

NIH News in Health

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Battling Bites Blocking Mosquito-Borne Diseases

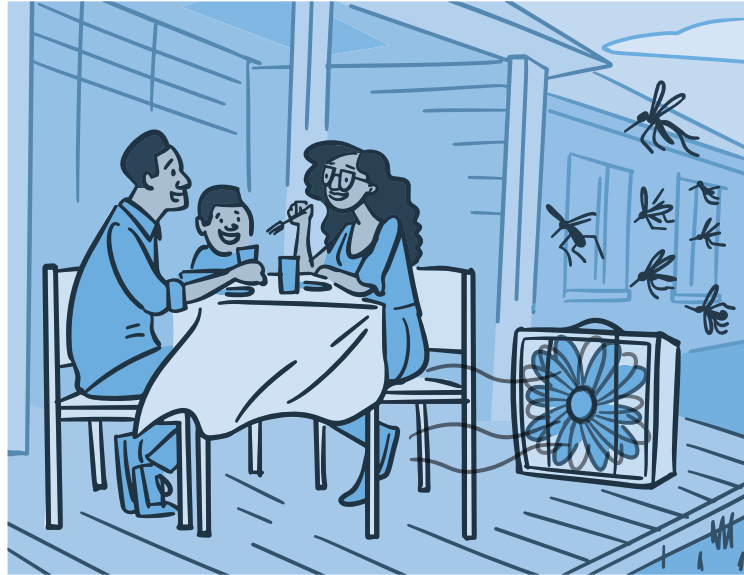
As the days grow longer and warmer, summer fun beckons. Swimming, sports, and picnics go hand in hand with warmer weather. But so do bug bites. Mosquitoes in particular can ruin a day outside. And their bites aren't just itchy and irritating. They can also spread disease.

The list of illnesses carried by mosquitoes keeps growing. Some, like malaria, are rarely seen in the United States. Others, like dengue fever, are spreading in the Southern states as temperatures get warmer. And others, like West Nile virus, now pop up seasonally in most parts of the country.

NIH-funded researchers are working to help stop the spread of mosquito-borne diseases. They're testing ways to stop mosquitoes from biting people and keep those who are bitten from getting sick.

Blocking Disease • For decades, researchers have been trying to develop vaccines to protect people against mosquito-borne diseases. But most haven't been as effective as hoped, explains Dr. Matthew Memoli, an infectious diseases researcher at NIH.

"And there's a lot of mosquito-borne diseases," he says. "If you make a vaccine for every single one, that's a lot of vaccines to have to develop."



But what if you could vaccinate people against mosquitoes? That may sound far-fetched, but Memoli's lab has been trying to do just this. When a mosquito bites you, their saliva gets under your skin. This saliva contains compounds that make it easier for a mosquito to suck blood. It also has compounds that help any disease the mosquito is carrying to get into your body.

"When you get bitten by a mosquito, you have an allergic response to the saliva," explains Memoli. That response causes an itchy bump to appear after a bite. This is normal, but it can interfere with your body's ability to fight germs. "When that allergic response gets turned on, the anti-infection response gets turned down," Memoli says.

So Memoli's team is testing a vaccine that helps the body's defense system recognize mosquito saliva.

They hope it can help the body prevent infections from sneaking in. In a small study, the team found that the vaccine was safe and boosted people's defense responses. They now hope to test the vaccine in areas of the world where the risk of deadly mosquito-borne diseases is high.

Deterring Mosquitoes •

One of the best ways to avoid mosquito-borne diseases is to prevent bites in the first place.

People can take certain steps to protect themselves.

"We have personal repellents, like DEET, which you can put on," says Dr. Carolyn McBride, who studies mosquito biology at Princeton University. Tools like mosquito nets can also prevent bites. But to keep diseases from spreading, they need to be used by everyone in an area.

Researchers want to develop better ways to prevent mosquito bites. But first they have to figure out how mosquitoes sense people. How do they find us to bite us?

McBride and her team recently uncovered a set of chemicals that

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the *Aedes aegypti* mosquito detects to let it home in on people. These chemicals include certain fats and other substances in and on human skin. They found that a specific mixture of these substances could attract mosquitoes from several feet away. They hope this knowledge can be used to design new ways to repel or trap mosquitoes, over large areas.

“This would allow us to push mosquitoes away from all the houses in high-risk neighborhoods. Or to place a trap where we can pull them in and kill them,” McBride explains. This would allow for better control of mosquitoes than requiring everyone to protect themselves.

Her team is now looking at a different kind of sensing: how mosquito eggs sense when it’s time to hatch. “If we can understand that, we could screen for compounds

that block hatching,” McBride says. “Maybe chemicals that are otherwise safe, but if you sprinkle them on all the places mosquitoes lay their eggs, the eggs never hatch.”

