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Stunning Results From Sunscreen Testing

Analysis by Dr. Joseph Mercola ✔ Fact Checked | July 26, 2023

STORY AT-A-GLANCE

- Many sunscreens are far less effective than claimed on the label and 24 of the 73 products evaluated offered less than half of the protection promised by their stated SPF
- SPF applies to UVB rays only, and not UVA, which are actually responsible for most of the UV damage. To protect against UVA, you need to look for a broad-spectrum product that specifies protecting against UVA
- Ninety-six percent of the U.S. population has oxybenzone in their bodies — a known endocrine disruptor linked to reduced sperm count in men and endometriosis in women. The main source is sunscreens
- Researchers also warn that some sunscreen ingredients are neurotoxic, posing a hazard to brain health and development
- Aside from the problem of toxicity, excessive use of sunscreen also contributes to vitamin D deficiency, which in turn increases your risk for a wide array of chronic diseases, including diabetes, heart disease, osteoporosis and cancer

Editor's Note: This article is a reprint. It was originally published May 30, 2018.

While regular, consistent, sensible sun exposure is vital for optimal health and well-being — having many benefits beyond vitamin D production — overexposure can result in skin damage that could raise your risk of skin cancer.

This means if you're spending the day at the beach or engaging in outdoor activities for hours at a stretch, you likely need to bring some form of sun protection. While clothing

is an ideal choice, most people opt for sunscreen, which can have a number of adverse ramifications.

Not only do many sunscreens contain toxic ingredients, many are also only half as effective as claimed. Consumer Reports recently issued its 2018 Sunscreen Buying Guide,[1] which notes that testing reveals more than 70 sunscreen products do not provide the level of UVB protection stated on the label. As a result, you may end up getting sunburned anyway. The report also found that only a dozen or so products offered decent protection against both UVA and UVB rays.

Can You Trust the Sun Protection Factor?

Sun protection factor (SPF) is a measure of how long the product will prevent your skin from burning when exposed to UVB rays. "For example, assuming you apply — and reapply — the sunscreen correctly, if you'd normally burn after 20 minutes in the sun, an SPF 30 protects for about 10 hours," Consumer Reports explains. However, it's important to realize that the SPF applies to UVB rays only, and not UVA, which are actually responsible for most of the UV damage.

To protect against UVA, you need to look for a broad-spectrum product that specifies protecting against UVA. Unless specified, it's safe to assume it does not protect against UVA. It's also important to realize that no sunscreen is capable of blocking 100% of UVB or UVA. As a general guideline:

- SPF 30 blocks 97% of UVB
- SPF 50 blocks 98% of UVB
- SPF 100 blocks 99% of UVB

As in previous years, recent testing again reveals many products overstate their SPF. In this round of testing, 24 of the 73 products evaluated[2] offered less than half of the protection promised by their stated SPF. What this means is if a product is labeled SPF 30, it may only offer SPF 15 protection or less, which could lead to overexposure and burning. This finding echoes the results of other investigators as well. For example:

- A JAMA Dermatology study published last year found nearly half of the top-rated sunscreen products tested failed to meet the standards set by the American Academy of Dermatology[3]
- An analysis by Consumer Reports earlier this year found many sunscreens tested failed to meet SPF standards; 40% worked at less than half the SPF indicated on the label[4]

Oxybenzone — Just One of Several Toxic Sunscreen Ingredients

Research by the Centers for Disease Control and Prevention shows 96% of the U.S. population has oxybenzone in their bodies — a known endocrine disruptor linked to reduced sperm count[5] in men and endometriosis[6] in women.

The main source of this chemical? Sunscreens. Oxybenzone is also lethal to certain sea creatures, including horseshoe crab eggs, and researchers warn the widespread use of oxybenzone-containing sunscreens pose a serious threat to coral reefs and sea life.[7]

In fact, Hawaiian lawmakers recently approved a ban on the sale of sunscreens containing oxybenzone and oxtinoxate, both of which have been linked to severe coral damage. Estimates suggest sunscreen-wearing beachgoers introduce as much as 6,000 metric tons of sunscreen into the world's oceans each year.[8] As reported by Hawaii News Now:[9]

> *"At a science class at Kaimuki Middle School, students learn to make homemade sunscreen. It includes bees wax, shea butter, a mix of oils and non nano zinc oxide for sun protection. 'I think it's really cool because I know it doesn't have oxybenzone so when I use it. I won't think it hurt the coral reefs,' said Lochlan Ajimine, a 6th grade student in Nicole Ross' science class.*
>
> *The husband and wife founders of organic sunscreen maker, Little Hands Hawaii, have been teaching their techniques and advocating for a ban on the sale of sunscreen with oxybenzone and octinoxate, two common chemicals which some studies show harm coral reefs.*

'I think it's both very important for our bodies and for the environment and also for the keiki. They are so little and they need good stuff going on to them,' said Rosalyn Ardoin, co-founder of Little Hands Hawaii."

