

CR Consumer Reports®

- ✓ **TRUSTED RATINGS**
String Trimmers
Freezers
Dishwasher Detergents
E-Bikes
Smart Thermostats

HOW TO EAT LESS PLASTIC



You may be consuming as much as a credit card's worth of plastic a week

HOW TO LIMIT YOUR RISK

PLUS

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THE SURPRISING DATA YOUR CAR IS COLLECTING

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CR ConsumerReports™

The Costs of COVID-19
Mounting medical bills? We help you navigate financial options—whether you have health insurance or not.



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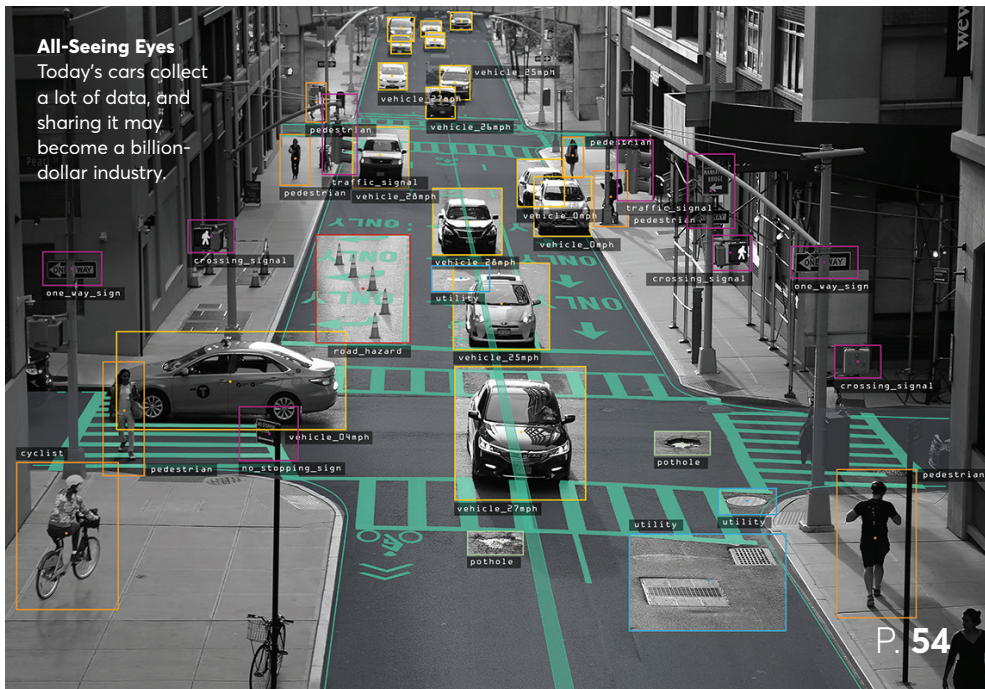
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ABOUT CONSUMER REPORTS

Consumer Reports is an independent, nonprofit organization founded in 1936 that works side by side with consumers to create a safe, fair, and transparent marketplace. To achieve our mission, we test thousands of products and services in our labs each year and survey hundreds of thousands of consumers about their experiences with products and services. We pay for all the

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In addition to our rigorous research, investigative journalism, and consumer advocacy, we work with other organizations, including media, consumer groups, research and testing consortiums, and philanthropic partners. We also license our content and data, as well as work with business partners to offer shopping and other consumer services, and may

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We rate products using these symbols:

- ❌ POOR
- 🟡 FAIR
- 🟢 GOOD
- 🟢 VERY GOOD
- 🟢 EXCELLENT

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A Path Toward Sustainability



AS ALL OF US continue to grapple with the ongoing consequences and uncertainty of COVID-19, we at CR are keeping one eye on the hazards that could threaten to similarly disrupt our lives down the road. One of the key lessons of the novel coronavirus is that we must act with urgency and fact-based planning to prepare ourselves for large-scale

challenges—including the threat of climate change.

With that in mind, we will be shining an even brighter light on how all of us can factor in sustainability when we make choices in the marketplace, by highlighting products and services that do not harm public health or the environment in their production, use, or disposal. Our cover story this month (see page 26) on the omnipresence of plastics in our environment underscores the health implications of more than 10 billion tons of plastics produced over past decades.

As we ramp up our insights and testing on sustainability, we'll be using the same rigorous, evidence-based testing and reporting that you have come to depend on from CR. Our mission has always been to ensure your well-being and safety by equipping you with the trustworthy information you need to shift the marketplace toward better outcomes for yourself and for the world.

We cannot prevent pandemics or undo all the harm that has been done to the environment, but—working together—there are steps we can take today to shape our world for the better and preserve the planet for future generations.

It took an enormous effort by the CR team while working remotely, full of resilience and dedication, to put together this issue. I hope you find it useful and relevant.

Remember to take good care of yourselves and your loved ones.

Marta L. Tellado,
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COVID Action for Consumers

WHAT'S AT STAKE

In March, Congress passed legislation to address the economic impact of the coronavirus pandemic—and more federal, state, and local initiatives to mitigate the damage are probably on the way. But we at CR believe it's vital that all efforts put people, not companies, first.

HOW CR HAS YOUR BACK

CR began working with lawmakers well before the \$2 trillion package was signed. Our goal of ensuring that all coronavirus-related legislation be guided by a core set of principles—fairness, safety, and transparency for consumers—is backed by the more than 76,000 people who signed a CR petition as of early April.

In a letter to congressional leaders, CR president Marta Tellado specifically called on Congress to protect consumers from deceptive products, scams, and abusive practices related to the pandemic; prevent surprise medical bills, including for COVID-19 treatment; provide people facing financial hardship temporary waivers for rent, mortgage, and other debt payments; prohibit utilities and internet providers from cutting off services or charging late fees during the crisis; and stop credit agencies from reporting negative data during the crisis.

The federal relief package fulfilled some, but by no means all, of CR's aims—so our advocates will continue pushing to focus government efforts on consumer hardships.

WHAT YOU CAN DO

Go to [CR.org/covid19](https://www.consumerreport.org/covid19) to learn more about protecting your physical and financial health during the outbreak. And sign our petition calling for relief that focuses on consumers, at [CR.org/peoplefirst0620](https://www.consumerreport.org/peoplefirst0620).

Safer Auto Safety Systems

WHAT'S AT STAKE

Most new cars and trucks today come equipped with high-tech features that help avoid crashes. CR recommends that buyers seek key safety features, such as automatic emergency braking with pedestrian detection, when they shop.

But we have serious concerns about other features. Tesla's Autopilot, for example, can steer, brake, and adjust speeds in certain conditions but—despite what its name implies—requires drivers to stay engaged to safely operate the car. A recent study by the Insurance Institute for Highway Safety found that such systems need improvements to ensure that drivers pay attention.

HOW CR HAS YOUR BACK

A fatal crash of a Tesla Model X

in California two years ago proves the point. A February report from the National Transportation Safety Board concluded that the car steered itself toward a highway exit ramp barrier, that the driver failed to react before the crash, and that the driver's phone was playing a video game at the time of impact.

