Too much sunscreen? Why avoiding the sun could damage your health

For years we have been told to slather up or seek shade to avoid skin cancer. But now it is becoming clear that shunning the sun comes with its own health perils.

SLIP! Slop! Slap! As public-health campaigns go, Cancer Council Australia’s dancing seagull telling people to slip on a shirt, slop on some sunscreen and slap on a hat must rank among the stickiest in history. Launched in 1981, it prompted many a devoted sun worshipper to reconsider whether a “healthy tan” was virtuous, or a herald of premature skin ageing and cancer.

It seems to have been effective: after increasing in the general population for decades, rates of the deadliest form of skin cancer, melanoma, are now falling among Australians under the age of 40. “These are people who will have been exposed to the [Slip, Slop, Slap] message for pretty much their whole lives,” says Heather Walker of Cancer Council Australia.

But has this come at a cost? In Australia and worldwide, the prevalence of vitamin D deficiency is increasing – and sunscreen has taken much of the blame. Low levels of vitamin D are associated with weaker bones and teeth, infections, cardiovascular disease and autoimmune and inflammatory diseases including multiple sclerosis. And although vitamin D supplements have been touted as a solution, so far they don’t seem to have the effect that was expected. Now evidence is accumulating that sun exposure has benefits beyond vitamin D.

All of this has prompted some to label sunscreen “the new margarine” – a reference to health advice in the 1980s and 90s to switch from butter to hydrogenated vegetable oil to protect heart health, only to discover that the trans-fats found in many margarines were potentially more harmful. Could sunscreen face a similar fate? And if sun exposure is necessary, how do we reap the benefits without getting skin cancer?

The Ancient Babylonians, Egyptians, Greeks and Romans all recognised that sunlight could be harnessed to promote health. Hippocrates, for instance, believed that it was beneficial in the treatment of most ailments. But medical interest in sunlight truly took hold at the turn of the 20th century, following observations that it kills bacteria and that a deficiency is associated with rickets, a condition that affects bone development during childhood. By the late-1920s, sunlight was being touted as a cure for pretty much every illness under the sun, and a suntan had become an emblem of health and status.

Soaking up rays

It was also around this time that scientists identified one of the key mechanisms by which sunlight promotes health. When the ultraviolet (UV) B rays in sunlight hit the skin, they spur the synthesis of vitamin D3. This circulates in the blood before being further metabolised into the active form of vitamin D elsewhere in the body. Bone and muscle cells use vitamin D to regulate levels of calcium and phosphorus, keeping them strong and healthy – but it is also important for certain immune cells,
which spew out an antimicrobial in response to it. Indeed, last month a study found that giving vitamin D supplements alongside antibiotics could speed up treatment of multidrug-resistant tuberculosis in the lungs.

Of course, sunlight also has a dark side. This was recognised in 1928 by British researcher George Findlay, who exposed mice to regular irradiation with UV light and observed that tumours developed on their skin. Since then, many more studies have shown that UV light triggers DNA mutations in our skin cells, potentially leading to cancer. Sunscreen, in combination with other sun avoidance measures, reduces that risk.

Today, the sunscreen industry is booming. Global sales of sun-care products totalled around $15.8 billion in 2015 and are projected to reach $24.9 billion by 2024. There is also a trend towards ever higher sun protection factors, even SPF100, although they don’t necessarily provide much extra protection (see “Sunscreen myths”). Combined with the fact that most Westerners spend a lot of time indoors – in the US it is, on average, 90 per cent of their lives – this has prompted concerns that, at least at high latitudes, many people aren’t storing enough vitamin D to see them through winter. The fear is that their bones, muscles and possibly other tissues are suffering as a result.

About 10 per cent of people in the UK have insufficient levels of vitamin D during the summer, rising to nearly 40 per cent during the winter months. For this reason, in 2016, the UK’s Scientific Advisory Committee on Nutrition recommended that everyone should consider taking vitamin D supplements during winter, because there is good evidence that they can make a difference to bone and muscle health.

The trouble is, in recent years the list of illnesses associated with vitamin D deficiency has grown to include cardiovascular disease, infections and even infertility, but for many of these, supplements don’t seem to lead to better health. Several recent studies actually associated high doses of vitamin D with an increased risk of falls in older people.

According to a recent review of trials, apart from bone-related conditions, there is good evidence for only two things: that vitamin D can prevent upper respiratory tract infections and stop existing asthma from getting worse. Ongoing trials may yet find additional benefits, but it is unlikely vitamin D will be a panacea for our many modern health challenges.