Other Harmful Sunscreen Ingredients

Disturbingly, at least nine of the sunscreen ingredients approved by the U.S. Food and Drug Administration (FDA) are known to disrupt human endocrine function.[10] Aside from oxybenzone — which is found in 70% of sunscreens — other commonly used chemicals that can enter your bloodstream and can cause toxic side effects, including hormone disruption, include but are not limited to:[11,12]

Octyl methoxycinnamate (OMC)	Para-aminobenzoic acid (PABA)
Octyl salicylate	Phenylbenzimidazole
Octocrylene	Octisalate
Dioxybenzone	Menthyl anthranilate
Homosalate	Octinoxate
Cinoxate	Parabens

Unfortunately, the health risks of these chemicals are typically ignored entirely, and many still recommend[13] looking for products containing these toxic ingredients. Many sunscreens also contain vitamin A and/or its derivatives, retinol and retinyl palmitate, which have been linked to an increased risk of skin cancer by increasing the speed at which malignant cells develop and spread.

Researchers Warn of Neurotoxicity

Research published last year also warns that some sunscreen ingredients are neurotoxic, posing a hazard to brain health. The authors noted that since sunscreens need to be applied in significant amounts all over the body, calculations suggest the total amount of a given compound being absorbed from a single application could be as high as 200 milligrams.

Studies also show these chemicals are found in blood, urine and breast milk following application, in some cases within as little as two hours.

Here, the scientists reviewed the neurotoxicity of octyl methoxycinnamate, benzophenone-3 and −4, 4-methylbenzylidene camphor, 3-benzylidene camphor and octocrylene — chemical sunscreens that scatter and reflect UV rays — as well as zinc oxide and titanium dioxide, which prevent burning by acting as physical filters. These minerals have a minimal absorption rate (unless nanosized particles are used), which adds to their safety profile. According to the authors:

> *"[W]hile sunscreens have been effective in protecting against a variety of UV-related pathologies … growing popularity and thus, possibility for exposure questions their safety in environment and human health …*
>
> *The endocrine disruptive and developmental toxicity of many organic UV filters in experimental models is well established; these filters seem to be associated with altered estrogen, androgen and progesterone activity, reproductive and developmental toxicity and impaired functioning of the thyroid, liver or kidneys …*
>
> *Since many of UV filters were shown to cross the blood-brain barrier, the risk for neurotoxicity also occurs … [S]ince it is known that other chemicals classified as endocrine disruptors can impair neuronal transmission, synaptic plasticity and produce neurotoxic effects, chemical filters might potentially produce similar effect."*

Indeed, studies included in the review show a number of neurotoxic effects. For example, octyl methoxycinnamate has been found to decrease motor activity in female

rats and alter the release of a number of different neurotransmitters. Benzophenone-3 has been found to decrease cell viability of neurons, and upregulate estrogenic-related genes in male animals.

The chemical 4-methylbenzylidene camphor also decreased cell viability, and impaired neuronal development in lab animals, while octocrylene impaired expression of genes related to brain development and brain metabolism. The authors also stress that simultaneous application of insect repellents such as DEET enhances the penetration of the compounds, thereby multiplying their potential toxicity.

The Problem With Nanoparticles

Then there's the issue of nanoparticles.[14] Despite their general safety, when zinc oxide and titanium dioxide are nanosized, such as in spray-on sunscreens,[15] they too can pose a significant health hazard by irritating lung tissues.[16] Animal research has shown that inhaled nanoparticles can reach all areas of your respiratory tract and, since your lungs have difficulty clearing small particles, they may end up passing into your bloodstream and crossing your blood-brain barrier.

If allowed to enter your lungs or penetrate your skin, nanoparticles therefore have the potential to cause widespread damage to your cells and organs, immune system, nervous system, heart and brain.[17] The International Agency for Research on Cancer has even classified ultrafine titanium dioxide particles as a "possible carcinogen" when inhaled in high doses, noting that:[18]

> *"Titanium dioxide causes varying degrees of inflammation and associated pulmonary effects including lung epithelial cell injury, cholesterol granulomas and fibrosis. Rodents experience stronger pulmonary effects after exposure to ultrafine titanium dioxide particles compared with fine particles on a mass basis."*

Concerns about nanoparticles have also prompted the FDA to issue a warning to parents, urging them to avoid spray-on sunscreens.[19] Some scientists postulate the toxic

effects of nanoparticles relate to their size being in the range of a virus, which may trigger your body's immune response.[20]

Sunscreens Contribute to Vitamin D Deficiency

Aside from the problem of toxicity, excessive use of sunscreen also contributes to **vitamin D deficiency**, which in turn increases your risk for a wide array of chronic diseases.