The NTSB said in its report that Tesla has failed to address the balance between claimed autonomy and real capabilities and that the National Highway Traffic Safety Administration hasn't set standards that could prevent fatalities. So CR is calling for major improvements across the auto industry. "Manufacturers and NHTSA must make sure these driver assistance systems come with safety features that actually verify drivers are monitoring the road," says Ethan Douglas, CR senior policy analyst.

WHAT YOU CAN DO

Learn more about CR's push for better auto safety standards, at [CR.org/autosafety](https://www.consumerreport.org/autosafety).

Saying No to Toy Magnets

WHAT'S AT STAKE

Small children put all sorts of foreign objects in their mouths and, unfortunately, often end up swallowing them. Most simply pass through their digestive tracts, causing little or no harm. But doctors warn of a dangerous exception: tiny, high-powered magnets.

If a child swallows more than one of these superstrong "rare earth" magnets—which are typically sold in sets and sometimes marketed as toys—the magnets can find each other inside the body and cause severe trauma. Emergency surgery may be needed to prevent holes in the intestine, infection, and other deadly problems. The Consumer Product Safety Commission reported an estimated 2,900 emergency-room-treated cases, and one death, after ingestion of high-powered magnets from 2009 to 2013.

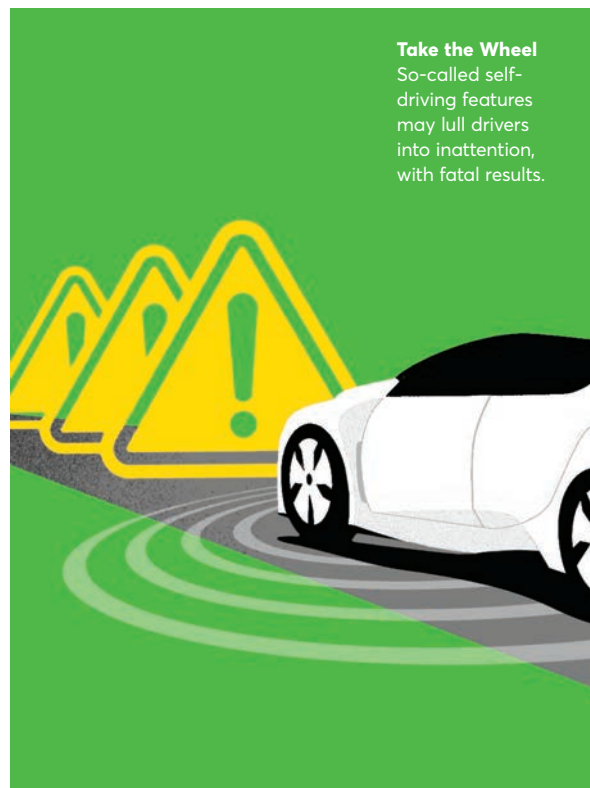
HOW CR HAS YOUR BACK

CR and other safety groups successfully pushed to limit sales of the magnets in 2014. But a company challenged the standard in court and won; the restrictions were invalidated in November 2016. Since then, annual reports of ingestion have increased sixfold, says the American Association of Poison Control Centers.

That's why doctors and consumer advocates, including CR, are endorsing a bill in Congress to ban the magnets.

WHAT YOU CAN DO

Contact your lawmakers at [congress.gov](https://www.congress.gov) and ask them to co-sponsor the Magnet Injury Prevention Act.





Our March cover story, “**Leafy Greens Safety Guide,**” which addressed rampant romaine contamination and how to protect yourself, generated a lot of discussion. Plus, fans of the annual April auto issue had lots to say.

REGARDING LEAFY GREENS: A discussion should be brought up about irradiating produce. The Food and Drug Administration has approved it for two types of leafy produce. You can argue that having the ability to prevent spoilage is an important contributor to enhancing food security. Which is worse: getting a package with a label saying it has been irradiated or getting salmonella?
—Brian Rennie, Joshua Tree, CA

EDITOR'S NOTE The FDA has approved irradiation for

spinach and iceberg lettuce. Though it doesn't necessarily eliminate all bacteria, it could kill or reduce the types of bacteria that cause foodborne illness. But it's not a substitute for proper sanitation, agriculture, and food-handling practices. What's more, there's some research to suggest that irradiation at doses high enough to have an impact would make the greens limp and soggy.

THE INFORMATION ON “How Greens Become Contaminated” lists feces, feedlots, wild birds and animals, etc., as sources of contamination. This seems to me to indicate

that “organic” greens would tend to have a higher incidence of contamination than non-organic greens.
—Gerald Robertson, Fremont, CA

EDITOR'S NOTE Raw manure, which is used for fertilizer in both organic and conventional farming, can carry bacteria that cause foodborne illness. The FDA has placed restrictions on how raw manure is used to prevent contamination. However, there are stronger regulations for organic farmers regarding the use of raw manure, which require them to follow rules aimed at minimizing contamination. For conventional growers, those same rules are only recommended.

YOUR REPORT INCREASED the concern I already had about eating these vegetables. I would be interested in alternatives to salads without the leafy greens, such as raw cucumber, tomatoes, and cauliflower. Are they safer, or subject to the same contamination sources as greens? And could they provide a comparable level of nutrients and benefits?
—John Merry, Golden, CO

EDITOR'S NOTE Yes, you can make a very nutritious salad with a variety of vegetables. Though any fresh produce can become contaminated, leafy greens have been especially implicated in recent illnesses resulting from *E. coli* outbreaks.

The best way to make the most healthy salad is to grow the ingredients yourself. Lettuces are about the easiest vegetable to grow. Check out your local county extension office or master gardener group and start being empowered with your own food!
—Bridgit Martin, McConnellsburg, PA



FAULTY PRODUCTS

YOUR EXCELLENT ARTICLE “Clause for Concern” (March 2020) [about manufacturers denying consumers the right to sue] did not mention other unconscionable aspects: 1. In court proceedings, the civil justice system provides the judges and juries. In forced arbitration, the consumer must typically pay half of the expense of the arbitrators, which can easily be \$1,000 or more. 2. In forced

WRITE

Go to [CR.org/lettertoeditor](https://www.consumerreports.org/lettertoeditor) to share your comments for publication.

arbitration, the language of the clause often requires the proceedings to be held in a major city, far from the consumer, adding even more expense to the claim.

—Wayne F. Shade, Esquire, Carlisle, PA

MOST DISTRESSING TO ME is the prevalence of arbitration clauses in the medical field. A few years ago, as I was lying on a gurney in the admitting room after a bad accident, I had to sign away my rights to a fair trial before the hospital would extend further treatment. Then when the surgeon came into the room to see me, I had to sign an arbitration agreement with him! Of course, my only option was to sign or run the risk of not receiving the procedures that I needed. This is neither right nor fair. Thank you for taking up the cause and becoming my voice in such an important issue. I'm proud to be a subscriber and a contributor to CR.

