YOUR LOCAL EPIDEMIOLOGIST

Here Comes The Sun(Screen)

Nuances In Effectiveness, Safety, And More.

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Introduction

Summer is here! While sunscreen may seem like an easy health decision, many people, especially younger and health-conscious ones, have doubts. Sunscreen health advice and rumors are **everywhere** on social media, and we're seeing it reflected in national surveys:

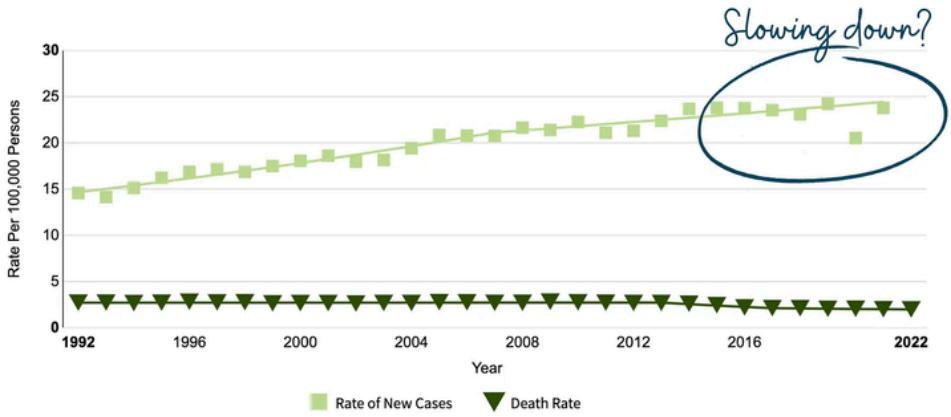
- 1 in 7 younger adults think daily sunscreen use is more harmful than direct sun.
- 1 in 4 believe drinking water prevents sunburn.

So, what's going on with sunscreen? With the help of many people, including Dr. Michelle Wong, an Australian cosmetic chemist, I went down a rabbit hole. Ultimately, it comes down to a general lack of scientific nuance in sunscreen discussions and differing risk tolerance.

Here's what we know about sunscreen, what we don't know, and what it may (or may not) mean to you.

First, skin cancer is bad.

Skin cancer is the fifth most common cancer in the U.S. While rates have steadily increased over the past few decades, recent years may suggest rates are plateauing. We don't know why, but some have attributed it to a new awareness of sun protection, including reducing tanning bed use.



New cases and deaths from melanoma of the skin over time.
Figure from National Cancer Insitute.

Is sunscreen effective against skin cancer?

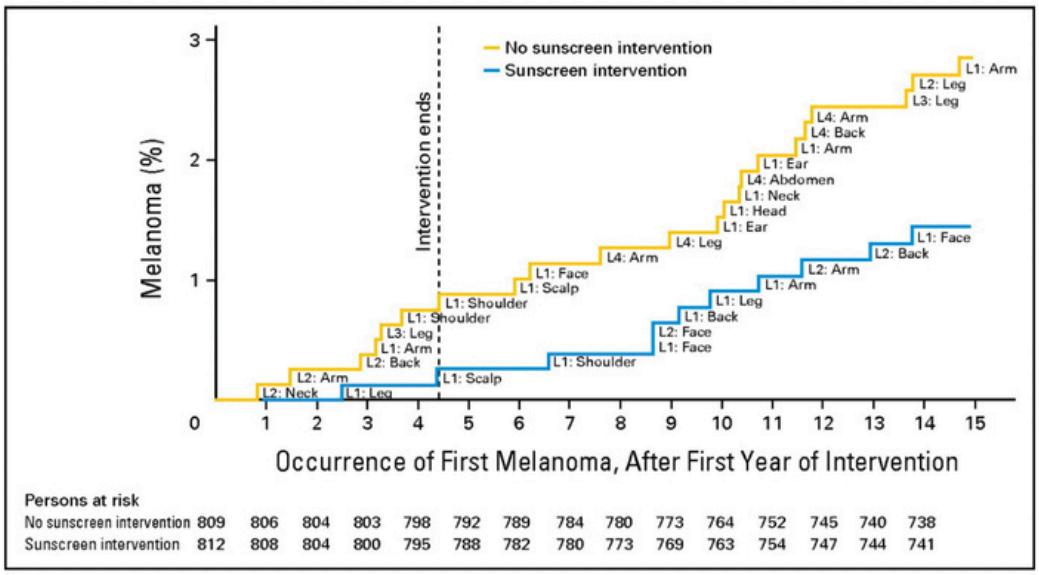
Yes. But this is hard to study.