Reducing the Spread • If there were fewer biting mosquitoes around, there would be less disease.

“But trying to keep mosquitoes down to a low level is really hard,” says Dr. Zach Adelman, a mosquito geneticist at Texas A&M University. “They’re really resilient. Spraying insecticides can get them temporarily. But they always come back.”

To disrupt this cycle, researchers have been working on an idea called reduce and replace. First, insecticides would be used to lower the mosquito population in an area. Then, before they could bounce back, new mosquitoes that are less likely to infect people would be introduced in their place.

Many ideas are being tested to make mosquitoes that can’t spread disease. One is infecting them with bacteria called *Wolbachia*. This doesn’t kill the mosquitoes. But mosquitoes that carry it have a harder time passing viruses on to people.

Adelman’s lab is looking at ways to modify the **genes** mosquitoes carry to make them less able to spread disease. For example, mosquitoes aren’t normally affected when they pick up the virus that causes dengue fever. Adelman and his team are trying to make a mosquito that would die when exposed to the virus. This would lower the chances that infected mosquitoes bite people and spread the disease.

They’re also making sure that such gene changes would be temporary. “People want to know: What happens if these technologies don’t work out? Can you stop them? If

they’re temporary, people are much more likely to want to try them,” Adelman says.

While researchers continue to work on ways to battle mosquitoes, there are simple steps you can take to reduce bites right now. See the Wise Choices box for tips. ■

Definitions

Genes

Stretches of DNA that define characteristics like size and disease resistance.

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For more about preventing mosquito-borne diseases, see “Links” in the online article: newsinhealth.nih.gov/2024/03/battling-bites



Wise Choices Preventing Mosquito Bites

- **Cover your skin.** When outside, use long sleeves, pants, and socks to help block bites.
- **Use insect repellents when outside.** Products containing DEET, picaridin, lemon eucalyptus, IR3535, or para-menthane-diol can be sprayed directly on your skin. Follow label instructions. Products containing permethrin can be put on clothing and outdoor gear. Don’t spray permethrin directly on your skin. To find effective bug repellents, visit www.epa.gov/insect-repellents.
- **Use a fan when sitting outside.** Aim the air from a box fan at your legs when eating outside or gardening.
- **Protect your home.** Use screens on open doors and windows. Repair screens if they get holes.
- **Remove breeding grounds.** Drain puddles around your house where mosquitoes can lay eggs. Look for pots, buckets, pet bowls, gutters, lawn decorations, and other sites that hold water.
- **Get vaccinated before you travel.** Talk to your doctor before going to areas with many mosquito-borne diseases. Learn more at wwwnc.cdc.gov/travel.

The Persistence of Plastics

Can Tiny Plastic Pieces Affect Our Health?

Since their invention over a century ago, plastics have become part of our daily lives. Our food and drinks are often packaged in plastics. Plastics are also found in fabrics, toys, tools, and more. Plastic packaging can help keep medical tools and equipment germ-free. But we make and use so much plastic that plastic pollution is now a big concern.

Some plastics can be recycled. But most are thrown into landfills, where they break down over time into smaller pieces. These have seeped into our oceans and waterways, so tiny plastic bits are showing up in some seafood. And when we wash fabrics made of plastics like nylon or polyester, plastic bits can blow out of our dryers, adding to air pollution.

These tiny plastic particles, called



microplastics, are raising health concerns. Microplastics are generally smaller than a sesame seed. They can get into our bodies through the foods we eat and air we breathe.

Scientists have found microplastics in human blood, lungs, guts, and feces. They've also been seen in the placenta and breast milk. Although microplastics have been found in people, it's not yet clear if and how these plastic pieces affect our health.

"Surprisingly, even though we produce millions of tons of plastic each year, we know very little about the health effects of microplastics," says Dr. Douglas Walker, an expert in environmental health at Emory University. "This is a relatively new and active area of research. We still have much to learn."

Walker and others have long studied how exposure to many different substances in our environment can affect human health. "We know that exposure to particles in air pollution has been linked to heart and lung diseases," Walker says. Although microplastics have not been specifically implicated, these tiny plastics likely play a role.

Some researchers are focused on even smaller plastic bits, called

nanoplastics. These are too small to be seen with your eyes. Nanoplastics may pose more serious risks to human health because they're small enough to slip into the body's cells and organs. Their small size has made nanoplastics especially hard to detect and study.

Earlier this year, an NIH-supported research team developed a powerful new imaging method that could detect both micro- and nanoplastics. They

found that, on average, a liter of bottled water contained nearly a quarter-million plastic bits, mostly nanoplastics. This was up to 100 times more plastic pieces than had been seen in prior studies.