—Mike Silverberg, Lake Forest, CA

CR AND OTHER advocacy organizations should work to get Congress to amend federal arbitration legislation to establish separate rules for commercial disputes and any matter involving consumer product/service quality issues. For the latter, rules are needed (a) to establish a requirement that consumers can be bound only by an arbitration clause that each of them has expressly accepted; (b) to allow class actions in any arbitration of a consumer dispute; and (c) to require that arbitrators in consumer cases be randomly selected from a pool of available, credentialed arbitrators. Otherwise, enforcement of standard consumer arbitration clauses is just unconscionable.

—Suzy Evans, Fort Worth, TX

EDITOR'S NOTE CR is supporting the *Forced Arbitration Injustice Repeal (FAIR) Act*, legislation that would ban a company from requiring a consumer to arbitrate unless the consumer agrees to it after the dispute arises. This bill would stop companies from hiding behind a paragraph slipped into a sales or service agreement under which consumers supposedly agree to give up their legal rights voluntarily, but in fact have no power to negotiate. If you support the FAIR Act, join CR in calling for its passage at [CR.org/endorcedarbitration](https://www.consumersreport.org/).

THOUGH I SHARE your concerns about the dangers of manufacturers' increasing use of mandatory arbitration, my experience with class-action lawsuits illustrates that consumers can each receive minimal compensation while law firms reap multimillion-dollar fees.

—Louis Metzger, Natick, MA



ELECTRIC REVOLUTION

THANK YOU for the strong and thorough coverage of electric vehicles ("Your EV Questions, Answered") in the April car issue. You picked up on concerns that are in the minds of consumers and at the cusp of changes in the industry. Many state and local governments are considering infrastructure to support EVs to obtain climate and air-quality benefits, and quiet. Planners wrestle with whether EVs will truly become the mainstream, Main Street vehicle. Your



STAY INFORMED ABOUT THE CORONAVIRUS

As we went to press, daily life around the globe was being transformed as people tried to understand how to cope with the coronavirus pandemic. The resulting disease, COVID-19, is marked by respiratory problems, and symptoms can be severe, especially in older adults and those with underlying health conditions. To help keep you and your family safe, this issue has expert advice on everything from safer grocery shopping (page 12) and gas pumping (page 53) to the home cleaners that are effective at killing coronavirus (page 20). You can also check regularly for our free updates, at [CR.org/covid19](https://www.consumersreport.org/covid19).

research reveals that EVs have indeed overcome most of the hurdles. Some in my community are considering a buyers' club to help convince local planners to expedite electric infrastructure for transportation. I will share your careful, balanced EV review and articles widely.

—Dallas Burtraw, Washington, D.C.

WHY DIDN'T YOU include the MPGe for the Tesla Model 3? This is a super-important aspect of total cost of ownership. Onward and mahalo!

—Steve Parsons, Kauai, HI

EDITOR'S NOTE We focus on range—how far an EV can travel before being recharged—because that's a tangible measure that buyers can relate to, consumer research shows. MPGe is harder to grasp and inflates small differences in terms of miles per kWh. But we do include MPGe on individual car model pages at [CR.org/cars](https://www.consumersreport.org/cars).

WE WANT TO replace our all-wheel-drive (AWD) Subaru with an all-wheel-drive all-electric car. But we can't figure out who makes one.

—George Carvill, Brattleboro, VT

EDITOR'S NOTE There are a few EVs that offer AWD, but they tend to be expensive: Audi, Jaguar, and Tesla all make all-electric AWD models that cost \$60,000 and up. But slightly more affordable ones are on their way, such as the Ford Mustang Mach E.

THANK YOU for "6 Tips to Jump-Start Your Test Drive" (April 2020). My wife tested out and bought a car—only to find out that she could not make calls with the car's voice system. She had to pay an additional \$10K to get an updated stereo and other options!

—Bryan Sklar, Ft. Lauderdale, FL

What We're Testing in Our Labs ...

In our 63 labs, we continually review and rate products. Here, timely picks for this month.

Single-Dose Dishwasher Detergents

WE TESTED: 14 single-dose detergents (tablets, tabs, and pacs)

WE TEST FOR: The removal of caked-on food from dishes, water spots, and more.

ABOUT THE SCORES:

Median: 80
Range: 64-92

Best Value & Performance
Member's Mark (Sam's Club)
Ultimate Clean Pacs
10 cents per load

92
OVERALL SCORE



Made to Tackle Caked-On Food
Cascade Platinum
ActionPacs +Oxi
34 cents per load

90
OVERALL SCORE



Free of Synthetic Fragrance
Seventh Generation Ultra
Power Plus Packs
28 cents per load

83
OVERALL SCORE



18" Compact Dishwashers

WE TESTED: 5 models
WE TEST FOR: How well a model's normal cycle cleans a full load of dishes with baked-on food, how thoroughly a model dries items, noise, and more.

ABOUT THE SCORES:

Median: 65
Range: 58-71

Short Cycle Time
Whirlpool WDF518SAHM
\$825

71
OVERALL SCORE



Excellent Brand Reliability
Miele Dimension G4720SCI
\$1,500

71
OVERALL SCORE



Bargain Buy & Excellent Dry
Frigidaire FFBD1821MW
\$670

65
OVERALL SCORE



Ask Our Experts

In a pinch, can I use a laundry detergent pod in my dishwasher?



SINGLE-DOSE LAUNDRY PODS and single-dose dishwasher pacs and tablets contain surfactants, molecules that help lift soil off surfaces. "They look similar enough," says Joe Pacella, a test technician manager at CR. "But laundry pods don't have the enzymes found in dishwasher pacs that actively target crusted food." What's more, laundry detergents may also contain brighteners, fragrances, stain removers, and other chemicals that can leave residue on your dishes. Plus, laundry detergents create more suds than dish detergents, which can block water spray getting to your dishes and may even damage your dishwasher. So in short: Don't do it.

ILLUSTRATION: SERGE BLOCH

For the latest ratings of these and other product categories, readers with a Digital or All-Access membership can go to CR.org.

Freezers Under \$600

WE TESTED: 22 models
WE TEST FOR: Temperature uniformity, thermostat control, energy efficiency, usable capacity, and more.

ABOUT THE SCORES:

UPRIGHT

Median: 59. Range: 37-82

CHEST

Median: 77. Range: 37-89

Top-Notch Chest Freezer (Manual Defrost)
 GE FCM11PHWW
 (34Hx51Wx27D)
 \$540

89

OVERALL SCORE



Cool Price (Manual Defrost)
 Frigidaire FFFU06M1TW
 (56Hx22Wx22D)
 \$360

69

OVERALL SCORE



More Storage & Self-Defrost
 Whirlpool WZF34X16DW
 (61Hx30Wx30D)
 \$580

63

OVERALL SCORE



Innerspring Mattresses

WE TESTED: 86 models
WE TEST FOR: A model's support for petite, average, and large/tall side sleepers and back sleepers; durability; firmness; and more.

