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Original Research

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

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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 recommendation 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.

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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; Herzinger 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-

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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.⁴ 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 $\geq 98\%$ 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 rigor-

ous 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 reapplication 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; Shimaoka 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

Table 1
Allergens

Allergen	Allergenicity index classification
Preservatives:	
Methylchloroisothiazolinone	H
Methylisothiazolinone	H
Iodopropynyl butylcarbamate	H
Parabens	L
Phenoxyethanol	L
Benzoic acid (/sodium benzoate)	L
Formaldehyde-releasing biocides	
Quaternium-15	H
Diazolidinyl urea	H
DMDM hydantoin	H
Bronopol	H
Imidazolidinyl urea	H
Botanicals	
Compositae (Asteraceae) mix	H
D-limonene	L
A-bisabolol	L
A-glucosones	L
Botanical extracts	L
<i>A. vera</i> , <i>A. mellifera</i> , <i>C. officinalis</i> , <i>H. annuus</i> , <i>L. angustifolia</i> , <i>M. chamomilla</i> , <i>M. alternifolia</i> , jojoba	
A-tocopherol acetate	L
Fragrance	
Fragrances	H
Myroxylon pereirae	H
Benzyl alcohol	L
Surfactants/vehicles/humectants	
Lanolin	H
Cocamidopropyl betaine	H
Propylene glycol	H
Decyl glucoside	H
Lauryl glucoside	H
Coco-glucoside	L
Ethylhexylglycerin	L
Sorbitan sesquioleate + derivatives	L
Triethanolamine	L
Panthenol	L
Sunscreens	
Padimate O	L
Benzophenone-3/oxybenzone	L
Avobenzone	L
Octocrylene	L

relevant and applicable as possible. The purpose of this selection method was to obtain a thorough and robust sample of the most popular and widely available sunscreens in the entire United States. Of those 74 products, 22 were eliminated for not meeting our effectiveness criteria of >SPF-50, broad spectrum, and water resistant. The 52 remaining sunscreens that met the inclusion criteria were analyzed further, gathering data about cost and allergen profile.

The allergen list (Table 1) was compiled with the expert opinion of Dr. Bruce Brod, MD, a specialist in contact dermatitis and allergic skin reactions, and based on North American Contact Dermatitis Group (NACDG) core data. The allergens were further classified into low prevalence (L) and high prevalence (H). High-prevalence allergens are those that have a prevalence of >1% per the recent NACDG data (2015–2016) and have at least one definite relevant reaction per the NACDG data. Allergens associated with allergic contact dermatitis based on the available literature but not on the NACDG list were included and classified as low-prevalence allergens.

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 ThinkSport™, Babyganics™, Australian Gold™, the Banana Boat Simply Protect™ line, and the CVS Clear Zinc™ line (Table 2). In the SPF-100 category, notable brands are the Banana Boat Kids™ line and Banana Boat Sport™ 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 avobenzone (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. Allergenic ingredients are particularly harmful to patients with autoimmune skin conditions because these patients can be more sensitive to allergenic 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 avobenzone, 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
Babyganics Mineral-Based Baby Sunscreen Spray	50	Physical and chemical	2	0	<i>Helianthus annuus</i> (sunflower) seed oil, jojoba	None	\$1.63
Banana Boat Simply Protect Sport Sunscreen Spray	50	Chemical	2	0	Avobenzene, octocrylene	None	\$1.05
Australian Gold Botanical tinted face Sunscreen Mineral Lotion	50	Physical	3	0	Phenoxyethanol, tocopheryl acetate, panthenol	None	\$4.33
Babyganics Pure Mineral Sunscreen Stick	50	Physical and chemical	3	0	<i>Helianthus annuus</i> (sunflower) seed wax and oil, ethylhexylglycerin, jojoba	None	\$14.87
Babyganics Mineral Based Baby Sunscreen Lotion	50	Physical	3	0	<i>Helianthus annuus</i> (sunflower) seed oil, ethylhexylglycerin, phenoxyethanol	None	\$1.67
Banana Boat Simply Protect Kids Spray	50	Chemical	3	0	Avobenzene, octocrylene, phenoxyethanol	None	\$1.05
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 (<i>Apis mellifera</i>), phenoxyethanol	None	\$5.59
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 butylcarbamate	\$6.27
La Roche-Posay Anthelios Mineral Face Sunscreen Lotion	50	Physical	1	1	Phenoxyethanol	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	70	Chemical	3	1	Avobenzene, octocrylene, oxybenzone	Fragrance	\$17
Banana Boat Sport Sunscreen Spray	50	Chemical	4	1	Avobenzene, octocrylene, tocopheryl acetate, panthenol	Fragrance	\$0.98
Sun Bum Face Sunscreen Lotion	50	Chemical	4	1	Avobenzene, octocrylene, tocopherol acetate, ethylhexylglycerin	Methylisothiazolinone	\$4.33
Sun Bum Original Sunscreen Spray	50	Chemical	4	1	Avobenzene, octocrylene, oxybenzone, tocopheryl acetate	Fragrance	\$2.67
Biore Sarasara UV Aqua Rich Sunscreen Lotion	50	Chemical	4	1	Avobenzene, octocrylene, oxybenzone, phenoxyethanol	Fragrance (perfume)*	\$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 Phenoxyethanol, triethanolamine	Propylene glycol	\$7.20
Alba Botanica Hawaiian Coconut Sunscreen Spray	50	Chemical	5	1	Avobenzene, octocrylene, <i>Chamomilla recutita</i> (Matricaria) flower extract, sodium benzoate, tocopheryl acetate	Fragrance (vanilla, coumarin)*	\$1.87
Neutrogena Cool-Dry Sport Sunscreen Spray	50	Chemical	5	1	Avobenzene, octocrylene, oxybenzone, ethylhexylglycerin, tocopheryl acetate	Fragrance	\$2.56
Neutrogena Hydro Boost Sunscreen Lotion	50	Chemical	5	1	Avobenzene, octocrylene, oxybenzone, tocopheryl acetate, phenoxyethanol	Fragrance	\$4.16
Neutrogena Beach Defense Sunscreen Lotion	70	Chemical	5	1	Avobenzene, octocrylene, oxybenzone, benzyl alcohol, ethylhexylglycerin	Fragrance	\$0.97
CVS Health Sunscreen Lotion	50	Chemical	6	1	Avobenzene, octocrylene, oxybenzone, benzyl alcohol, parabens, triethanolamine	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, oxybenzone, ethylhexylglycerin, tocopheryl acetate	Fragrance, methylisothiazolinone	\$2.50