Vitamin D isn’t the only way sunlight affects our health, however. UV light itself may also help marshal our immune system via the largest organ in the body: our skin. Long thought to be simply a protective barrier that provides a way to sense our environment, it turns out our skin may also be a vital part of the immune system. The outermost layer contains cells called keratinocytes that absorb UV light, then send signals to regulatory cells that help to keep the immune system in check. If there is plenty of UV light, these dampening signals are transmitted to the rest of the body, suppressing its immune responses.

One idea for why, as daytime creatures on this sunny planet, we evolved this response to the sun is that it is a way to tolerate our own cells, rather than misidentifying them as “foreign” and destroying them. By getting sunlight, we boost that tolerance of self, which is essential for preventing autoimmune diseases, says Scott Byrne, an immunologist at the University of Sydney.
Protection factor

Byrne has been working with Prue Hart at the University of Western Australia to investigate whether UV light could help people with multiple sclerosis (MS), an autoimmune condition that is more common at higher latitudes. Hart has shown that exposing mice to UV doses equivalent to a brief stint in the midday sun can prevent them from developing a form of MS. Now she and Byrne are looking into whether UV exposure from specialised lamps could slow, or even prevent, the development of MS in people.

However, sunlight’s effect on immune suppression also has a big downside: “Probably the reason why skin cancers grow is because the immune system is dampened and less efficient,” says Hart. Even so, immune suppression can’t explain all the effects of sunlight on health that we have seen. Consider the perplexing finding that people with high sun exposures have higher life expectancies, on average, than sun avoiders – despite facing an increased risk of skin cancer.

That was the discovery of a large Swedish study into the risks associated with melanoma and breast cancer. In 1990, nearly 30,000 women were interviewed about their health and behaviour – including their sun habits. They were then interviewed again 20 years later. When Pelle Lindqvist at the Karolinska Institute and his colleagues crunched that data, they found that, on average, women who spent more time in the sun lived one to two years longer than sun avoiders, even after adjusting for factors such as disposable income, education level and exercise. That suggests it wasn’t simply about having a more healthy lifestyle overall. The researchers found this reduced life expectancy among sun avoiders was mostly due to a greater risk of death from cardiovascular disease and other non-cancer-related illnesses, such as type 2 diabetes, autoimmune disease or chronic lung disease.

What could be going on?

Richard Weller at the University of Edinburgh, UK, thinks he has the answer. Like most dermatologists, Weller started his career believing that sunlight is terribly bad for you. He still wouldn’t dispute that it is a major risk factor for skin cancer. However, his discovery that we produce and stockpile vast quantities of nitric oxide – a potent dilator of blood vessels – in our skin, which can be activated by sunlight, made him think again.

He wondered if this UV-activated nitric oxide was why people’s blood pressure readings are lower in summer than in winter, and whether it may help to explain why cardiovascular disease is more prevalent at higher latitudes. If that were the case, it would also help to explain the puzzling results of the Swedish study. What he found pointed in that direction: his experiments showed that if you expose somebody to the equivalent of about 20 minutes of UK noontime summer sunlight, they experience a drop in blood pressure that continues even after they step indoors.

“People with high sun exposures have higher life expectancies, on average, than sun avoiders”

This sunlight-activated nitric oxide may have other functions as well. Separate studies have revealed that mice fed a high-fat diet that has been shown to promote weight gain and metabolic dysfunction can be protected against these effects through regular exposure to UV light, but not if nitric oxide production is blocked. Nitric oxide is implicated in wound healing, not to mention achieving and maintaining an erection. It also seems to be another substance to which regulatory immune cells respond.

More evidence will be needed to convince the wider dermatology community to step back into the sunlight. “The only established benefit of solar exposure is vitamin D production; others are still controversial,” says Antony Young, who studies the effect of solar UV on the skin at King’s College London. Even so, he believes there may be something to Weller’s findings: “UV has an awful lot of effects at a cellular and a molecular level, and it would certainly not be surprising if these had been exploited by evolution to get some advantages.”

All of this leaves health policy-makers with a dilemma. Most still believe that the need to protect
Smearing on sunscreen should be a last resort after covering what you can with clothing

Skin from sun damage outweighs the risk of vitamin D deficiency, given repeated findings about skin cancer. For example, getting sunburnt once every two years has been found to triple a person’s risk of developing melanoma.

