

# HIDDEN DANGERS OF UV: KEEPING YOUR EYES SAFE





## INTRODUCTION

It is invisible, penetrating and pervasive, and it poses considerable danger to human eyes and skin. Yet in most people's daily lives, the issue of solar radiation merits little attention. Most are unaware of the serious vision problems that can be caused by exposure to the sun's unseen rays.

The problems should instead be front and center. Although always a threat, ultraviolet (UV) exposure has risen in recent decades as the Earth's protective ozone layer has been depleted by the discharge of certain man-made chemicals into the atmosphere.<sup>1</sup> Given the sensitivity of the eyes and skin, that has meant a simultaneous increase in potential harm. The damage can occur at any age, but there's often a cumulative punch in later years. Abnormal growths and disease may be the result, diminishing or distorting vision – or worse.

Public knowledge lags significantly. Many people now recognize the connection between sun exposure and skin cancer, but fewer than one in three Americans realize the hazards to the eye. Only 24 percent link UV exposure to cataracts.<sup>2</sup> And while geography, eye color and occupation are some of the elements that put particular individuals at more risk, the reality is that everyone should take heed.

In this issue brief, published by The Vision Council, this is the most important message. UV doesn't discriminate. Protecting eyesight should be a universal focus, every day of the year.

*From my years of professional experience, as well as from a painful episode of snow blindness I suffered as a teen-aged skier, I know all too well how much UV exposure can damage the eye. Sometimes the injury is short-lived, but too often it's not. And too often it's because someone was unaware of the risks. The Vision Council wants to get the word out. We want to help children and adults alike protect their eyes from solar radiation. This issue brief offers easy tips for doing so. We hope that you find them useful—and that you enjoy a lifetime of good vision.*

-- Scott MacGuffie

*Chairperson,  
Sunglass and Reader Division  
of The Vision Council*



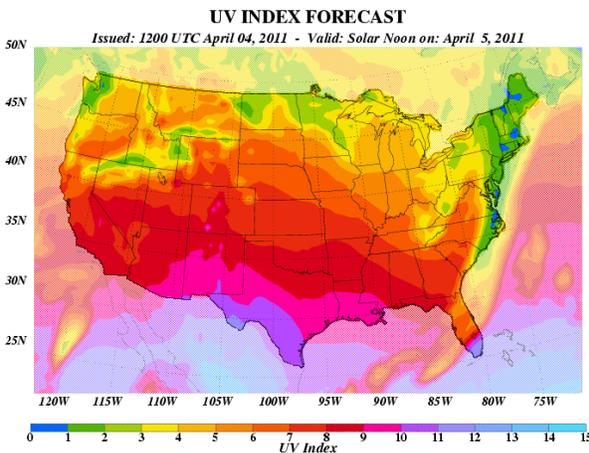
## YOUR UV EXPOSURE

Location, location, location. Just as in real estate, it can make all the difference for a person's UV exposure – and risk of eye damage.

Geography influences the situation in sometimes complicated ways. In the United States, southern communities tend to receive more intense solar rays than northern ones. But elevation can be a factor, since the thinner atmosphere at higher altitudes can't absorb as much radiation. Surroundings also affect things. At the beach, sand or water can reflect up to 25 percent of UV; on a snow-covered surface, as much as 80 percent of UV may be reflected<sup>3</sup> – adding to the initial exposure.

According to the National Weather Service (NWS), the UV Index is a forecast of the amount of skin- and eye-damaging UV radiation expected to reach the earth's surface at the time when the sun is highest in the sky. The calculation is primarily related to the elevation of the sun in the sky, the amount of ozone in the stratosphere and the amount of clouds present. The higher the UV Index, the greater the dose rate of damaging UV radiation.

It is easy to check an area's UV level. Scientists at the NWS and Environmental Protection Agency (EPA) created a UV Index scale and then paired it with weather forecasting. Their computer model takes into account seasons, climatic conditions and stratospheric ozone concentration – three more things that can make a difference in ultraviolet exposure – to produce an extended UV forecast map.



The EPA posts these national maps every afternoon at [www.epa.gov/sunwise/uvindex.html](http://www.epa.gov/sunwise/uvindex.html). The website also allows viewers to get a ZIP code-specific forecast from the weather service. Based on the latest NWS data available, nearly half of the 58 cities monitored have very high or extreme UV levels for at least a fifth of the year.