Theoretically and at a microscopic level, sunscreen makes sense. It stops burns and prevents microscopic changes from accumulating over time that eventually cause cancer.

When we look at "real world" studies among humans, though, there is **mixed evidence** of sunscreen's effectiveness against cancer. Two recent meta-analyses that pooled all these studies found **no effect**. However, sunscreen use is notoriously hard to measure—many other things could explain the link (i.e., confounders), it takes time to see an impact on cancer, and there is variability in how people use sunscreen.

If we pull out the most rigorous studies (randomized controlled trials, or RCTs) that followed people over a long period of time, there is a consistent positive effect:

- A well-conducted RCT of adult Australians was **followed for more than 15 years** and found a 40% lower incidence (876 vs. 996 per 100,000) of cancer among participants randomized to daily sunscreen compared with participants assigned to use sunscreen on a discretionary basis.



- Some populations are at higher risk of skin cancer, mainly because the medications they take make them more susceptible. Among organ transplant recipients—some of the highest-risk people for skin cancer—studies have found sunscreen prevented cancer.

Is sunscreen effective against photoaging?

This is a clear yes. Evidence from many studies and different populations, including a large RCT, shows that sunscreen prevents signs of photoaging, including wrinkles and pigmentation.

But DIY sunscreens don't work well

The chance of you consistently getting sunscreen in your home kitchen is... not great. Scientists **estimated** the highest SPF achieved in DIY SPF is 6.

DIY sunscreens don't work for two reasons:

01 **Sunscreen developers use special grades of zinc oxide with very small particles**, which absorb more UV and can cover a larger area. These powders are also often coated to improve dispersion, while DIY recipes usually specify "uncoated" powders.

02 Even with the right ingredients and equipment, **sunscreen formulators must optimize the formula extensively** to achieve consistently high SPF—sunscreens are considered one of the hardest products to create!

What about the safety of ingredients?

Safety is always important; we must ensure benefits continue to outweigh the risks on a population level.

A lot has happened regarding sunscreen ingredients in the past few years:

- **FDA studies.** In 2019, FDA conducted safety studies on four specific ingredients. Public concern escalated after 2019 and **2020 randomized controlled** studies confirmed that common sunscreen ingredients, like oxybenzone, were found in the bloodstream. In 2021, the FDA stated two (out of 16) ingredients were safe, two were unsafe (thankfully, these aren't included in U.S. market sunscreens), and the rest had inconclusive evidence.

Considered safe	Zinc oxide and titanium dioxide
Considered unsafe	Aminobenzoic acid and trolamine salicylate
Insufficient data	Avobenzone, cinoxate, dioxybenzone, ensulizole, homosalate, meradimate, octinoxate, octisalate, octocrylene, oxybenzone, padimate O, and sulisobenzone

Summary of FDA findings in 2021 for sunscreen ingredients

- **Sunscreen contaminants caused a recall**. In 2021 and 2022, a private lab found traces of benzene—a chemical that causes cancer—in some sunscreens. Importantly, benzene was a contaminant, not a sunscreen ingredient.

- **Continued research on sunscreen ingredients**. Some independent studies have found links between chemical sunscreen ingredients and **hormone** and **reproductive** function.

Are these safety signals enough to change population-level behavior? The scientific consensus is "no" given three reasons:

01 **Most are lab or animal studies**. Petri dishes (bacteria, cells, yeast) and animal studies (rats, fish, etc.) differ from ours, so these studies must be interpreted cautiously.

02 **Dose determines the poison**. Animal studies often use very high doses, administered orally. With the right dosage and route of exposure, anything can be a poison, even water.

03 Human studies suggest correlation vs. causation. One human study, for example, linked sunscreen ingredients to hormone disrupters in children, but the link was correlational—even the authors stated that many other things could explain the relationship. Another study found more than 96% of people had oxybenzone in their urine. However, fewer than 96% of people use sunscreen, suggesting other environmental sources contribute to levels. Multiple systematic reviews of human studies have concluded there is no support for sunscreen causing infertility, differing hormone levels, body fat, kids' growth, or cancer.

In other words, just because we can measure something doesn't necessarily mean it's harmful. It does suggest that more studies should be done.

As a precaution, the EU has lowered the allowed percentages of a few ingredients, particularly homosalate and oxybenzone. “Unsafe” in the EU means there isn't a 100-fold margin of safety with daily full-body application. These regulatory changes are small shifts to improve the safety of already safe products on a population level.

What about the risks to the environment, like reefs?