According to a clinical review[21] published in The Journal of the American Osteopathic Association last year concluded overzealous sunscreen use is one of the reasons why this deficiency has gotten so widespread. Coauthor Dr. Kim Pfotenhauer, assistant professor at Touro University, stated:[22]

> *"People are spending less time outside and, when they do go out, they're typically wearing sunscreen, which essentially nullifies the body's ability to produce vitamin D. While we want people to protect themselves against skin cancer, there are healthy, moderate levels of unprotected sun exposure that can be very helpful in boosting vitamin D …*
>
> *Science has been trying to find a one-to-one correspondence between vitamin D levels and specific diseases. Given vitamin D's ubiquitous role in the body, I believe sufficient vitamin D is more about overall health."*

According to this study, about 1 billion people worldwide have insufficient vitamin D levels for health, defined here as a vitamin D level below 30 ng/mL. African-Americans are disproportionally affected, primarily due to the fact that dark-skinned people need far more sun exposure to achieve ideal levels. The findings presented here suggest a staggering 95% of African-American adults have insufficient or deficient levels of vitamin D.

If you decide you want to avoid all sun exposure, you'll need to be extra vigilant about tracking your vitamin D level year-round and optimize your level by taking an oral vitamin D supplement, making sure you balance your vitamin D3 with your intake of **vitamin K2,**

magnesium and calcium. Just keep in mind that oral vitamin D cannot provide all of the benefits of sunlight exposure, so it's not a perfect workaround. Supplementation is better than nothing though.

How Much Unprotected Sun Exposure Do You Need?

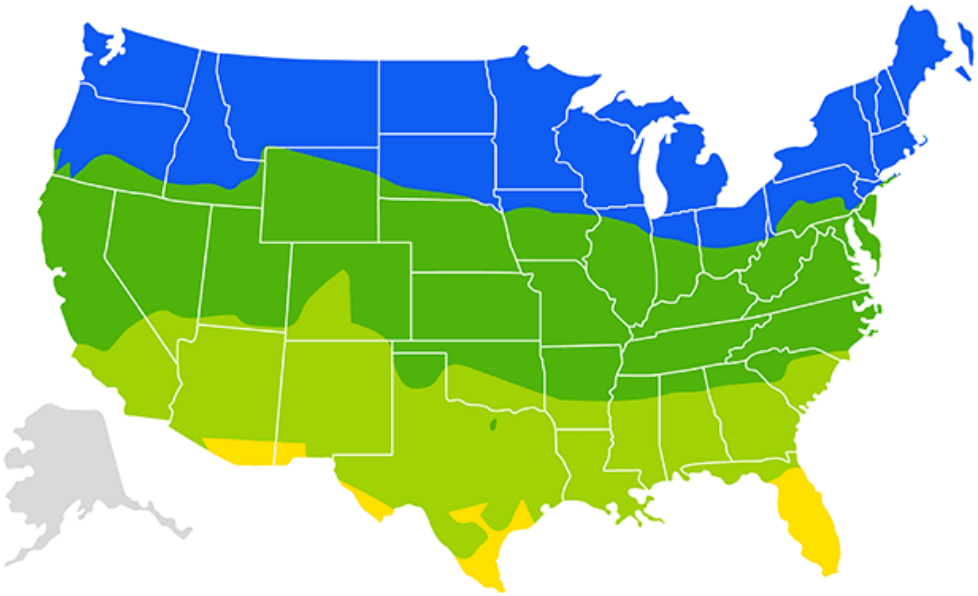
Caucasians and others with paler skin will hit an "equilibrium point" after about 20 minutes of exposure to UVB light, at which point vitamin D will no longer be produced. You can tell you've reached your optimal exposure for the day when your skin turns a very light shade of pink. After that you're only increasing your chances of getting burned, which is something you definitely want to avoid.

There appears to be no additional benefit to staying in the sun beyond this point. You only risk damage. If you have darker skin, reaching this equilibrium point can take two to six times longer (or up to an hour or two), depending on your pigmentation. Now, while those living in tropical regions have an abundance of sunshine, there are individuals who hardly have exposure, especially in most of the continental U.S.

It doesn't make much sense to expose your skin to the sun when the temperature is lower than 50 degrees F, which has a scarcity of UVB rays. This occurs a lot in most regions in the U.S., especially those who experience four seasons. The charts below display the likelihood of vitamin D synthesis across the U.S. by month. For more information about how to optimize your vitamin D from sensible sun exposure, see my vitamin D resource page.