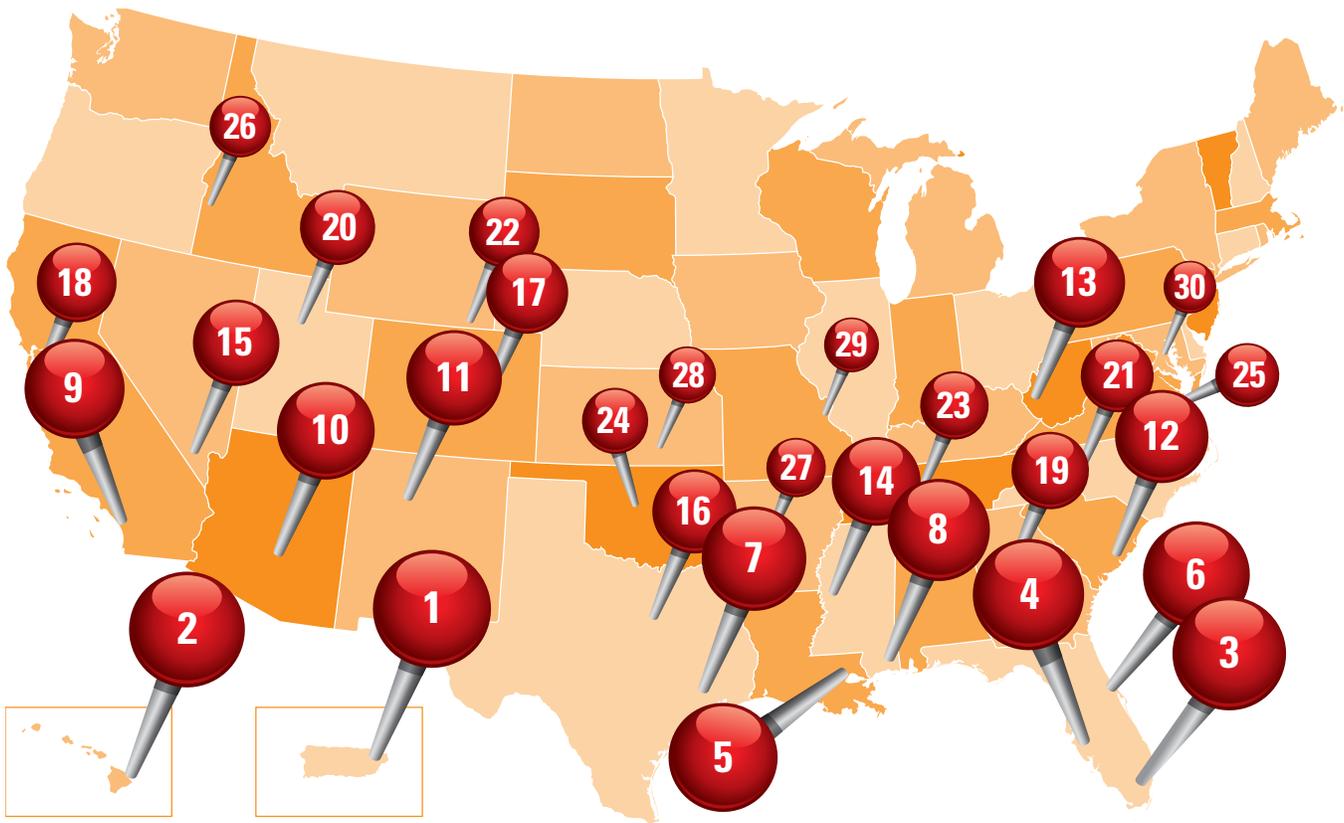
The range of energy that makes up visible light is just a small portion of the electromagnetic spectrum so integral to modern life. Ultraviolet radiation comprises invisible rays that can damage the eyes, burn the skin and cause skin cancer.

UV radiation that reaches the Earth's surface is made up of two types of rays -- ultraviolet A (UVA) and ultraviolet B (UVB). UVA is weaker than UVB but passes further into the body's tissue than UVB. It is now generally accepted that both UVA and UVB cause skin cancer and can damage the eyes. For this reason, eye protection and sunscreens are recommended that block both kinds of radiation -- UVA and UVB.



# UV INDEX RANKINGS OF SELECT U.S. CITIES AND TERRITORIES

The NWS monitors UV levels in nearly five dozen cities across the United States and Puerto Rico. The map shows the locations with the most days of “very high” or “extreme” risk from unprotected exposure to the sun. In these cities - as well as in neighboring communities - sunglasses and sunscreen are always smart to wear when outside. (For any area, UV intensity varies by season and time of day. In the United States, UV levels are highest during summer months, especially between 10 a.m. and 4 p.m.).