ABOUT THE SCORES:

Median: 71

Range: 43-85

A Dream for All Sleep Styles
 Ethan Allen EA Signature
 Platinum Plush
 \$3,000

83

OVERALL SCORE



Best ZZZ's for Your Buck
 Beautyrest BR-800 12"
 Medium-Firm
 \$770

80

OVERALL SCORE



On the Softer Side But Still Supportive
 Sealy Posturepedic
 Performance Copper II
 \$1,550

78

OVERALL SCORE



Smart Thermostats

WE TESTED: 27 models
WE TEST FOR: Smart features, including messaging, learning, occupancy sensing, and more; ease of controlling a model manually, including scheduling; and more.

ABOUT THE SCORES:

Median: 56

Range: 28-83

Excellent Smart Features
 Nest Learning Thermostat
 \$250

83

OVERALL SCORE



Easy-to-Use Interface
 Ecobee Smart With Voice
 Control EB-STATe5-01
 \$250

73

OVERALL SCORE



Budget-Friendly Buy
 Honeywell Home T9
 RCHT9510WF
 \$170

73

OVERALL SCORE



Video Doorbells

WE TESTED: 22 models
WE TEST FOR: Video quality in regular and low light, audio quality, and response time between motion capture and speaking to a visitor. We also assess smart features.

ABOUT THE SCORES:

Median: 46

Range: 16-88

Quick Response Time
 Nest Hello Video Doorbell
 \$230

88

OVERALL SCORE



Excellent Video Quality
 Wisenet SmartCam D1
 \$230

76

OVERALL SCORE



Nice Price
 Eufy T8200
 \$160

74

OVERALL SCORE



Note: We rate different products according to different testing protocols; as a result, Overall Scores of one product category are not comparable with another.

COMING NEXT MONTH **Blenders**



Is there a risk of COVID-19 exposure from bringing groceries into my house?

The risk of becoming infected with the novel coronavirus from your groceries—whether you pick them up yourself or have them delivered—is considered low if you practice good hygiene when handling them, says James E. Rogers, Ph.D., CR’s director of food safety research and testing. That means washing your hands for at least 20 seconds with soap and water after putting away all packaging, including porous containers, such as paper boxes and bags. Then, after opening the containers, wash your hands again before preparing any food. “But if you use a pasta box a few days after you get it, there is little likelihood that the virus could still be live on the box and cause an infection,” says Eike Steinmann, Ph.D., a

virologist at Ruhr-Universität Bochum in Germany who has studied how long coronaviruses live on different surfaces. Still, it can’t hurt to wipe down nonporous grocery containers (plastic, glass, and metal) with disinfectant wipes before putting them away.

The good news: There’s no current evidence of food-to-person transfer of the virus, whether food is cooked or raw. Still, it’s always a good idea to rinse fruits and vegetables to help remove adherent dirt and possible pesticides. Scrub hard-skinned produce, such as potatoes and apples, with a soft-bristled vegetable brush under plain running water. To reduce the level of harmful bacteria, such as *E. coli*, on leafy greens, soak them in vinegar or a vinegar-water solution for 10 to 15 minutes, then rinse thoroughly.

Are washers with a steam setting better at cleaning?

Many manufacturers of front-loader washing machines and

some HE top-loaders now offer a setting (Electrolux’s Perfect Steam and Maytag’s Steam for Stains, for example) that adds hot steam to certain wash cycles, with the goal of improving stain removal.

To evaluate how steam affects cleaning performance, we tested five front-loaders from brands in our lab, as well as one HE top-loader and an agitator washer. (Steam features are rare on agitator washers, which is why we tested only one of that type.) We ran our usual washer performance tests, which include evaluating five hard-to-remove stains before and after a wash cycle. We then repeated each test, adding the washers’ steam options.

The results? “The steam didn’t improve stain removal in our cleaning tests,” says Rich Handel, who tests washers for CR. “But it did cause most of the seven machines to use more water than usual, and all of them used more energy.” One washer’s steam option upped water consumption by 18 gallons and increased energy usage by almost 600 percent. Cycle times also were extended substantially on certain models.

Instead of focusing on washers that offer a steam

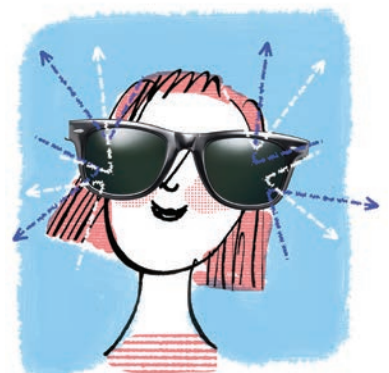
option, pick a washer that fits your budget and performs well in our tests. All-Access and Digital members can go to [CR.org/washers0620](https://www.consumerreports.org/washers0620) for full ratings. For more laundry tips, see page 19.

Polarized sunglasses will protect my eyes, right?

Polarized lenses can help you see better on bright days, thanks to the light-blocking filters they contain. They do this by reducing glare caused by light reflecting off a shiny horizontal surface, such as the ocean or a snowy field.

But on its own, polarization won’t shield your eyes from the sun’s ultraviolet (UV) rays, which have been linked to vision problems such as cataracts, macular degeneration, and even cancerous growths. So be sure any polarized pair you are interested in also has a UV protection label, says Scott Brodie, M.D., Ph.D., professor of ophthalmology at NYU Langone Health in New York City. The American Academy of Ophthalmology recommends sunglasses that block UVA and UVB light as completely as possible, which will be labeled “100 percent UV protection” or “UV400.”

For a history of CR’s reporting and testing of glasses, see *Time Traveler*, on page 14.



We have more than 140 in-house experts who research, test, and compare. Submit your questions at [CR.org/askourexperts](https://www.consumerreports.org/askourexperts) ... and watch for the answers.

CR Insights



Nakto Fashion
\$600

- 1 RANGE
- 2 BRAKING
- 3 ACCELERATION
- 1 CONTROL RESPONSE
- 2 HILL CLIMB
- 1 UNASSISTED HILL CLIMB
- 2 UNASSISTED CRUISING



Electra Townie Go! 7D
\$1,500

- 1 RANGE
- 2 BRAKING
- 3 ACCELERATION
- 1 CONTROL RESPONSE
- 2 HILL CLIMB
- 3 UNASSISTED HILL CLIMB
- 2 UNASSISTED CRUISING



Jetson Adventure
\$1,300

- 1 RANGE
- 2 BRAKING
- 3 ACCELERATION
- 2 CONTROL RESPONSE
- 3 HILL CLIMB
- 2 UNASSISTED HILL CLIMB
- 3 UNASSISTED CRUISING



RadRunner Electric Utility Bike
\$1,300

- 3 RANGE
- 2 BRAKING
- 3 ACCELERATION
- 1 CONTROL RESPONSE
- 2 HILL CLIMB
- 2 UNASSISTED HILL CLIMB
- 3 UNASSISTED CRUISING

IN THE KNOW

IS AN E-BIKE RIGHT FOR YOU?

ON AN ELECTRIC bike, a rider can glide uphill without breaking a sweat: Either a battery-powered pedal assist will kick in, or you can activate the throttle for a boost (by twisting or pushing a mechanism on the handlebars).

It's little wonder, then, that the sales of e-bikes in the U.S. grew more than eightfold between 2014 and 2017 and consumer curiosity is on the rise—despite their high prices.