VITAMIN D SYNTHESIS

JANUARY*



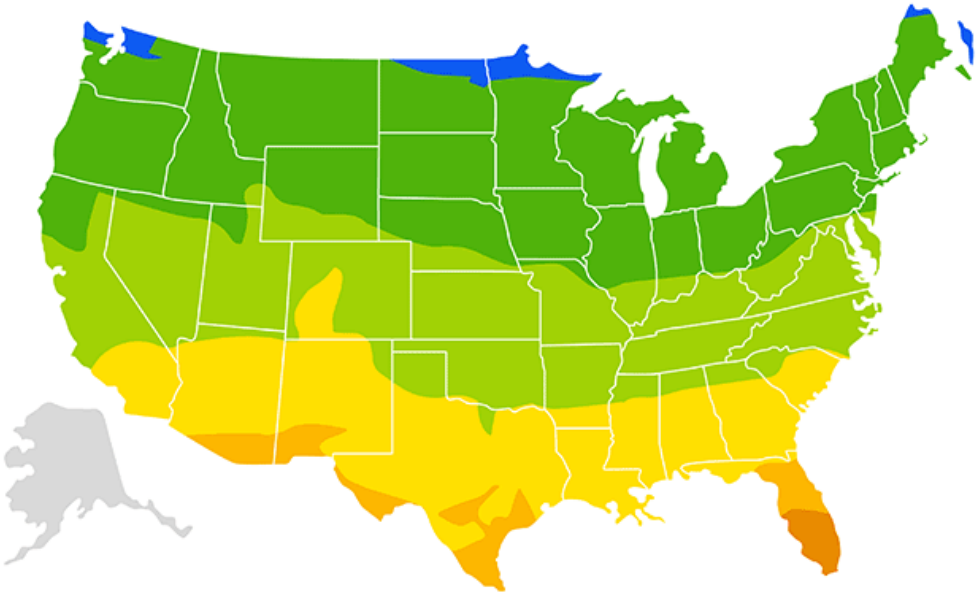
UNLIKELY — LIKELY

0 1 2 3 4 5 6 7 8 9 10 11

Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
*The figures provided are estimates and can vary depending on the person and/or climate changes.

VITAMIN D SYNTHESIS

FEBRUARY*



UNLIKELY 0 1 2 3 4 5 6 7 8 9 10 11 LIKELY

Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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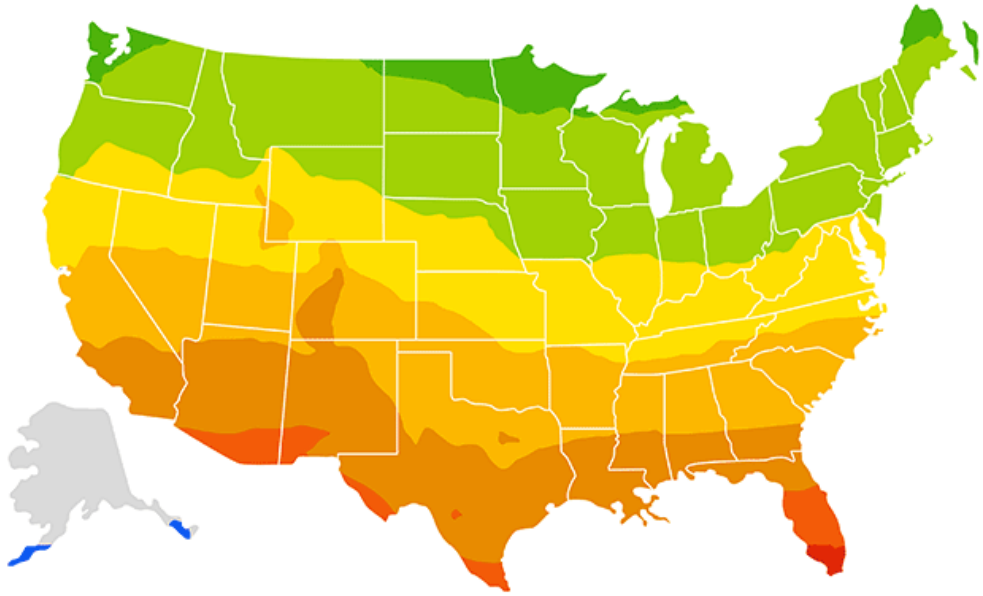
VITAMIN D SYNTHESIS

MARCH*



Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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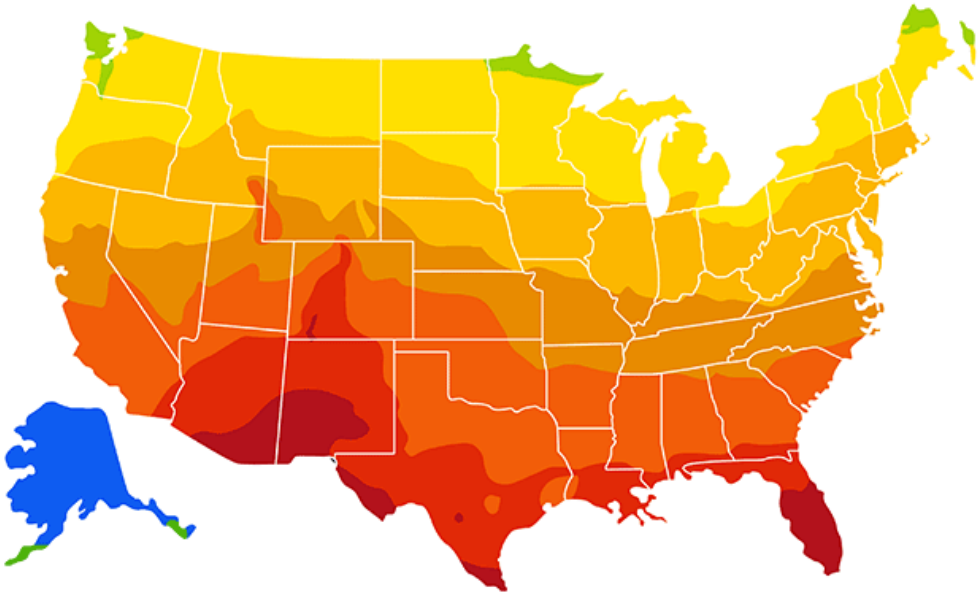
VITAMIN D SYNTHESIS