Rank	City	Total Days of Extreme and Very High Risk	% Annually	Rank	City	Total Days of Extreme and Very High Risk	% Annually
1	San Juan, PR	279	76.44%	16	Dallas, TX	108	29.59%
2	Honolulu, HI	227	62.19%	17	Denver, CO	106	29.04%
3	Miami, FL	210	57.53%	18	San Francisco, CA	106	29.04%
4	Tampa Bay, FL	181	49.59%	19	Atlanta, GA	103	28.22%
5	New Orleans, LA	165	45.21%	20	Salt Lake City, UT	101	27.67%
6	Jacksonville, FL	160	43.84%	21	Raleigh, NC	94	25.75%
7	Houston, TX	147	40.27%	22	Cheyenne, WY	90	24.66%
8	Mobile, AL	144	39.45%	23	Memphis, TN	89	24.38%
9	Los Angeles, CA	141	38.63%	24	Oklahoma City, OK	87	23.84%
10	Phoenix, AZ	136	37.26%	25	Norfolk, VA	83	22.74%
11	Albuquerque, NM	127	34.79%	26	Boise, ID	80	21.92%
12	Charleston, SC	123	33.70%	27	Little Rock, AR	80	21.92%
13	Charleston, WV	123	33.70%	28	Wichita, KS	80	21.92%
14	Jackson, MS	118	32.33%	29	St. Louis, MO	66	18.08%
15	Las Vegas, NV	114	31.23%	30	Washington, DC	66	18.08%



## OTHER RISK FACTORS

Equally important are the other factors that put people's eyes at greater risk from UV exposure.

- **Age** is relevant in the calculus of risk for both young and old. Children receive three times the annual sun exposure of adults,<sup>4</sup> and research has shown that their young eyes are especially susceptible to UV-related harm. Unlike the mature lens of an adult eye, a child's lens cannot filter out UV rays and so more radiation reaches the retina.<sup>5</sup> At the same time, decades of sun exposure make older people's eyes much more prone to visual problems and disease. Decreased concentrations of protective molecules in the eye, also related to age, may be implicated, too.<sup>6</sup>
- **Eye color** appears to play a role, with some studies suggesting that blue eyes are at more risk for UV damage than brown eyes. The protective pigment melanin may be the key detail – blue irises have less of it – and a higher incidence of age-related macular degeneration may be one consequence.<sup>7</sup>
- **Skin complexion** may decrease some people's risk of sunburn but not of eye damage. According to the World Health Organization (WHO), darker skin affords no greater defense against UV harm to the eyes.

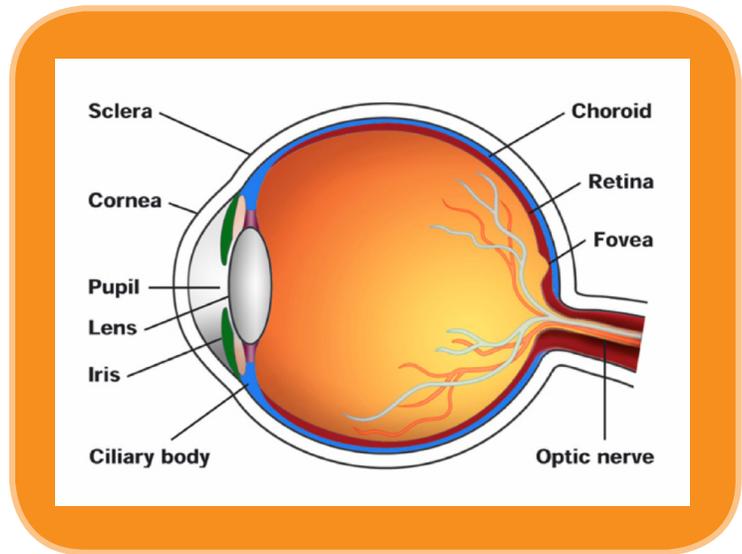
## PROBLEMS NOW – AND IN YEARS TO COME

The eye's internal structures are vulnerable to the narrow band of the light spectrum that includes UVA and UVB.

### SHORT-TERM PROBLEMS

In the aftermath of a long, sunny day at the beach, people frequently notice how their eyes seem bloodshot, swollen or hyper-sensitive to light. Even just several hours of intense, unprotected exposure to UV radiation can cause a variety of short-term problems, which range from irritating to painful.

