | Iodopropynyl butylicarbamate | $6.27          |
| La Roche-Posay Anthelios Mineral Face Sunscreen Lotion | 50 | Physical and chemical | 1       | 1       | Phenoxethanol            | Propylene glycol | $19.99         |
| CVS Sport Clear Broad Spectrum Sunscreen Spray | 50 | Chemical | 2       | 1       | Avobenzene, oxybenzone  | Fragrance      | $1.50          |
| Coppertone Sport Continuous Sunscreen Spray | 50 | Chemical | 3       | 1       | Avobenzene, octocrylene, oxybenzone | Fragrance | $1.12          |
| Up&Up Continuous Mist Sunscreen Spray | 50 | Chemical | 3       | 1       | Avobenzene, octocrylene, oxybenzone | Fragrance | $0.82          |
| Neutrogena Ultra Sheer Non Greasy Sunscreen Stick | 70 | Chemical | 3       | 1       | Avobenzene, octocrylene, oxybenzone | Fragrance | $5.72          |
| Neutrogena Wet Skin Kids Stick Sunscreen Spray | 70 | Chemical | 3       | 1       | Avobenzene, octocrylene, oxybenzone, panthenol | Fragrance | $0.98          |
| Banana Boat Sunscreen Sport Spray | 50 | Chemical | 4       | 1       | Avobenzene, octocrylene, tocopheryl acetate, ethylhexylglycerin | Fragrance | $4.33          |
| Sun Bum Face Sunscreen Lotion | 50 | Chemical | 4       | 1       | Avobenzene, octocrylene, oxybenzone, tocopheryl acetate | Methylisothiazolinone | $2.67          |
| Sun Bum Original Sunscreen Spray | 50 | Chemical | 4       | 1       | Avobenzene, octocrylene, oxybenzene, tocopheryl acetate | Fragrance | $5.42          |
| Biore Sarasara UV Aqua Rich Sunscreen Lotion | 50 | Chemical | 4       | 1       | Avobenzene, octocrylene, oxybenzene, tocopheryl acetate | Fragrance | $5.42          |
| Neutrogena Sensitive Skin Sunscreen Lotion | 60+ | Physical | 4       | 1       | Benzyl alcohol, bisabolol, ethylhexylglycerin, tocopheryl acetate | Methylisothiazolinone | $4.43          |
| Neutrogena Beach Defense Body Sunscreen Spray | 70 | Chemical | 4       | 1       | Avobenzene, octocrylene, oxybenzone, tocopheryl acetate | Fragrance | $1.38          |
| La Roche-Posay Anthelios Melt-In Milk Sunscreen | 60 | Chemical | 5       | 1       | Avobenzene, octocrylene, oxybenzone, phenoxethanol, triethanolamine | Propylene glycol | $7.20          |
| Alba Botanica Hawaiian Coconut Sunscreen Spray | 50 | Chemical | 5       | 1       | Avobenzene, octocrylene, Chamomilla recutita (Matricaria) flower extract, sodium benzoate, tocopheryl acetate | Fragrance | $1.87          |
| Neutrogena Cool-Dry Sport Sunscreen Spray | 50 | Chemical | 5       | 1       | Avobenzene, octocrylene, oxybenzene, tocopheryl acetate | Fragrance | $2.56          |
| Neutrogena Hydro Boost Sunscreen Lotion | 50 | Chemical | 5       | 1       | Avobenzene, octocrylene, oxybenzene, tocopheryl acetate | Fragrance | $4.16          |
| Neutrogena Beach Defense Sunscreen Lotion | 70 | Chemical | 5       | 1       | Avobenzene, octocrylene, oxybenzone, tocopheryl acetate, phenoxyethanol | Fragrance | $0.97          |
| CVS Health Sunscreen Lotion | 50 | Chemical | 6       | 1       | Avobenzene, octocrylene, oxybenzone, benzyl alcohol, ethylhexylglycerin | Fragrance | $1.12          |
| Neutrogena Clear Face Sunscreen Lotion | 55 | Chemical | 6       | 1       | Avobenzene, octocrylene, oxybenzone, bisabolol, ethylhexylglycerin, phenoxyethanol | Propylene glycol | $4.50          |
| Neutrogena Sport Face Sunscreen Lotion | 70+ | Chemical | 8       | 1       | Avobenzene, octocrylene, oxybenzone, benzyl alcohol, bisabolol, ethylhexylglycerin, parabens, triethanolamine | Methylisothiazolinone | $5.20          |
| Sun Bum Original Lotion | 50 | Chemical | 5       | 2       | Avobenzene, octocrylene, oxybenzene, ethylhexylglycerin, tocopheryl acetate | Fragrance, methylisothiazolinone | $2.50          |

