

EYE AND THE STORMS

BY MELANIE PADGETT POWERS



Extreme weather changes due to **climate change** can affect eye health. Here's how doctors of optometry can prepare.

IN 20 YEARS OF PRACTICE, MELISSA BARNETT, O.D., HAD NEVER SEEN ANYTHING LIKE IT.

In fall 2020, a patient arrived complaining of excruciating eye pain in one eye. She had gone to an urgent care center first, where they diagnosed her with an eye infection and gave her antibiotic eyedrops. The drops didn't help.

"When she came in and I flipped her upper lid, I found a piece of ash in the palpebral conjunctiva," says Dr. Barnett, principal optometrist at the University of California, Davis, Eye Center and chair-elect of the AOA Contact Lens & Cornea Section. "It caused a massive corneal abrasion, which caused excruciating pain."

California wildfires were raging nearby, creating not only smoky, unhealthy air, but also depositing ash over nearby communities. The patient said she had only been outside a short amount of time—going from her house to her car, running one errand, then returning home.

Dr. Barnett removed the ash with a spud, and after discussing options, applied a bandage contact lens with topical antibiotic prophylactics. The following day, the patient was symptom-free and the corneal abrasion was completely resolved. That second day, another patient arrived complaining of eye pain, redness and a foreign body sensation. He had been playing golf on a windy, smoky day, with wildfires in the distance. He was not wearing sunglasses or other protective eyewear.

"He also presented with a piece of ash under his upper lid," Dr. Barnett says. "Fortunately, he did not have a corneal abrasion. However, he had a lot of irritation."

In the western part of the U.S., 2020 was the worst fire season on record. Climate change was partly to blame, as warmer temperatures dry out areas, which leads to more fuel for more fires.

Climate change is causing an increase in extreme weather patterns in the United States and around the world, harming both the environment and humans. NASA reports that most of the Earth's warming happened in the past 40 years, with the six warmest years on record taking place since 2014. Furthermore, 2016 was the warmest year on record, and eight months that year set records for their respective months.

Climate change research has shown three primary areas with the most potential to affect health care, says Kyle Klute, O.D., owner of Pacific Family Vision in Omaha, Nebraska, who has a bachelor's degree in meteorology and climatology. Winters are shorter—fall is lasting longer and spring is starting earlier—and temperatures and rainfalls are more extreme.

As climate change worsens, a variety of health problems, including eye conditions and diseases, may increase in numbers or emerge anew. Two of the biggest culprits? Air pollution and prolonged allergy seasons.

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DOCTORS CAN HELP PROTECT THE ENVIRONMENT BY DEVELOPING SUSTAINABLE OPTOMETRIC PRACTICES.

EDUCATE PATIENTS ON EYE HEALTH RISKS AND SAFE DISPOSAL OF CONTACT LENSES.



Inform patients about recycling programs available for contact lenses and packaging, including [terracycle.com](https://www.terracycle.com), or consider turning your practice into a recycling drop-off site.

Eye health dangers

Air pollution can lead to an increased risk in age-related macular degeneration (AMD), dry eye and conjunctivitis. A 2019 study in Taiwan showed a 91% greater risk of developing AMD among those exposed to the highest level of ambient nitrogen dioxide—which mostly comes from vehicle emissions—compared to those exposed to the lowest level. The risk of those exposed to the highest level of carbon monoxide was 84% higher. The study, which was published in the *Journal of Investigative Medicine*, included 40,000 city dwellers age 50 and older. Of those, 1,400 developed AMD.

Climate change also can worsen allergies, including itchy and red eyes. “You will have people in your regions having extended allergy periods, or it’s going to be a different time of the year or for a longer time,” Dr. Klute says. “And, because of changes in weather patterns, patients may potentially be exposed to different types of pollens than they have been before.”

Allergy seasons in the Northern Hemisphere are both longer and have more pollen. Rising temperatures extend growing seasons, and longer springs allow pollen to stick around longer. In fact, pollen levels have been going up for the past 20 years, according to a 2019 study in *The Lancet Planetary Health*.

Longer, tougher allergy seasons mean more patients may need antihistamine eyedrops and may not connect their new-found symptoms to allergies. Patients also are taking more oral allergy medicines, some of which have decongestants, which can cause acute angle-closure glaucoma in susceptible patients, says Anu Laul, O.D., associate clinical professor of optometry at State University of New York College of Optometry.

However, most patients probably don’t know about eye health risks when reaching for an over-the-counter allergy medication, Dr. Laul says, so it’s important to inform patients with narrow angles about decongestant risks.



Use of decongestants for allergies and increased use of air conditioning as summers get hotter and longer also can contribute to dry eye, Dr. Laul says.

Another risk to eye health and eyesight is exposure to ultraviolet (UV) radiation, which can cause cataracts, snow blindness or eye sunburns, pterygium and pinguecula. The Earth’s ozone layer absorbs UV light, but the depletion of the ozone in the 20th century meant people faced higher exposure to UV radiation. A global agreement known as the Montreal Protocol banned ozone-depleting chemicals in 1987, which led to the ozone layer’s ongoing recovery. However, the layer is not completely healed, and a greater UV danger still exists.

“As we are all aging, and cataracts are becoming much more prevalent, UV radiation could cause premature cataracts and lead to early onset presbyopia,” Dr. Barnett says. It’s also important that patients know to protect the outside of their eyes and the skin around their eyes to prevent malignant conditions, such as skin cancer, that also could affect eye health.



Emerging diseases

Dr. Laul is developing a continuing education (CE) course focused on climate change and eye health. One thing he discovered is the increase in a wide variety of diseases as the Earth warms and deforestation increases. Mosquito-borne illnesses, such as West Nile virus and Zika virus, may continue to spread into new areas as warmer temperatures and more flooding create conditions ripe for mosquitoes. West Nile virus has ocular manifestations, such as multifocal choroiditis, anterior uveitis, retinal vasculitis, optic neuritis, subconjunctival hemorrhage and sixth nerve palsy.