The most extreme of these problems is photokeratitis, which essentially is a sunburn of the eye. It's also known as "snow blindness," although a ski slope in winter isn't the only place that reflected UV rays can sharply increase the risk to unprotected eyes. The condition can be quite painful and can result in a loss of vision for 24 to 48 hours.<sup>8</sup>



### LONG-TERM PROBLEMS

The cumulative impact of UV exposure on an eye can be very serious. Over a lifetime, the toll can even lead to significant visual impairment. Problems surface more often among older adults, but younger people still can be affected.

Among the most common complications are:

- **Cancer** of the eye, eyelid and surrounding skin. Although cancer of the eye is relatively rare, skin cancers of the area surrounding the eye is not. According to The Skin Cancer Foundation, a tenth of all skin cancers are found on the eyelid. Most are diagnosed as basal cell carcinoma, which can spread to the eye and adjacent tissue.<sup>9</sup>



- **Pterygium**, or “surfer’s eye,” an abnormal but typically benign growth on the eye’s surface (most times originating in the corner of the eye near the nose). Pterygium is linked to excessive exposure to sun, wind and sand. It can cause irritation, swelling and itchiness as well as corneal problems that can affect vision. And while it can be removed surgically, it also can recur.
- **Cataract**, a progressive clouding of the lens of the eye and a main cause globally of reversible blindness. Studies have shown that UV harms the lens and accelerates deterioration that leads to age-related cataract. Worldwide, 18 million people are blind because of cataracts,<sup>10</sup> and WHO cites UV exposure in as many as five percent of those cases. Nearly 3 million surgeries to remove cataracts are done in the United States annually.
- **Age-related macular degeneration (AMD)**, a major cause of vision loss in older people that may result from prolonged UV exposure. The macula sits at the back of the eye, in the middle of the retina, where it focuses sharp, clear central vision. Damage to nerve cells there blurs fine detail and dulls colors in the center field of vision. Smoking, obesity and other factors also are associated with AMD.<sup>11</sup> The disease is irreversible.

The Vision Council has partnered with the Environmental Protection Agency’s SunWise® program, the largest national health and environmental education program. With a goal of preventing skin cancer and eye damage by changing the sun protection practices of children and their caregivers, SunWise has worked with more than 25,000 schools throughout the United States – reaching more than 3 million children.

The SunWise program provides schools with in-classroom education materials, fun activities and giveaways and also prompts schools to invite guest speakers to school assemblies to enhance sun safety efforts. All schools are encouraged to become “SunWise,” and SunWise materials are available in both English and Spanish.

As a result of the program’s efforts, the EPA reports that SunWise students show an 11 percent decrease in sunburns. More SunWise kids wear sunscreen and sunglasses when outdoors, and more understand that sun tans are not healthy.

[www.epa.gov/sunwise](http://www.epa.gov/sunwise)



## SEEKING PROTECTION

The good news is that eyes can be safeguarded from UV rays. Not surprisingly, sunglasses are the most essential item. They should absorb UVA and UVB rays. They also should meet quality and safety criteria set by the American National Standards Institute (ANSI).<sup>12</sup>

Extra protection comes from wraparound glasses or glasses with side pieces big enough to block the sun from most angles. Polarized lenses, which reduce glare, and glasses with photochromic lenses, which darken automatically when exposed to UV, offer additional benefits.

Some contact lenses also have UV protection. For settings where exposure will be intense, the U.S. Food and Drug Administration recommends contacts designated Class I, which means they absorb more than 90 percent UVA and 99 percent UVB. Class II, which must absorb more than 70 percent UVA and 5 percent UVB, is recommended for general settings.<sup>13</sup> And even then, many eye doctors suggest still wearing sunglasses to shield parts of the eye not covered by contacts.

Year-round, sunscreen that blocks both UVA and UVB and provides an SPF of 30 or higher should be used carefully in the general area around the eyes. A hat with a wide brim or bill can help to keep UV from reaching the eyes.

Finally, outdoor enthusiasts might want to consider some of the specialized sports equipment now available, such as swim or ski goggles with UV protection.

One special note: A 2008 survey of more than 2,000 U.S. adults found that less than a third made their children wear sunglasses outdoors, compared to more than 80 percent who insisted on sunscreen. Because children's eyes are particularly vulnerable to UV, parents should be particularly adamant that they wear sunglasses. And parents should lead by example.<sup>14</sup> The glasses should be comfortable and fit a child's face.