APRIL*



Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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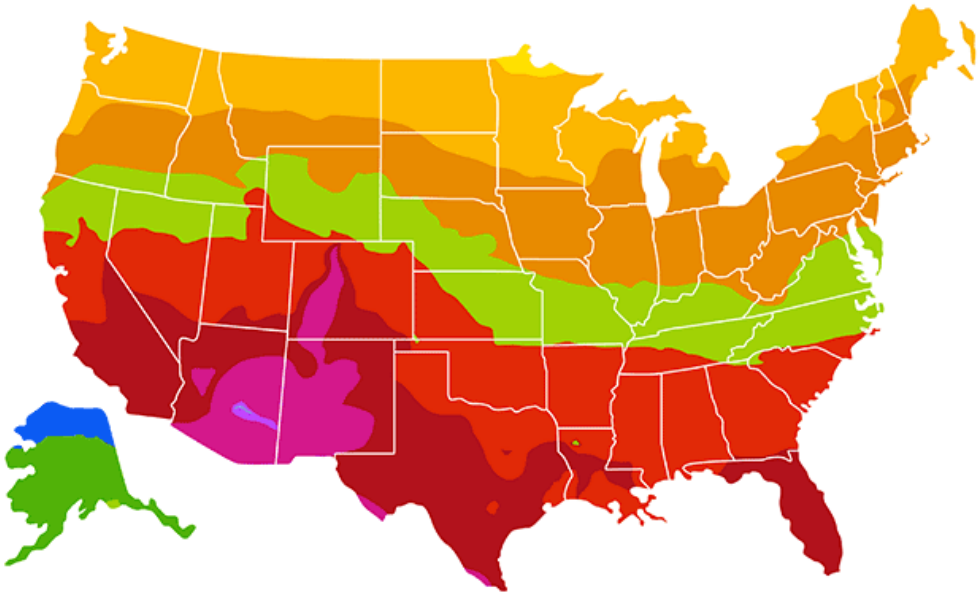
VITAMIN D SYNTHESIS

MAY*



UNLIKELY — LIKELY

0 1 2 3 4 5 6 7 8 9 10 11

Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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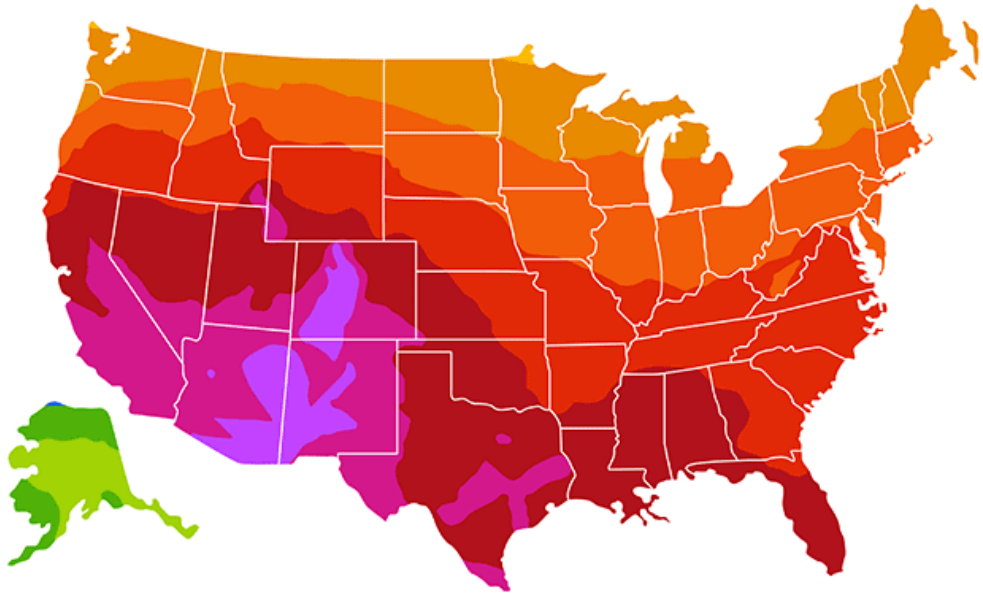
VITAMIN D SYNTHESIS