“When you see those conditions in the clinic, West Nile virus is not something you would think about as a first-line, potential cause,” Dr. Laul says. He hopes to call more attention to these diseases through his CE course, but it’s also important to weave this information into optometric school curriculums, he says. Doctors of optometry “should also start thinking about some of these things—which will likely become a lot more prevalent due to the fact that the climate is changing,” he says. “That may cause them to move up on your deferential list as the years go on.”

Deforestation and illegal animal trade also can lead to emerging diseases, as humans and animals come into closer contact with one another, allowing a virus to jump from animal to human. These are known as zoonotic diseases, and the most notorious right now is the novel coronavirus, SARS-CoV-2, which is currently thought to have originated in bats and made the jump into humans at one of the open-air wet markets in Wuhan, China. (Scientists believe the virus first jumped from a bat to another animal but aren’t sure which one yet.) According to the Centers for Disease Control and Prevention, more than 6 out of every 10 known infectious diseases in people can be spread from animals, and 3 out of every 4 new or emerging infectious diseases in people come from animals.

“As new viruses tend to emerge, there is definitely a possibility of ocular manifestations,” Dr. Laul says. “We need to really be aware of what’s happening from a worldly, systematic standpoint of what viruses are out there and their possible impact on ocular health.”

Building a sustainable practice

Doctors can help protect the environment by developing sustainable optometric practices, including installing energy-efficient products, committing to a paperless office and promoting contact lens recycling programs.

Samuel Adelman, O.D., owner of Portland Eye Care in Oregon, aims to operate a green business and even encourages patients to offer their sustainability suggestions. A staff “green team” holds regular meetings to discuss and implement sustainable practices, such as installing LED lights and low-flow faucet aerators and providing reusable dishes for staff use. Dr. Adelman sought approval from his landlord to install a bike rack outside his front door, and the office keeps a bike pump, flat-tire kit and lock on hand for patients. He also has adopted a “rainwater diversion” area in Portland and is responsible for keeping it clean and weeding it.

Dr. Adelman’s office also is a recycling drop-off site for daily disposable contact lenses and their packaging through the Bausch + Lomb ONE by ONE Recycling Program. “Patients save up their lenses and, at their appointments, they bring in a big bag of contacts,” he says. This also can serve as a reminder to patients not to put their contact lenses in with their regular household recycling and not to flush them down the toilet.

The recycling program also accepts the top foil and unopened blister packs and will accept any contact lens brand. According to the company, the metal layers of the blister packs are recycled, and the contact lenses and plastic blister pack parts are melted into plastic that can be remolded to make recycled products.

“It’s not hard at all for our practice. The company sends you a box that has their branding on it,” Dr. Adelman explains. “You just have to mail it back. It’s pretty easy.”

During the pandemic, medical waste has increased substantially because of the necessity of personal protective equipment (PPE) such as disposable gloves and gowns,

which are often made of plastic. Catalonia, Spain, reported a 350% increase in medical waste during the pandemic, according to the *Chemical Engineering Journal*. In addition, the need to frequently clean has led to an increased waste of disposable disinfectant wipes and paper towels, as well as increased chemical use.

While one optometric practice may not generate a ton of waste, it adds up. Plastic can take hundreds of years to decompose, damaging ecosystems worldwide and killing marine life. There are some alternatives to

single-use, plastic PPE, such as gloves and face visors made from more biodegradable bioplastics, but their availability and use are not currently widespread. Bioplastics are similar to traditional plastics but are made from biological sources such as sugar cane, potato starch or the cellulose from trees, straw and cotton or seaweed.

In Swansea, Illinois, G. Michael Murphy, O.D., owner of Swansea Vision Source, discovered that installing solar panels was a good financial, as well as environmental, decision. He had solar panels installed over

his practice first in February 2017, then over the rest of the building, which he owns, in October 2019. He thought he would recoup installation costs in about five years, but the first installation has already paid for itself. In fact, he has earned money through state-specific solar renewable energy credits.

“My outlay was \$61,500 for that initial installation,” he says. “We’re coming up on the four-year period in February [2021], but I’m already \$11,000 in the black.” He took out a seven-year loan to pay for the initial installation and paid cash for the second one.

Dr. Murphy also recommends doctors of optometry look into whether their local utilities offer instant rebates for upgrading to more efficient lighting or HVAC systems. He replaced his building’s 4-foot-long, 32-watt fluorescent tubes with 15-watt LED tubes for about \$1 each. The tubes are expected to last five times longer than the fluorescent tubes, while using less than half the electricity, he explains. “Even if you don’t go with solar, you can have a massive reduction in the amount of power that you’re using, which again, saves you money, but it also reduces the load on the system and helps with reducing the amount of carbon that is produced in power generation.”

He also installed low-flow toilets, replaced worn carpet with floating floor tiles that can be replaced individually, and installed low-transmission window tinting to keep out heat in the summer and reduce heat loss in the winter.

As Earth’s climate continues to change, leading to warmer weather and extreme weather patterns, doctors of optometry may begin to see an increase in certain eye conditions.

“Climate change is real, and it is having a profound impact on our health and well-being,” Dr. Laul says. “As integral members of the health care community, it is our responsibility to address these issues and ultimately better the lives and vision of our patients.”

—Melanie Padgett Powers is a freelance health care writer in the Washington, D.C., area.

The AOA's Contact Lens & Cornea Section has published guidelines for the safe disposal of used contact lenses and their packaging, including an infographic you can share with patients. Visit aoa.org/contact-lens-disposal.