In 2022, the National Academies brought together many leading environmental scientists to review the evidence on sunscreen's environmental impacts, collating it into a **400-page report**. The concentrations measured in a flawed 2016 study—initially sparking the rumor—were extreme outliers. The impacts of sunscreens pale in comparison to far more significant stressors, like warming weather.

So what do we do?

The health policy in the U.S. holds strong: Sunscreen’s known benefits outweigh the unclear risks. **Will this change over time?** It's possible, but it’s worth noting that the oldest—

chemical sunscreen ingredients have been used extensively worldwide for over 40 years without clear health risks emerging.

Population-level consensus can be different from individual-level decision-making, though. I still use sunscreen every morning and grab whatever I can for my family while rushing to the beach. Of all the risks we face every day, sunscreen is a very small one to me.

But everyone's risk tolerance is different. For those who are more hesitant, the good news is that there are options:

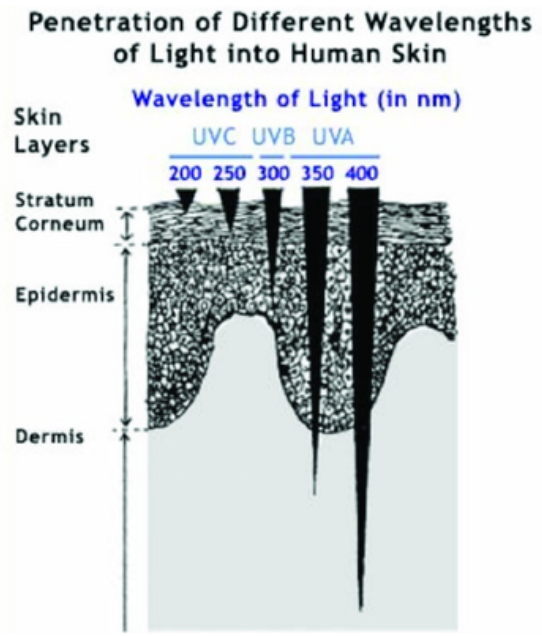
- **Concerned about effectiveness?** Whether you're using sunscreen or not, layers are the name of the game. The Covid-19 Swiss cheese model applies to sun protection.

- **Concerned about unclear risks?** Check the ingredient list—luckily, many different sunscreen formulas are available. The two ingredients FDA considers safe (zinc oxide and titanium dioxide) are in "mineral" sunscreens.

- **Concerned with sunscreen being white cast or heavy?** A chemical sunscreen is likely more suitable for you.
- **Concerned with skin sensitivity or oiliness?** A mineral sunscreen is more suitable.

Overall, keep in mind:

- **“Broad spectrum” sunscreen is best**. The SPF rating on American sunscreen bottles mostly denotes a sunscreen’s ability to block UVB rays. Importantly, these are the most damaging type—they cause burning, skin cancer, and premature skin aging. Some sunscreens in the U.S. don’t cover UVA rays well. Sunscreens labeled "broad spectrum" have a better UVA/UVB protection balance.



- **Higher SPF gives higher protection**. You may have seen that SPF 50 blocks 98% of UV while SPF 30 blocks 97%, so there's only a 1% difference. However, this is only true if you apply the correct amount perfectly evenly, which is impossible. If the same amount is applied, SPF 30 will always let 1.67 times more UV than SPF 50.

- **Vitamin D can still reach the skin**. High SPF sunscreens are designed to filter out UVB rays, the exact type of rays needed to produce vitamin D in our bodies. However, sunscreen doesn't filter out all of these rays, and, of course, sunscreen application is uneven because humans are humans. Getting the Vitamin D we need doesn't require much sun exposure. **Many studies** show that people who use sunscreen daily can maintain their vitamin D levels. We also get Vitamin D from food sources.

Bottom line

Sunscreen can help fight skin cancer and prevent photoaging. Given how difficult sunscreen is to study, there are some unclear risks. Uncertainty can be uncomfortable, so it's unsurprising that there is much contradicting information about sunscreen (and really anything in health).

The good news is that options exist, and the best type of sunscreen is one that you will use.

Love, YLE and M

Dr. Michelle Wong is an Australian cosmetic chemist and fellow science educator who addresses the top sunscreen rumors circulating widely these days.

"Your Local Epidemiologist (YLE)" is written by Dr. Katelyn Jetelina, MPH PhD—an epidemiologist, data scientist, wife, and mom of two little girls. During the day, she is a senior scientific consultant to a number of organizations, including the CDC. At night, she writes this newsletter. Her main goal is to "translate" the ever-evolving public health science so that people will be well-equipped to make evidence-based decisions.