(continued on next page)
chemical-based sunscreens may point toward preferential recommendation of physical blocker-based sunscreens in some patients. We did not include oxybenzone, also known as benzophenone-3, in the high-prevalence category. Based on the NACDG prevalence data as our metric, benzophenone-3 would qualify as a low-risk allergen (DeKoven et al., 2018). Benzophenone-3 was the allergen of the year in 2014, and is the most common sunscreen ingredient known to cause photoallergic contact dermatitis. However, photoallergic contact dermatitis to benzophenone-3 is still relatively uncommon in the general population, as noted by Heurung et al. (2014a, 2014b). One study found that photoallergic contact dermatitis may be even lower in the autoimmune population because there is a higher motivation among that population to avoid direct sunlight.

Fragrances are complex mixtures. A positive patch test to fragrance indicates allergy to certain fragrances, but not all. Due to more lax regulations for fragrance product labeling in the United States, discerning individual fragrance components in sunscreens is difficult; therefore, avoiding fragrances and other cross reacting ingredients is the safest option.

Interestingly, all SPF-100 sunscreens use chemical blockers, which is potentially a reason to recommend a sunscreen in the SPF-50 to 99 range instead.

Given that cost does not trend significantly with the allergenicity or SPF level of sunscreen, patients should use a sunscreen that has the fewest potentially allergenic ingredients and the highest SPF at the lowest possible cost, if this is an important factor, but cost is only one factor in patients' sunscreen product selection. Additionally, patients may want to consider the vehicle of sunscreen when deciding between products. Sprays may have propellants and additives that may increase the risk of allergenicity.

Although we focused on the most prevalent brands, this methodology could be applied to smaller-brand sunscreens by reading labels according to the effectiveness criteria detailed herein and examining ingredient lists for the allergens listed in Table 1.

This study has several limitations. The sunscreens analyzed were pulled from the bestseller lists on popular retail Websites.

Table 2 (continued)

| Sunscreen | Sun protection factor | Type of blocker | Total L | Total H | L allergens | H allergens | Cost per ounce |
|-----------|-----------------------|----------------|---------|---------|-------------|-------------|----------------|
| Aveeno Protect + Hydrate Sunscreen Lotion | 50 Chemical 6 2 | Avobenzone, octocrylene, oxybenzone, benzyl alcohol, ethylhexyglycerin, phenoxyethanol | Fragrance, propylene glycol | $2.60 |
| Aveeno Protect + Hydrate Face Sunscreen Lotion | 50 Chemical 6 2 | Avobenzone, octocrylene, oxybenzone, benzyl alcohol, ethylhexyglycerin, phenoxyethanol | Fragrance, propylene glycol | $2.59 |
| Aveeno Protect + Hydrate Sunscreen Lotion | 70 Chemical 6 2 | Avobenzone, octocrylene, oxybenzone, benzyl alcohol, phenoxyethanol, ethylhexyglycerin | Fragrance, propylene glycol | $2.83 |

* Ingredients were considered fragrance because they are components of fragrances and fragrance mixes.