(continued on next page)

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	Avobenzene, octocrylene, oxybenzone, benzyl alcohol, ethylhexylglycerin, phenoxyethanol	Fragrance, propylene glycol	\$2.60
Aveeno Protect + Hydrate Face Sunscreen Lotion	50	Chemical	6	2	Avobenzene, octocrylene, oxybenzone, benzyl alcohol, ethylhexylglycerin, phenoxyethanol	Fragrance, propylene glycol	\$2.59
Aveeno Protect + Hydrate Sunscreen Lotion	70	Chemical	6	2	Avobenzene, octocrylene, oxybenzone, benzyl alcohol, phenoxyethanol, ethylhexylglycerin	Fragrance, propylene glycol	\$2.83

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

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 was overreported, and reactions to benzophenone-3 were infrequently validated by photo patch testing (Shaw et al., 2010). We speculate that the incidence of 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 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	Avobenzene, octocrylene, oxybenzone, tocopheryl acetate, benzyl alcohol, parabens	None	\$2.12
Banana Boat Sport Performance Lotion	100	Chemical	6	0	Avobenzene, octocrylene, oxybenzone, tocopheryl acetate, benzyl alcohol, parabens	None	\$2.73
Coppertone Sport Kids Sunscreen Continuous Spray	100	Chemical	3	1	Avobenzene, octocrylene, oxybenzone	Fragrance	\$1.32
Coppertone Sport Continuous Spray	100	Chemical	3	1	Avobenzene, octocrylene, oxybenzone	Fragrance	\$3.36
Panama Jack Continuous Sunscreen Spray	100	Chemical	3	1	Avobenzene, octocrylene, oxybenzone	Fragrance	\$2.54
CVS Sport Clear Sunscreen Spray	100	Chemical	3	1	Avobenzene, octocrylene, oxybenzone	Fragrance	\$1.58
Neutrogena UltraSheer Sunscreen Spray	100	Chemical	4	1	Avobenzene, octocrylene, oxybenzone, tocopheryl acetate	Fragrance	\$1.80
Banana Boat Sport Performance Spray	100	Chemical	5	1	Avobenzene, octocrylene, oxybenzone, Tocopheryl acetate, panthenol	Fragrance	\$1.27
Banana Boat Ultra Defense MAX Sunscreen Spray	100	Chemical	5	1	Avobenzene, octocrylene, oxybenzone, tocopheryl acetate, panthenol	Fragrance	\$1.42
Coppertone Sport Sunscreen Lotion	100	Chemical	5	1	Avobenzene, octocrylene, oxybenzone, benzyl alcohol, triethanolamine	Fragrance	\$2.84
CVS Health Ultra Sheer Sunscreen Lotion	100	Chemical	4	2	Avobenzene, oxybenzone, ethylhexylglycerin, triethanolamine	Fragrance, methylisothiazolinone	\$2.68
CVS Health Sunscreen Lotion	100	Chemical	5	2	Avobenzene, octocrylene, oxybenzone, benzyl alcohol	Fragrance, propylene glycol	\$1.71
Neutrogena Ultra Sheer Dry Touch Lotion	100	Chemical	5	2	Avobenzene, octocrylene, oxybenzone, ethylhexylglycerin, triethanolamine	Fragrance, methylisothiazolinone	\$2.99
Neutrogena Age Shield Oil-Free Lotion	100	Chemical	5	2	Avobenzene, octocrylene, oxybenzone, ethylhexylglycerin, 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 reapplication 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.

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