We evaluated a slice of the wide variety of e-bikes, riding five models (ranging from \$600 to \$2,600) around a hilly loop course on CR's test grounds. "The first thing to consider is how far an e-bike can go on a single charge," says Bernie Deitrick, who leads CR's e-bike testing. In our test, all went between 15 and 30 miles before

running out of juice. When the battery's charge drains, an e-bike works like any other bicycle—powered solely by your pedaling. But e-bikes tend to be heavy; some we tested were almost unrideable when the battery was fully spent—so investigate how a bike rides without assistance.

And don't forget safety: On average, e-bike riders go about 3 mph faster than traditional riders. All cyclists, regardless of bike type, need a properly fitted helmet. (Turn to page 14 for more on helmet safety.)

ILLUSTRATIONS: RODRIGO DAMATI

HOW PROCESSED IS IT?

GRAPE PRODUCTS



1. GRAPES

Unlike many kinds of fruit, grapes are picked when they're fully ripe because they don't become any sweeter after harvest. Then they're hand-packed right away (sometimes even in the field) to go to market. A 1/2 cup (about 15 grapes) has 12 grams of natural sugars and less than 1 gram of fiber, though they're still a healthful whole food. They supply some vitamin K and

potassium, along with antioxidants that protect against cell damage and help reduce the risk of heart disease and other diseases.

2. RAISINS

Dehydrated grapes, raisins are minimally processed and generally don't contain added sugars or preservatives (although yellow raisins may have sulfur dioxide). Drying concentrates many of the good nutrients in grapes, so they're

a healthy option. But keep in mind that the calories and natural sugars also get condensed—1/4 cup has 108 calories and 29 grams of natural sugars.

3. GRAPE JAM

Jam may sound healthier than jelly, but nutritionally, there's not much difference between them. Jam contains fruit, and jelly is made with grape juice, but both often have added sugars—sometimes in the

form of high-fructose corn syrup—making these spreads the most processed of the three grape foods shown here. Two tablespoons of Smucker's jam has about 26 grams of sugars (18 of them added), 100 calories, and no fiber. All-fruit spreads are sweetened only with fruit juice and may have fewer sugars, but sugars contributed by juice still count as added sugars.

HOW DOES IT WORK?

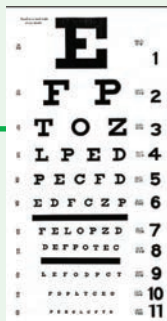
BIKE HELMET SAFETY



MIPS

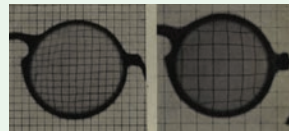
MIPS allows the helmet to move by 10 to 15 millimeters during a crash, which helps reduce the rotational energy transmitted to the brain.

CR Time Traveler EYEWEAR



1937 The Ray-Ban Aviator makes its debut in stores—with a metal teardrop-shaped frame and anti-glare green lenses, originally developed to protect the eyes of U.S. Air Force pilots while flying.

1862 The Dutch ophthalmologist Herman Snellen invents the Snellen eye chart to measure visual acuity—the basis for the chart that's still found in eye doctor offices today.



1938 As Hollywood helps make dark sunglasses more popular, roughly 20,000,000 pairs are sold in the U.S. But of the 39 pairs CR tests, 10 are rejected outright for poor quality.

1951 We test a new heavily advertised product called Lazy Lenses: modified eyeglass frames that give you right-angle vision for easy reading while you lie flat on your back. Our testers find them "far more annoying than relaxing."



THERE ARE a number of helmet technologies that work in different ways to achieve the same safety goal during an impact: reducing the rotational force on a rider's head that can contribute to concussions.

“Rotational motion is what correlates to how much the brain moves inside the skull,” says Steve Rowson, Ph.D., director of Virginia Tech’s

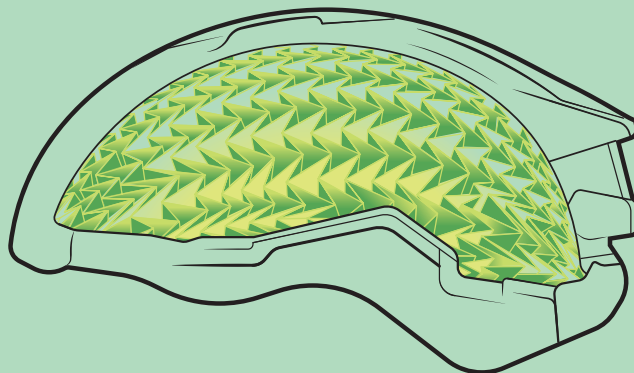
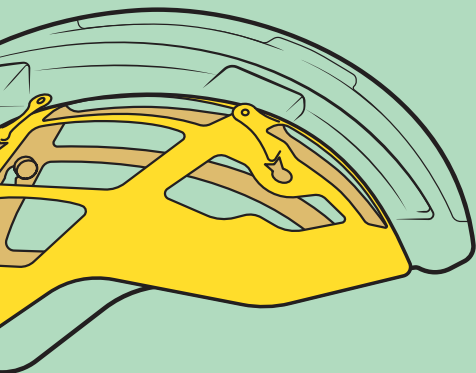
Helmet Lab. “If you can reduce the rotation of the head during impact, that reduces the strain or stretching of the brain, and that reduces the likelihood of injury.”

First introduced in cycling helmets in 2010, the MIPS Brain Protection System works by allowing the outer layer of the helmet to move slightly, deflecting some rotational force during

an impact. But recent developments have led to a new material called WaveCel, placed as a layer inside the helmet that will crumple, glide, and flex in a crash.

Though our labs don’t test the efficacy of anti-rotational force technology, we do “impact absorption testing,” which includes dropping the helmets at approximately 14 mph onto a

flat anvil and measuring the impact. Helmets made with each technology type rated Excellent in our impact tests. Additionally, some MIPS models rated Very Good. One difference we found between the two: The WaveCel helmets we tested don’t ventilate as well as top-scoring MIPS models. (See the similarly priced MIPS and WaveCel helmets, below.)



✓ **Bell Stratus**
MIPS \$150

81

OVERALL SCORE

IMPACT ABSORPTION

VENTILATION

WAVECEL

During a crash, the WaveCel layer in a helmet is designed to flex, crumple, and glide, absorbing rotational energy.



✓ **Bontrager Specter**
WaveCel \$150

74

OVERALL SCORE

IMPACT ABSORPTION

VENTILATION



1971 Roughly 75 million Americans wear prescription glasses with untreated glass lenses that can shatter. The Food and Drug Administration rules that all new lenses must be shatter-proof.



1972 Of the 750,000 Americans who buy hard contact lenses each year, half revert to glasses—so newly invented soft plastic contacts cause a stir. But our cover story notes their contamination risks.

1989 Gholam A. Peyman, M.D., ophthalmologist and retina surgeon, patents LASIK, an eye surgery that corrects vision.



2010 Warby Parker, a direct-to-consumer eyeglass company, is co-founded by four men (including Neil Blumenthal and David Gilboa, above) after one founder lost his glasses and balked at the replacement cost.