Table 3

Sunscreen analysis of sun protection factor 100

| Sunscreen | Sun protection factor | Type of blocker | Total L | Total H | L allergens | H allergens | Cost per ounce |
|-----------|-----------------------|----------------|---------|---------|-------------|-------------|----------------|
| Banana Boat Kids MAX Sunscreen Lotion | 100 Chemical 6 0 | Avobenzone, octocrylene, oxybenzone, tocopheryl acetate, benzyl alcohol, parabens | None | $2.12 |
| Banana Boat Sport Performance Lotion | 100 Chemical 6 0 | Avobenzone, octocrylene, oxybenzone, tocopheryl acetate, benzyl alcohol, parabens | None | $2.73 |
| Coppertone Sport Kids Sunscreen Continuous Spray | 100 Chemical 3 1 | Avobenzone, octocrylene, oxybenzone | Fragrance | $1.32 |
| Coppertone Sport Continuous Spray | 100 Chemical 3 1 | Avobenzone, octocrylene, oxybenzone | Fragrance | $3.36 |
| Panama Jack Continuous Sunscreen Spray | 100 Chemical 3 1 | Avobenzone, octocrylene, oxybenzone | Fragrance | $2.54 |
| CVS Sport Clear Sunscreen Spray | 100 Chemical 3 1 | Avobenzone, octocrylene, oxybenzone, tocopheryl acetate | Fragrance | $1.58 |
| Neutrogena UltraSheer Sunscreen Spray | 100 Chemical 4 1 | Avobenzone, octocrylene, oxybenzone, tocopheryl acetate | Fragrance | $1.80 |
| Banana Boat Sport Performance Spray | 100 Chemical 5 1 | Avobenzone, octocrylene, oxybenzone, tocopheryl acetate, panthenol | Fragrance | $1.27 |
| Banana Boat Ultra Defense MAX Sunscreen Spray | 100 Chemical 5 1 | Avobenzone, octocrylene, oxybenzone, tocopheryl acetate, panthenol | Fragrance | $1.42 |
| Coppertone Sport Sunscreen Lotion | 100 Chemical 5 1 | Avobenzone, octocrylene, oxybenzone, benzyl alcohol, triethanolamine | Fragrance, methylisothiazolinone | $2.84 |
| CVS Health Ultra Sheer Sunscreen Lotion | 100 Chemical 4 2 | Avobenzone, oxybenzone, ethylhexyglycerin, triethanolamine | Fragrance, methylisothiazolinone | $2.68 |
| CVS Health Sunscreen Lotion | 100 Chemical 5 2 | Avobenzone, octocrylene, oxybenzone, benzyl alcohol | Fragrance, methylisothiazolinone | $2.17 |
| Neutrogena Ultra Sheer Dry Touch Lotion | 100 Chemical 5 2 | Avobenzone, octocrylene, oxybenzone, ethylhexyglycerin, triethanolamine | Fragrance, methylisothiazolinone | $2.99 |
| Neutrogena Age Shield Oil-Free Lotion | 100 Chemical 5 2 | Avobenzone, octocrylene, oxybenzone, ethylhexyglycerin, triethanolamine | Fragrance, methylisothiazolinone | $2.21 |
However, hundreds of smaller sunscreen brands are available that were not accounted for in our analysis. Furthermore, product ingredients change as sunscreen formulas evolve, and the study does not account for these changes. Additionally, the assignment of allergens does not account for rare and emerging allergens or gradual changes in allergen prevalence.

Conclusion

Physicians can use these data to be informed about the sunscreens they are recommending to patients. Ideally, physicians can use this analysis to identify several good sunscreen options and weigh the various benefits and downsides of each with patients according to individualized preferences.

In addition to sunscreen use, physicians should also counsel patients about the proper use of sunscreen techniques, sun avoidance techniques, and alternative sun-protection methods, including but not limited to sun-protective clothing, frequent reaplication of sunscreens, and avoiding prolonged sun exposure. Sunscreen use is critically important for patients with autoimmune skin conditions, and finding a sunscreen that provides adequate protection while not exacerbating symptoms through an allergic contact reaction is a priority.

References

American Academy of Dermatology. Sunscreen FAQs. Ringworm [Internet]. [cited 2018 August 9]. Available from: https://www.aad.org/media/stats/prevention-and-care/sunscreen-faqs, 2018

American Contact Dermatitis Society. Core allergen series: History of allergen of the year [Internet]. [cited 2018 August 21]. Available from: https://www.contactderm.org/4a/pages/index.cfm?pageid=3520, 2018

Barnett JH. Disoid lupus erythematosus exacerbated by contact dermatitis. Cutis 1990;46(5):430–2.

Chu CY, Sun CC. Allergic contact dermatitis from triethanolamine in a sunscreen. Contact Dermatitis 2001;44(1):41–2.

Clemmenson A, Thormann J, Andersen K. Allergic contact dermatitis from retinyl palmitate in polycaprolactone. Contact Dermatitis 2007;56(5):288–9.

Clerens I, Goossens A. Allergic contact dermatitis caused by panthenol: A rare but relevant sensitizer. Contact Dermatitis 2017;76(2):122–3.

DeKoven J, Warshaw E, Zig K, Maibach HJ, Beliso DV, Sasseville D, et al. North American Contact Dermatitis Group patch test results 2015–2016. Dermatitis 2018;29(6):297–309.