Cancer Council Australia now emphasises the importance of the UV index – a measure of how strong the sun’s UV rays are on a scale of 1 to 11 – in dictating when sunlight should be avoided. Together with other Australian medical bodies, it recommends staying indoors when the UV index is 3 or above, or following the modified Slip, Slop, Slap, Seek and Slide message if you are outdoors for more than a few minutes (the latter two were added in 2007, to emphasise the importance of seeking shade and sliding on sunglasses). Sunscreen is a last resort. “You should use clothing to cover up,” says Walker. “That offers the most reliable protection. Only use sunscreen on the parts of your skin that are uncovered.” During autumn and winter, though, the council encourages people living in Southern Australia, where vitamin D deficiency is more of a risk, to head outside with some skin uncovered in the middle of the day, when the UVB rays needed to synthesise vitamin D are at their strongest.

That won’t work in countries at higher latitudes, such as the UK, because the sun doesn’t rise high enough during winter for the UVB rays to reach ground level. Populations in these countries are dependent on the vitamin D they stockpile during sunnier months, supplemented by that obtained from foods such as oily fish, egg yolks and some breakfast cereals, or taking vitamin D tablets.

You don’t need to spend hours sizzling in the summer sun to ensure you synthesise adequate vitamin D for the year (see diagram, below). “We still don’t know the minimal dose requirement [of sunlight] for adequate vitamin D production, but whatever it is, it is very much lower than is necessary to have a sunburn,” says Young.

How much sun?
The number of minutes you need in the sunshine to get your daily dose of vitamin D depends on your skin colour, where you are and the time of year

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*very difficult to make any vitamin D at high and mid latitudes in winter

Source: The UV Advantage by Michael Holick
You can even manufacture some vitamin D while wearing sunscreen – although the amount you make will be reduced. But preliminary studies by Weller suggest that sunscreen inhibits both the release of nitric oxide and vitamin D.

So, what does he tell his patients? “I am conflicted,” Weller says. “Sunlight is good and bad.” Both he and Young stress the importance of knowing your skin type: people with darker skin will need to spend longer in the sun to generate vitamin D and nitric oxide, and it also takes longer for them to burn.

Possibly, though, there is a way of getting the best of both worlds. Weller and his colleagues have recently patented an ingredient that could be added to sunscreen, and which releases nitric oxide into the skin when sunlight hits it. He has had little interest from sunscreen manufacturers, though, possibly because it makes things more complicated. “They have spent years and years – as has the dermatology community – saying sunlight is bad: avoid it,” says Weller. “Now we’re coming along with a more nuanced message.”

**Sunscreen myths**

1: **Being in the sun is safe if you are wearing sunscreen**

“Sunscreen is a screen, not a block,” says Heather Walker, chair of Cancer Council Australia’s national skin cancer committee. “There will always be some UV that gets through.”

SPF30, for instance, allows 3.3 per cent of UV through. With SPF50 it is 2 per cent, and with SPF100 it is 1 per cent. However, that assumes you are applying it properly: using roughly a teaspoon for each limb, plus one each for the front and back of the torso, and another for the face and neck, and reapplying every 2 hours. Most people apply less than three-quarters of this amount, and don’t reapply often enough.

And the SPF rating is primarily a measure of protection against UVB rays, and UVA rays also damage skin. For decent UVA protection, look for sunscreens labelled “broad spectrum protection”; with a symbol of UVA in a circle or with a high UVA star rating.

2: **I get plenty of sun exposure walking to and from work – I can’t be vitamin D deficient**

To make vitamin D, you need exposure to UVB rays, which peak around noon. You make relatively little vitamin D in the morning and late afternoon when the sun is lower in the sky. “If you want to top your vitamin D up, the best thing to do is just get a few minutes [of sun exposure] at noon,” says Antony Young at King’s College London.

There are still benefits to getting outdoors during the morning and afternoon however: exposure to bright daylight helps to strengthen our circadian rhythms. These 24-hour cycles in our biology and behaviour help us to feel sleepy and alert at the right time, among other things.

3: **You can make vitamin D by sitting next to a window**

Not if the window is shut, because UVB rays struggle to penetrate glass. You can burn, however, because some UVA rays can get through and these can cause skin damage.

4: **Sunscreen contains harmful chemicals – especially to coral**

In November, the western Pacific nation of Palau announced it was banning “reef-toxic” sunscreens in a bid to prevent coral damage. Ten ingredients have been banned, including oxybenzone, which absorbs UV light. A 2015 study suggested that this molecule could stunt the growth of baby coral and make it more susceptible to bleaching.

Some question what the impact will be of eschewing sunscreen. “The real risks to the reef are from climate change, overfishing and run-off from rivers,” says Heather Walker of Cancer Council Australia. Next to these things, the effect of sunscreen will be negligible. “Our advice anyway would be to use clothing to cover up.”

As to wider health concerns about oxybenzone and other chemicals in sunscreen – which are present in many other products we use daily – there has been no conclusive evidence that they cause harm.