2020 The results from last year’s member survey are in: Of the 33 eyeglass retailers and 17 contact lens retailers we rated, Costco Optical gets our top overall satisfaction rating for both.

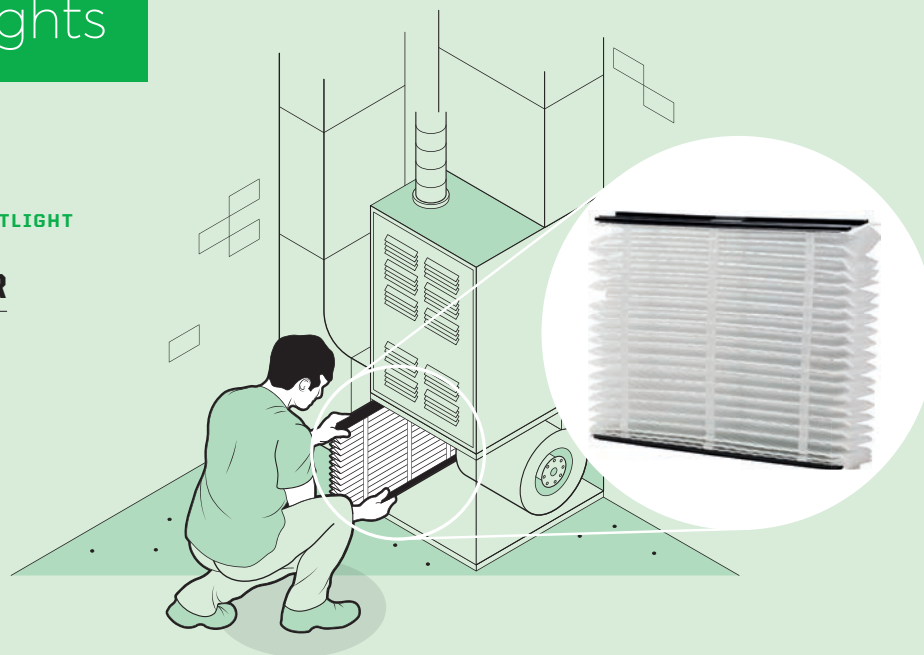


89/93 OVERALL SATISFACTION

EYEGLASSES/CONTACT LENSES

PRODUCT SPOTLIGHT

A BETTER HVAC FILTER



FIRST-PLACE FILTER

✓ **Aprilaire Healthy Home 213**
MERV 13 \$41

75 OVERALL SCORE

HIDDEN AWAY in your basement or attic, your HVAC system needs an air filter to keep your central air conditioner (and furnace) humming along by protecting the mechanicals from dust and debris. The best filters also trap indoor pollutants, such as dust, pet dander, and pollen, helping to clean the air in your home.

In CR's tests, we gauge

how well an air filter removes pollutants from the air and how freely air flows through the filter at all fan speeds.

"Thicker filters—those that are 4 or 5 inches—perform better in our tests, and we found that you don't have to replace them as often," says Dave Trezza, who oversees CR's air filter tests. But not every HVAC system can accommodate that

thickness; the most common size is 1 inch thick. If that's the size you need, the Filtrete 1900 model (below) is your best bet. Steer clear of the Filtrete 600 Dust & Pollen (\$9, not listed), which got a Poor Overall Score.

As you shop, pay attention to the filtering grade given by the manufacturer. The most commonly used system applies a MERV number

(minimum efficiency reporting value) to each filter. But 3M and Home Depot have each developed their own systems, called MPR (microparticle performance rating) and FPR (filter performance rating), respectively. "No matter the grading system, the higher the number, the better the filter should be at getting rid of air pollutants," Trezza says.



	Aprilaire Healthy Home 213 MERV 13	Aprilaire Allergy & Asthma 215	Lennox Healthy Climate Carbon Clean 15	Filtrete Healthy Living Ultra Allergen 14 MPR1550	Carrier EZ Flex Filter Cabinet	Filtrete 1900 Maximum Allergen Reduction	3M Filtrete 2500 Smart Premium Allergen Ultra Fine Particles S-EAX22DC-5	3M Filtrete 1900 Smart Premium Allergen, Bacteria & Virus	Honeywell F4401D03	Filtrete Ultra Allergen Reduction 1500 MPR
OVERALL SCORE	75	74	70	70	68	68	66	65	65	63
PRICE	\$41	\$92	\$100	\$29	\$64	\$20	\$30	\$25	\$40	\$17
DUST/POLLEN/SMOKE REMOVAL	HIGH: ⬆️ LOW: ⬆️	HIGH: ⬆️ LOW: ⬆️	HIGH: ⬆️ LOW: ⬆️	HIGH: ⬆️ LOW: ⬆️	HIGH: ⬆️ LOW: ⬆️	HIGH: ⬆️ LOW: ⬆️	HIGH: ⬆️ LOW: ⬆️	HIGH: ⬆️ LOW: ⬆️	HIGH: ⬆️ LOW: ⬆️	HIGH: ⬆️ LOW: ⬆️
AIRFLOW RESISTANCE	⬆️	⬆️	⬆️	⬆️	⬆️	⬆️	⬆️	⬆️	⬆️	⬆️
ANNUAL COST	\$41	\$184	\$100	\$29	\$128	\$80	\$60	\$50	\$40	\$68
THICKNESS (IN.)	4	4	5	4	5	1	1	1	1/4,5	1

HOW WE TEST: Overall Score is based on the performance of the model in all of our tests. Our

labs evaluate **Dust/pollen/smoke removal** by judging how well a model clears the air of fine clay dust and

cigarette smoke with high and low airflow. Our test for **Airflow resistance** reflects how freely air

flows through a unit. (Filters that restrict airflow make the fan work harder and reduce efficiency.)

CR SMART SOLUTION

FREE CONFERENCING APPS

DUE TO COVID-19, many Americans are hunkered down indoors, looking for ways to easily connect with others virtually. Before paying for pricey services, our experts suggest trying these free tools. Just be aware of how it may impinge on your privacy: All services collect personal data from hosts (and some collect data from participants, too), which can include recordings, transcripts, and names of people on the call, and might be shared with third parties.

CISCO WEBEX PERSONAL

In the free tier, meetings can run as long as you want and include as many as 100 participants.

GOOGLE HANGOUTS MEET

Anyone with a Gmail or G Suite account can host this service. In its basic free form, there's no limit on the duration of meetings and currently allows up to 250 people on video conferences through September 2020.

MICROSOFT TEAMS

Microsoft has introduced a new service called Microsoft Teams. The free version offers unlimited chat, as well as up to 50 people on a video conference call.

ZOOM BASIC

This free tier offers an unlimited number of meetings and up to 100 participants but caps each at 40 minutes. One-on-one calls, however, have no time limit.

For more privacy info and updates, go to CR.org/meet0620.

FACE-OFF

WHICH EARBUDS ARE BEST?