The health effects of these tiny plastics are still unclear. But scientists do know that some chemicals used in plastics manufacturing can cause problems. For instance, bisphenol A (BPA) and phthalates have been linked to various health concerns.

"There are over 10,000 chemicals used to manufacture plastics, and only a fraction of those have been studied for potential health effects," Walker says. "We're just barely scratching the surface of exposure to plastic-related chemicals."

Despite their drawbacks, Walker says, plastics remain important. "Plastics have changed how we save lives in hospitals, and they have countless other benefits. We could never completely eliminate plastic use, and we shouldn't try to."

But if you are concerned about possible health effects, Walker adds, "you can try to be mindful about your use of plastics." See the Wise Choices box for tips. ■



Wise Choices

Reduce Plastic Use

Experts recommend that we reduce, reuse, and recycle plastics.

- Pack lunch in reusable containers.
- Use glass or metal containers for food and drinks when possible.
- Choose reusable shopping bags.
- Bring old plastic bags to recycling bins at grocery stores.
- Recycle or reuse plastic packaging materials, like bubble wrap.
- Reuse plastic items that cannot be recycled in creative ways.
- Contact your local recycling office to learn what can be recycled.
- Never throw plastics into lakes, oceans, or other waterways.
- Participate in local litter clean-ups.



Web Links

For more about microplastics, see "Links" in the online article: newsinhealth.nih.gov/2024/03/persistence-plastics



Health Capsules

For links to more information, please visit our website and see these stories online.

Diabetes Drug May Reduce Colorectal Cancer Risk

People with obesity are at increased risk for type 2 diabetes and other health problems. Certain drugs that help keep diabetes symptoms in check also promote weight loss. These are called GLP-1RAs. Examples include Ozempic, Trulicity, Wegovy, and Zepbound.

People with obesity are also at higher risk for colorectal cancer. Scientists wondered whether people who take GLP-1RAs for diabetes also have a reduced risk for colorectal cancer.

To find out, researchers examined

the medical records of more than 1.2 million people with type 2 diabetes. They followed available patient records for up to 15 years. They compared the risk of colorectal cancer among people taking seven different types of drugs.

The analysis showed that people with diabetes who took GLP-1RAs had a lower risk of colorectal cancer than those taking other diabetes drugs. The protection was greatest in people with overweight or obesity. People in this group who took GLP-1RAs had a 50% lower

risk of colorectal cancer than those who took insulin to manage their diabetes. They had a 42% lower risk than those who took the common diabetes drug metformin.

“This research is critically important for reducing incidence of colorectal cancer in patients with diabetes, with or without overweight and obesity,” says Dr. Nathan Berger, who co-lead the study along with Dr. Rong Xu at Case Western Reserve University. More research is needed to confirm these results and learn more about how these drugs work. ■

Osteoporosis in Men

Osteoporosis is a condition that weakens bones. It’s often thought of as a disease that affects women since it’s more common in women than men. But men can also develop osteoporosis, especially when they reach age 65 and older.

Osteoporosis is a “silent” disease. It often has no symptoms until it is so severe that you break a bone. It is one of the major causes of bone fractures in older men. These fractures most often arise in bones of the hip, spine, and wrist, but can affect any bone.

A fracture after age 50 is an important signal that a person may have osteoporosis. Unfortunately, men are less likely than women to be evaluated for osteoporosis after a fracture. Men also are less likely to get osteoporosis treatment. But treatment strategies are the same for both men and women. These include medications and lifestyle changes.

Men and women have similar risk factors for osteoporosis. People who have chronic diseases like diabetes or rheumatoid arthritis are at increased

risk. So are those who smoke or drink too much alcohol.

You can take steps to prevent osteoporosis. Weight-bearing exercise is a great way to strengthen bones, especially if you start at a young age. Exercise can also help prevent falls that lead to fractures. Eating a well-balanced diet rich in calcium and vitamin D can help, too.

Learn more about osteoporosis in men at www.niams.nih.gov/health-topics/osteoporosis-men. ■



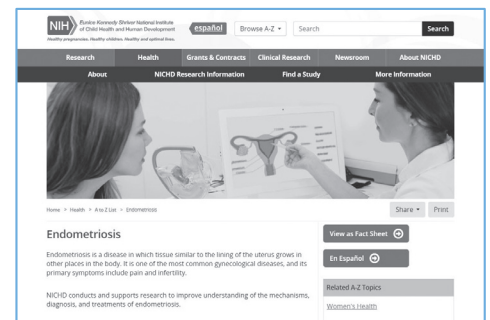
Featured Website

Endometriosis

www.nichd.nih.gov/health/topics/endometriosis

Endometriosis is one of the most common diseases of the female reproductive system. Its main symptoms include pain and infertility. It arises when tissue

similar to the lining of the uterus grows in other places in the body. There is no cure, but treatments can reduce pain and infertility.



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