JUNE*



UNLIKELY — LIKELY

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Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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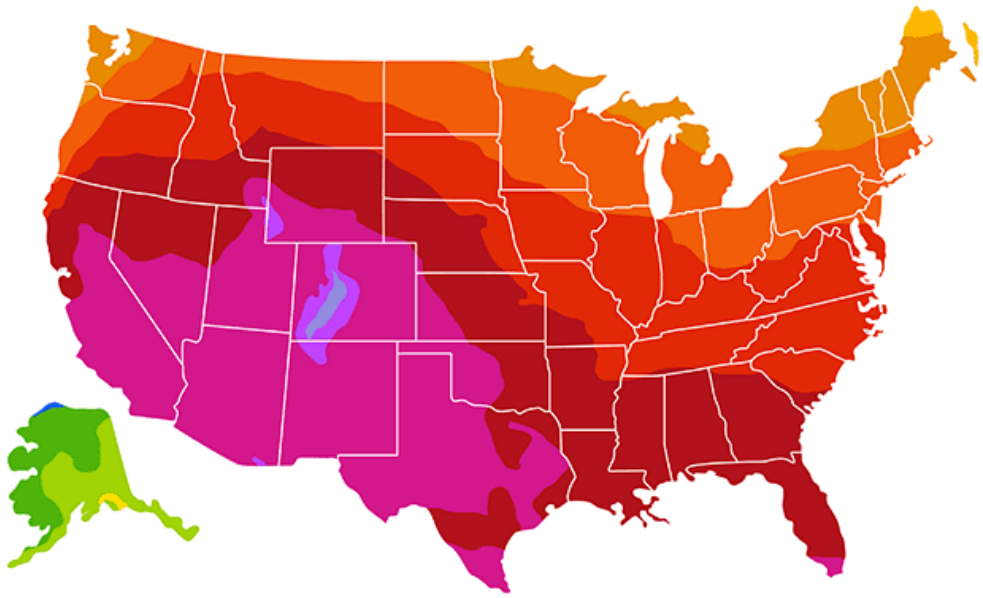
VITAMIN D SYNTHESIS

JULY*



Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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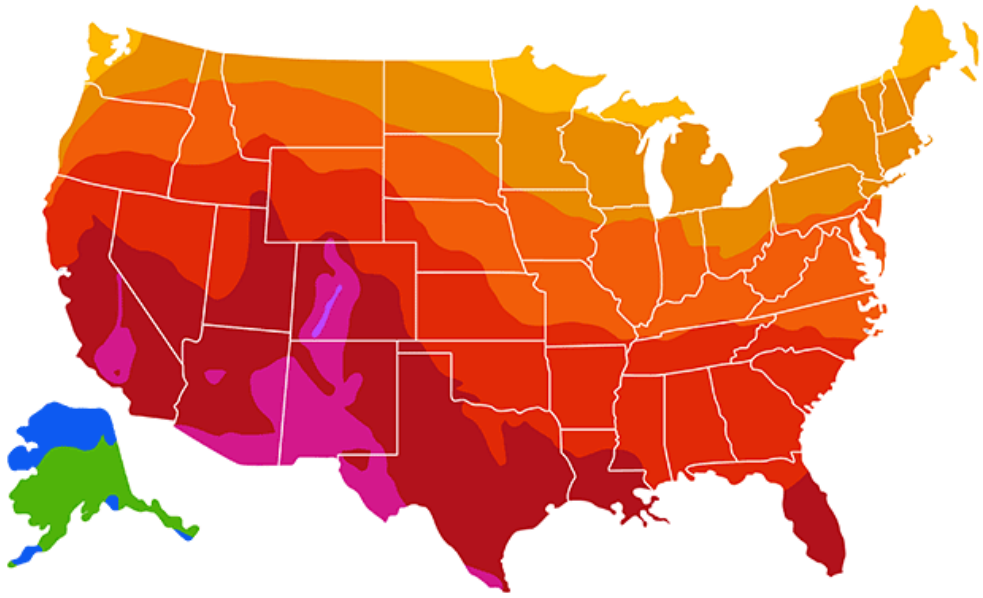
VITAMIN D SYNTHESIS

AUGUST*



UNLIKELY — LIKELY

0 1 2 3 4 5 6 7 8 9 10 11

Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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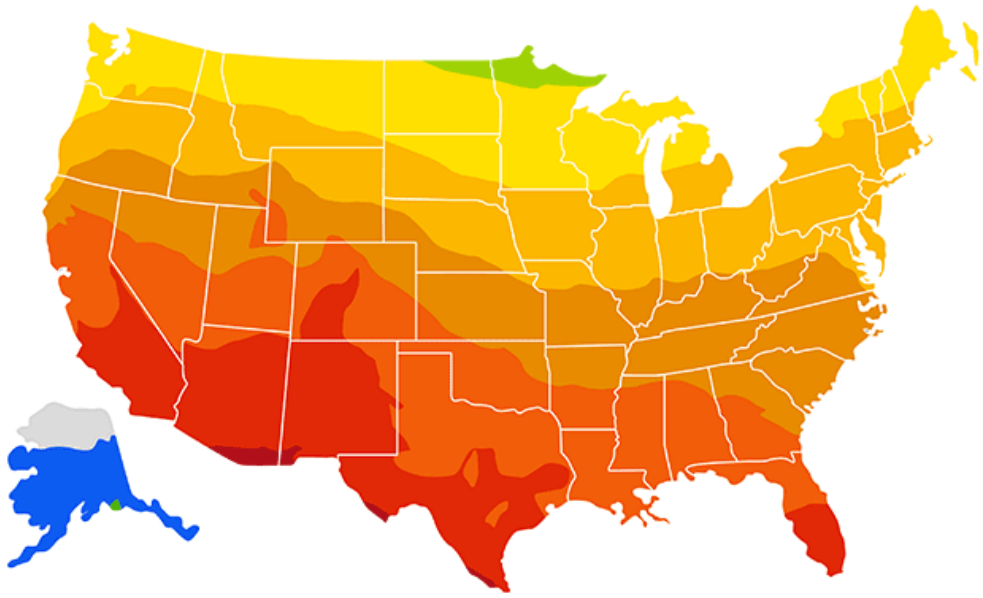
VITAMIN D SYNTHESIS