In my optometry office in Massachusetts, I treated many people whose eyes had been exposed to a lot of sunlight over the years. The signs weren't hard to identify. Their eyes were red and irritated, and the normally smooth surface may have looked bumpy. These patients typically said that their eyes stung and seemed very dry. I would pull out my camera, take a picture and then show them what UV rays have done. Sometimes the growth I was photographing - a condition called pterygium - had even begun to cover part of the cornea.

"I didn't know," they'd tell me. Many were in their 40s or younger. Because of all their sun exposure, they're at a greater risk for cataracts or macular degeneration as they age.

I'd like the vision problems caused by solar radiation to get more attention. Many people know to wear sunscreen when they're outside, but sunglasses to protect their eyes are just as important. I explained to my patients that being outside doesn't just mean an afternoon at the beach or several hours spent skiing. They should protect their eyes when they're walking the dog around the block or shopping at the farmer's market. Remember, I said, these small, incremental exposures can have a big cumulative effect later in life.

Some patients insisted that they didn't need sunglasses because glare didn't bother them. But the issue isn't glare, it's UV. That's another point I stressed. A pair of sunglasses may filter visible light well enough, yet how much damaging ultraviolet light is blocked? A person can't know by the color of the lenses; it's essential to make sure the sunglasses block UVA and UVB rays.

Given that most people now recognize the link between sun exposure and skin cancer, I am hopeful that the same will soon be true with sun exposure and eye damage. Awareness and prevention are gaining ground - just not fast enough given what's at stake.

-- W. Lee Ball, Jr., O.D.  
Chairperson, Better Vision Institute



## MYTHS AND TRUTHS

- **MYTH:** The eye is no more vulnerable to solar UV than other parts of the body. **TRUTH:** More than any organ but skin, the eye can suffer significant injury from the sun.
- **MYTH:** Eyes can't be damaged by UV rays on cloudy days. **TRUTH:** Overcast skies still allow 31 percent of solar radiation to reach the Earth.<sup>15</sup> Eyes need protecting on cloudy as well as sunny days.
- **MYTH:** UV rays are only dangerous in the summer. **TRUTH:** Although UV intensity varies according to the season – in this country, rising in the spring and peaking during the summer – solar radiation is present year-round. In the winter, UV rays reflecting off snow can double overall exposure.<sup>16</sup>
- **MYTH:** Sunglasses with adequate UV protection cost more. **TRUTH:** UV protection doesn't make a pair of sunglasses more expensive; rather, designer frames, specialized lenses and other features are what really affect the price tag.<sup>17</sup>
- **MYTH:** The darker the lens, the more UV will be blocked. **TRUTH:** UV protection has nothing to do with the darkness or color of a lens.<sup>18</sup> (However, grey, brown or green lenses do minimize color distortion.) Dark lenses without adequate UV protection can actually be worse than no sunglasses at all because they cause the eye's pupil to dilate, which then increases retinal exposure to the unfiltered UV.

## CONCLUSION

When it comes to the sun's rays and the human eye, it's what we can't see that matters most. Solar UV can cause both temporary and permanent problems, even acute visual impairment. And no matter what the season or location, exposure carries risk. That risk increases substantially over time.

Since UV damage can't be repaired, prevention is crucial. Yet it's also easy. Most days, protecting eyes takes little more than the right pair of sunglasses, a decent hat and dab of sunscreen. Put them together regularly to help ensure a lifetime of vision.

## THE VISION COUNCIL'S TOP TIPS

When picking shades:

**Buy from a reputable retailer  
(they'll meet frame and lens safety  
criteria set by the American National  
Standards Institute)**

**Insist on protection from UVA and UVB  
rays (both can damage the eyes)**

**Go for comfort (sunglasses that don't feel  
right are less likely to get worn)**

**Find the right pair(s) for the activities you  
do (different lenses and frames may be  
suited to various types of sports)**

**Select a lens color that improves clarity  
and reduces glare (yellow- and brown-  
tinted lenses are best when you're  
on the water; gray, brown and amber  
are great for field sports; and mirror  
coatings work well for downhill skiing  
and snowboarding)**

**Pick a design that works  
(wraparound glasses or glasses with  
larger temple pieces help block the sun  
from side angles)**

Want more sport- and scene-specific tips? Details on frame materials and lens options? Visit The Vision Council website at <http://www.thevisioncouncil.org/sunglasses>.



## ENDNOTES

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- 2 American Optometric Association. 2008 American Eye-Q survey.
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