Apple AirPods are among the best-selling earphones of all time. They're simple to use, sync easily with other Apple products, and come with appealing features. But despite their success, our tests of dozens of true wireless earphones (those with no physical connection between the two earpieces) show that AirPods are just middling when it comes to sound quality: The bass lacks depth and detail, and the midrange is a bit thin and gets somewhat congested during passages with lots of instruments.

We compared AirPods head-to-head with Samsung Galaxy Buds. Our experts note that the bass, midrange, and treble are more evenly balanced in the Galaxy Buds, and the overall sound is clearer and a bit livelier than in the AirPods. In fact, the Galaxy Buds are among the best-scoring Bluetooth headphones we've ever tested. Try them yourself: We think you don't have to be an audio pro to hear the difference. What's more, they're \$70 lower in price, and still generally easy to pair (yes, even with Apple products) and use.



Apple AirPods (2nd Gen.) with Wireless Charging Case

56

OVERALL SCORE

\$200

PRICE

\$130

1

SOUND QUALITY

2

NON-ISOLATING

DESIGN

ISOLATING

5 HOURS

CLAIMED BATTERY LIFE

6 HOURS

NO

INTEGRATED VOLUME CONTROL

YES



Samsung Galaxy Buds

86



RECALL ALERT

HONDA PORTABLE GENERATORS



Honda has recalled about 340,000 inverter generators because they can short-circuit, causing them to smoke and potentially catch fire, posing burn hazards. Honda says the reported problems are predominantly from generators used on ocean-going vessels and in coastal regions, where they might be affected by salt air. The recall includes EB2200i, EU2200i, EU2200i Camo, and EU2200i

Companion models. The generators were sold at authorized Honda Power Equipment Dealers, Home Depot, and other home improvement stores and online from February 2018 through January 2020 for \$1,100 to \$1,300.

What to do: Call American Honda at 888-888-3139 or go to powerequipment.honda.com and click on "Recalls and Updates" for more info about a free repair.

SAFETY UPDATE

**PROTECT
YOURSELF AND
OTHERS FROM
CORONAVIRUS**



The novel coronavirus quickly spread around the globe, turning into a pandemic. The virus can lead to COVID-19, a disease marked by respiratory problems that are usually mild (coughing, fever) but can become severe (pneumonia, organ failure), especially in older adults and people with underlying health conditions. One of the best ways to protect yourself is by social distancing (avoid gatherings, stay home as much as possible, and keep 6 feet away from others when you do have to go out). You should also wash your hands thoroughly and frequently, and use a hand sanitizer that's at least 60 percent alcohol when you can't get to a sink. Here are some additional ways to stay safe.

**SANITIZE YOUR
SMARTPHONE (WITHOUT
DAMAGING IT).**

Research suggests that the novel coronavirus may survive on surfaces for hours or even days. So if you touch your phone constantly (as so many of us do), you'll need more than the usual microfiber cloth to clean it.

For Apple and Google phones, power down your device, then use a wipe with 70 percent isopropyl alcohol to gently clean it. (Apple says that Clorox

Disinfecting Wipes are also safe to use.) Clean screen protectors with plain old soap and water, being careful not to get any moisture into the open ports. You can remove protective cases and wash them with soap and water, too. Just be sure to dry them completely. Avoid using bleach on smartphones, and never submerge your device in any other cleaning agents.

**CLEAN 'HIGH-TRAFFIC'
AREAS, I.E., THOSE
FREQUENTLY TOUCHED.**

Clean the areas in your home that are touched frequently, such as doorknobs, kitchen counters, and bathroom faucets—especially if someone in your household is sick. Disinfect them at least once daily with a product that kills viruses, such as a diluted bleach solution, or an alcohol solution with at least 70 percent alcohol. (To read more about virus-killing household cleaners, see “Cleaning Products That Destroy Coronavirus,” on page 20.) And don't forget to disinfect the remote control, too—but take the batteries out first.

**CARRY A PACK OF
SINGLE-USE TISSUES.**

As the weather gets warmer, wearing gloves when you're out in public spaces can be sticky and uncomfortable. If you don't have hand sanitizer (some stores in the U.S. are in short supply), use a tissue to open a door or grab a handrail, suggests Karen Hoffmann, R.N., an infection prevention specialist at the University of North Carolina's School of Medicine in Chapel Hill and immediate past president of the Association for Professionals in Infection Control and Epidemiology. Then toss it.



PRACTICE SAFER FOOD SHOPPING.

“For older people and those with underlying health conditions, I would strongly suggest asking someone to shop for you or using a grocery delivery service,” says James E. Rogers, Ph.D., CR’s director of food safety research and testing. When deliveries arrive, avoid a direct hand-off, and tip electronically. Many companies have places on their order forms for you to leave special delivery instructions. Ask for the items to be left at your doorstep.

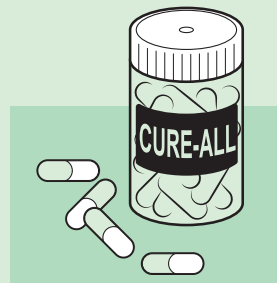
If you’re going to shop in a store, plan on doing a big shop so that you can limit your trips, and pick an off-peak time by going online and typing the store’s name and location in a Google search. A box will often appear showing when foot traffic there is lowest. And many stores are setting aside special hours for shoppers 60 and older and those with respiratory problems or other health conditions in an effort to help them shop in a less crowded environment.

No matter which store you visit or what time you go, make sure to take sanitizer with you to clean your hands and wipes to disinfect your cart before and after you shop. You can also bring a rubber-tipped pen to sign screens at checkout.

SKIP ANTIBACTERIAL SOAP FOR HAND-WASHING.

Antibacterial soaps target bacteria, and the novel coronavirus is a virus. So an antibacterial soap is unnecessary. In fact, the Centers for Disease Control and Prevention (CDC) doesn’t recommend that consumers use soaps with antibacterial ingredients even to reduce the risk of bacterial infections, noting that research shows they offer no added benefit compared with plain soap.

Rubbing your hands together with plain soap and water for at least 20 seconds is extremely effective at removing germs—whether that’s dirt, a bacterial cell, or a virus particle—but soap doesn’t kill them on contact; it washes them away. “The surfactants in soap lift up and break apart dirt and microbes from your skin,” explains Don Schaffner, Ph.D., a microbiologist and distinguished professor at Rutgers University. “And the friction of rubbing your hands together helps remove the particles so they get washed down the drain.”



BEWARE OF FALSE PRODUCTS AND PHISHING SCAMS.

“Con artists love to take advantage of new health

scars to cash in on the public’s anxiety,” says Chuck Bell, programs director for CR’s advocacy division. CR found a number of questionable products being sold online with claims that they help fight or even prevent COVID-19, including “protective hats.” And with more people working from home, cybercriminals eager to gain access to corporate computer systems are on the prowl. Some email letters that may appear to be from the World Health Organization (WHO) or the CDC claim to offer new information about the virus. Some emails hint at the availability of a vaccine, and others claim to be from charitable organizations looking to raise money for people with the disease. Consumers need to be vigilant and use common sense before clicking on email links about the coronavirus pandemic. If a claim sounds too good to be true, it probably is.

DO LAUNDRY IN WARM WATER.