SEPTEMBER*



UNLIKELY — LIKELY

0 1 2 3 4 5 6 7 8 9 10 11

Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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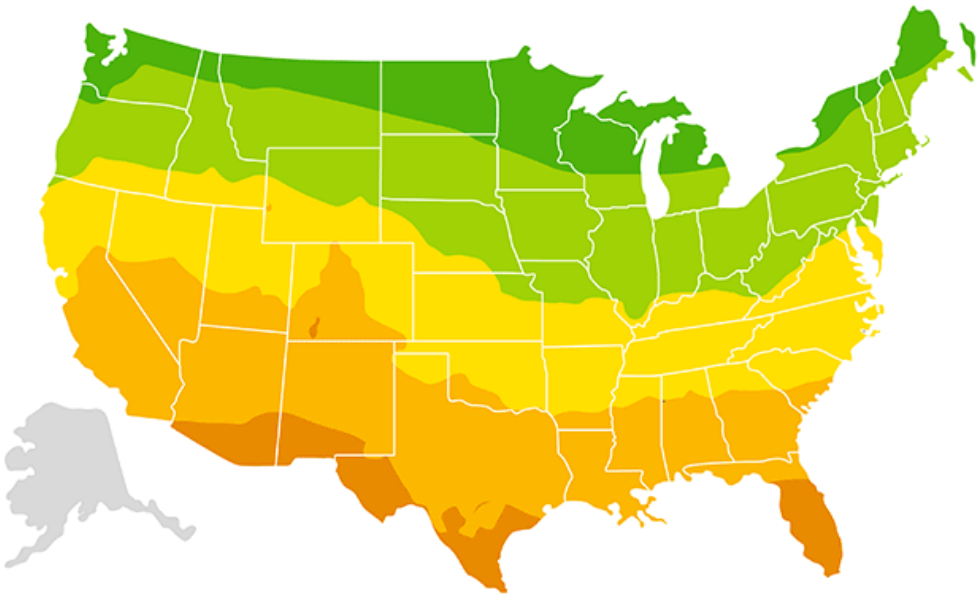
VITAMIN D SYNTHESIS

OCTOBER*



UNLIKELY 0 1 2 3 4 5 6 7 8 9 10 11 LIKELY

Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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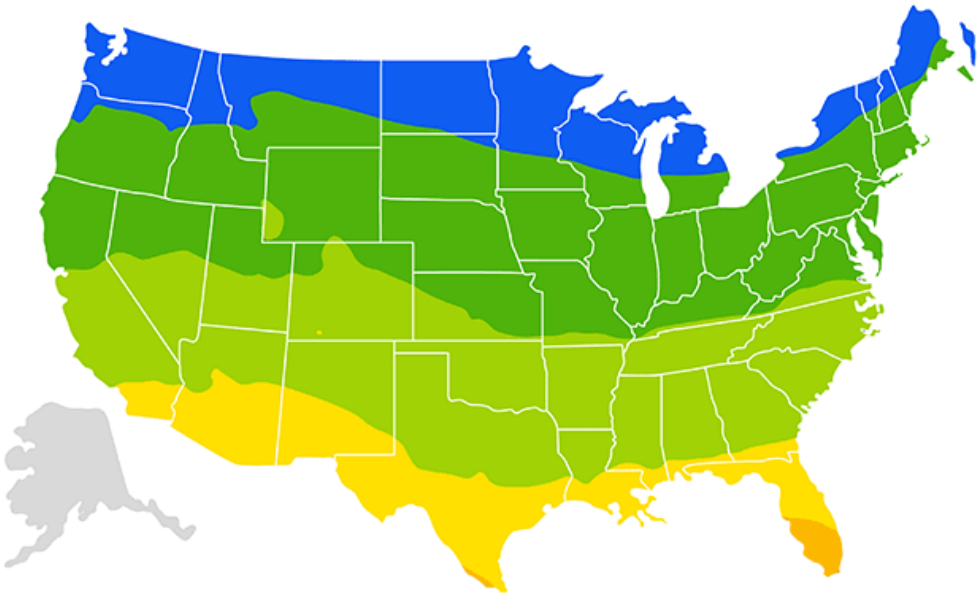
VITAMIN D SYNTHESIS