Environmental Working Group. Retinyl palmitate (vitamin A palmitate) [Internet]. [cited 2018 August 21]. Available from: https://www.ewg.org/skindexdeep/ingredient/705545/retinyl_palmitate_ (vitamin_a_palmitate)\#W3t120bbMzq0, 2018.

Fulton A. Many common sunscreens may harm coral. Here’s what to use instead [Internet]. [cited 2018 August 9]. Available from: https://www.npr.org/sections/health-shots/2018/07/02/624379378/many-common-sunscreens-may-harm-coral-heres-what-to-use-instead, 2018.

Günther E, Kalkan G, Meral E, Baykal M. The triggering role of allergic contact dermatitis in disoid lupus erythematosus. Cutan Ocul Toxicol 2013;32(3):194–9.

Herzinger T, Plewig G, Röcken M. Use of sunscreens to protect against ultraviolet-induced lupus erythematosus. Arthritis Rheum 2004;50(9):3045–6.

Heurung A, Raju S, Warshaw E, Benzophenones. Dermatitis 2018;29(5):3–10.

Heurung A, Raju S, Warshaw E. Adverse reactions to sunscreen agents: Epidemiology, responsible irritants and allergens, clinical characteristics, and management. Dermatitis 2014;25(6):289–326.

Hill G, Goldenberg A, Colker J, Beck K, Williams J, Jacob SE. Pre-emptive avoidance strategy (PÆAS): Addressing allergic contact dermatitis in pediatric populations. Expert Rev Clin Immunol 2016;12(5):551–61.

Kuhn A, Genisch K, Haust M, Meuth AM, Boyer F, Dupuy P, et al. Photoprotective effects of a broad-spectrum sunscreen in UV-induced cutaneous lupus erythematosus: A randomized, vehicle-controlled, double-blind study. J Am Acad Dermatol 2011;64(1):37–48.

Ou-Yang H, Stanfield J, Cole J, 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):1220–7.

Russak JE, Chen T, Appa Y, Rigel DS. A comparison of sunscreen protection of high- and low-protection factor (SPF) sunscreens: SPF 50 sunscreen is significantly more protective than SPF 50. J Am Acad Dermatol 2010;62(2):348–52.

Shaw T, Simpson B, Wilson B. True photorelief to sunscreens is rare despite popular belief. Dermatitis 2010;21(4):185–98.

Shimaoka Y, Hatamoto A, Hamasaki Y, Suzuki H, Ikeda H, Yamazaki S. Disoid lupus erythematosus exacerbated by contact dermatitis caused by use of squalic acid dibutylerster for topical immunotherapy in a patient with alopecia areata. J Dermatol 2008;35(3):151–3.

Stege H, Budde MA, Grether-Beck S, Krutmann J. Evaluation of the capacity of sunscreens to photoprotect lupus erythematosus patients by employing the photoprovocation test. Photodermatol Photoinmunol Photomed 2000;16(6):256–9.

Trindade MA, Alchorne AO, Da Costa EB, Enokihara MM. Eyedilicoid Disoid lupus erythematosus and contact dermatitis: A case report. J Eur Acad Dermatol Venereol 2009;23(5):577–9.

U.S. Food and Drug Administration, Center for Drug Evaluation and Research. Guidelines (Drugs) - Labeling and effectiveness testing: Sunscreen drug products for over-the-counter human use - Small entity compliance guide [Internet]. [cited 2018 August 9]. Available from: https://www.fda.gov/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/ucm130694.htm, 2018.

U.S. Food and Drug Administration, Center for Drug Evaluation and Research. Understanding over-the-counter medicines - Sunscreen: How to help protect your skin from the sun [Internet]. [cited 2018 August 9]. Available from: https://www.fda.gov/drugs/ResourcesForYou/Consumers/BuyingUsingDrugsafety/understandingover-the-countermedicines/ucm239463.htm, 2018.

van Aerde E, Kerre S, Goossens A. Disoid lupus triggered by allergic contact dermatitis caused by a hair dye. Contact Dermatitis 2016;74(1):61–4.

Williams JD, Maitra P, Attilasso E, Wu MM, Farberg AS, Rigel DS. SPF 100 sunscreen is more protective against sunburn than SPF 50 in actual use: Results of a randomized, double-blind, split-face, natural sunlight exposure clinical trial. J Am Acad Dermatol 2018;78(5):902–910.e2.