NOVEMBER*



UNLIKELY 0 1 2 3 4 5 6 7 8 9 10 11 LIKELY

Source for UV index: https://www.epa.gov/sunsafety/sun-safety-monthly-average-uv-index
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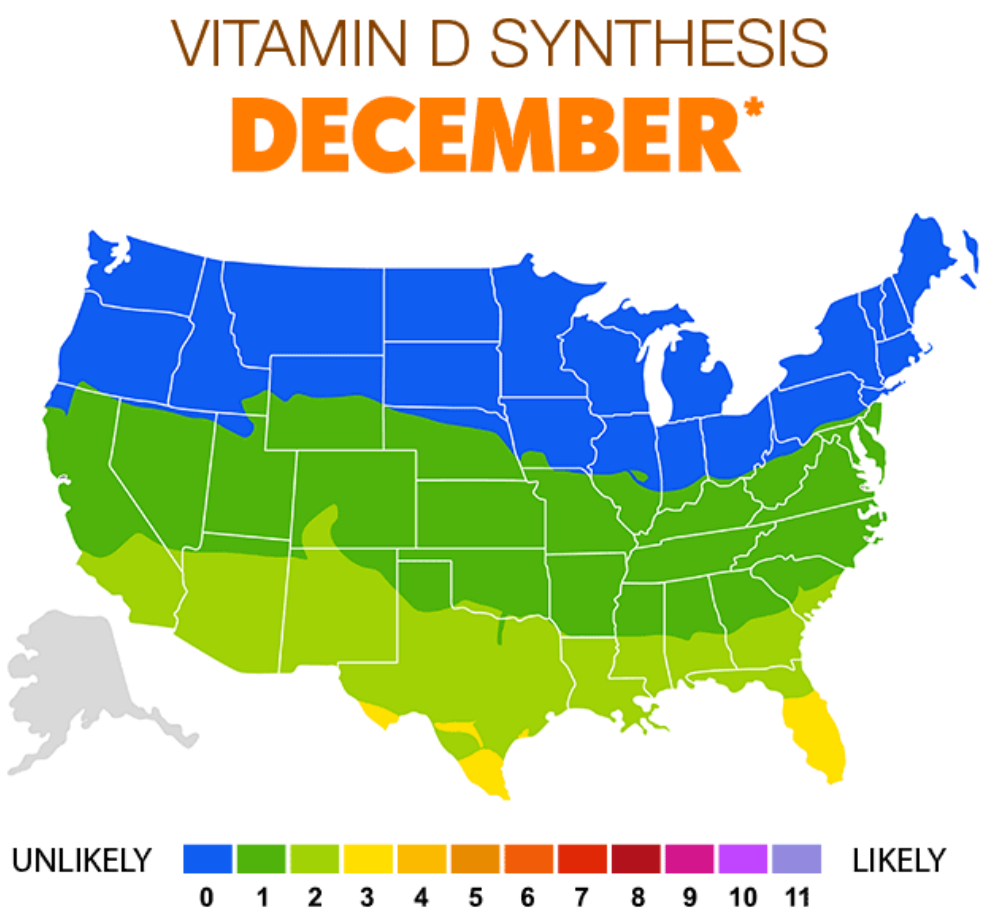

Safest Sunscreens

Getting back to sunscreen, your absolute best bet is to cover up with clothing once you've reached your ideal sun exposure time. If you absolutely want to use a sunscreen lotion or cream, your safest bet is to use topical zinc oxide or titanium dioxide product that does not contain nanosized particles. As noted by the Environmental Working Group (EWG), which also issues an annual sunscreen guide:[23]

> *"Almost three-fourths of the products we examined offer inferior sun protection or contain worrisome ingredients like oxybenzone, a hormone disruptor, or retinyl palmitate, a form of vitamin A that may harm skin. And despite scant evidence,[24] the government still allows most sunscreens to claim they help prevent skin cancer …*

> *Sunscreens using zinc oxide and titanium dioxide tend to rate well in our analysis: They are stable in sunlight, offer a good balance between protection from the two types of ultraviolet radiation — UVA and UVB — and don't often contain potentially harmful additives."*

Last year, my Mercola SPF 50 Sunscreen topped the list of EWG's top picks of highly recommended sunscreens. The EWG has not yet released its picks for this year. Other recommended products included True Natural Neutral Unscented Sunscreen SPF 50; Loving Naturals Adorable Baby Sunscreen stick SPF 30+; Blue Lizard Australian Sensitive Sunscreen SPF 30 and Burnout Ocean Tested Physical Sunscreen SPF 30.

Fourteen of the worst-scoring sunscreens for kids included several popular brands, including two Banana Boat products, seven Coppertone products, a CVS-branded sunscreen and two Neutrogena products.

Sources and References

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