Experts don’t currently have data on how long the new coronavirus can remain on clothes and other fabric, but it can last on other surfaces such as cardboard or plastic for hours or even days. Wash potentially contaminated clothes and linens as usual, but use “the warmest appropriate water setting for the items, and dry items completely,” the CDC says.

The CDC doesn’t recommend using a specific detergent plus bleach, but the International Scientific Forum on Home Hygiene states that bleach may help inactivate viral microbes in the wash. So if you’re washing whites and light colors, you may want to

add bleach to the load. Or you could use a detergent that contains a color-safe bleach if it’s appropriate for the items you’re washing.

Also, while more research is needed to determine what temperature might inactivate the virus, Schaffner explains that the entire washing process should rid fabrics of the coronavirus. He says it’s the combination of detergent, warm water, and physical agitation in the rinse and spin cycles that removes, inactivates, and washes away viral microbes.

Once the washing is done, use a dryer rather than air-drying clothes because the heat may also help inactivate any viral microbes. Plus, dry fabrics are less likely to transfer germs than wet ones. If you go to a laundromat, stay at least 6 feet away from anyone else, and disinfect handles before you touch the machines.



STAY INFORMED.

While the information in this article was the most current available at press time, you should check [CR.org/covid19](https://www.crisisresponse.org/covid19) frequently for updated news and more advice from experts. CR members can also add their email address to their membership account at [CR.org/connect](https://www.crisisresponse.org/connect) to receive important account notices and updates from CR, including the latest on the coronavirus. You should also consult [coronavirus.gov](https://www.cdc.gov) for updates and guidance from the CDC.

PRODUCT SPOTLIGHT

CLEANING PRODUCTS THAT DESTROY CORONAVIRUS



THE CORONAVIRUS is one of the easiest types of virus to kill if you have the appropriate product, according to the Environmental Protection Agency (EPA). “It has an envelope around it that allows it to merge with other cells to infect them,” says Stephen Thomas, M.D., chief of infectious diseases and director of global health at SUNY Upstate Medical University in Syracuse. “If you disrupt that coating, the virus can’t do its job.” Soap and water is one effective way to break that protective envelope. But there are other products you may already have at home or can buy from a store that will kill the virus.

BLEACH

The Centers for Disease Control and Prevention (CDC) recommends a diluted solution for virus disinfection (½ cup of bleach per 1 gallon of water, or 4 teaspoons of bleach per 1 quart of water). Wear gloves while using bleach, and never mix it with anything—especially ammonia—except water. (The exception is when doing laundry, when bleach can be added with detergent.) “Bleach works great

against viruses,” says Richard Sachleben, a retired organic chemist and member of the American Chemical Society. Just don’t keep the solution for longer than a few days, because bleach will degrade certain plastic containers.

Bleach can also corrode metal over time, so Sachleben recommends not getting in the habit of cleaning faucets and stainless steel products with it. Because bleach is too harsh for many countertops as well, you should rinse surfaces with water after disinfecting with it to prevent discoloration or other damage.

HYDROGEN PEROXIDE

According to the CDC, household hydrogen peroxide (3 percent) is effective in deactivating rhinovirus, the virus that causes the common cold, within 6 to 8 minutes of exposure. It’s also effective at destroying the coronavirus, and should even be able to break it down in less time. Pour it undiluted into a spray bottle and spray it on the surface to be cleaned, letting it sit for at least 1 minute.

Hydrogen peroxide won’t corrode metal surfaces such as faucets and handles. But

like bleach, it can discolor fabric if you get it on your clothes. “It’s great for getting into hard-to-reach crevices,” Sachleben says. “You can pour it on the area and you don’t have to wipe it off because it essentially decomposes into oxygen and water.”

ISOPROPYL ALCOHOL

Alcohol solutions with at least 70 percent alcohol are effective against the virus; just don’t dilute them. Alcohol is generally safe for all surfaces but can discolor some plastics, Sachleben says. Alcoholic spirits like vodka are high-proof but don’t contain enough ethyl alcohol (also an effective disinfectant) to kill the virus. And vinegar, though fine as a general cleaner in some cases, hasn’t been proved effective against the coronavirus either.

STORE-BOUGHT OPTIONS

Ordinary household cleaners like soap and hydrogen peroxide are preferred for general cleaning, but if you already have a store-bought disinfectant or want to buy one, you can find out if it will

be effective by looking for the product’s registration number from the EPA, found on the label. Just look for the words “EPA Reg. No.” followed by a number with a dash. Then go to epa.gov to see if the number is included on List N: Disinfectants for Use Against SARS-CoV-2. If it is, the product can be used against the novel coronavirus. (This list includes only EPA-registered surface disinfectants, not hand sanitizers, which are regulated by the Food and Drug Administration.)

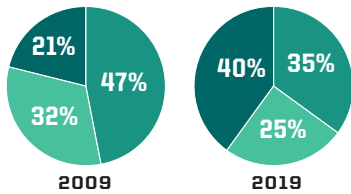
“Products may be marketed and sold under different brand names, but if they have the same EPA registration number, they are related products,” the EPA notes. “If a product doesn’t have an EPA registration number, then the EPA has not reviewed any data on whether the product will kill public health pathogens such as viruses.”

Many of these products contain strong chemicals that can exacerbate asthma and allergies, especially in children, so CR recommends using them only when kids are in another room.

EPA-registered products on List N that can kill the coronavirus include Clorox Multi-Surface Cleaner + Bleach (5813-105), Lysol Max Cover Disinfectant Mist (777-127), and CleanSmart (89896-2).

Battery-powered string trimmers gain in market share

■ BATTERY ■ GAS ■ CORDED



Source: Estimated breakdown from TTI.

PRODUCT UPDATE

THE LATEST RATINGS FROM OUR LABS

How to Weed Whack Like a Pro

Our expert testing reveals which string trimmers make the cut. **by Paul Hope**

Back row, from left:

✓ HUSQVARNA 322L \$250

BOLENS BL110 \$70

✓ RYOBI RY41135 \$70

✓ ECHO CDST-58V2AH \$230

✓ EGO ST1521S \$230

74

63

77

84

89



INSIDE CR'S LABS

Misha Kollontai, the CR tester for string trimmers, holds a top-performing battery-powered EGO model.



NO MATTER HOW great your lawn mower is at cutting grass, it just can't get to tough spots like those around your mailbox post or patio edge. For that you need a string trimmer, also known as a weed whacker. These tools are key to giving your property that coveted manicured look. In fact, they're the No. 1-selling outdoor power equipment, with an estimated 12 million units sold in 2019, according to TTI, a leading manufacturer of outdoor power equipment.

When you see dozens lined up side by side in a store, string trimmers can look very similar, but CR experts have found that their performance is anything but. Our testers have spent hundreds of hours blazing through tall grass and weeds, sizing up how well they trim and timing how long each model takes to cut through 80 square feet of grass. "Through that rigorous process we routinely find huge disparities between models, especially when cutting tall grass and weeds," says Misha Kollontai, CR's test engineer for string trimmers.

Three Types of Trimmers

String trimmers fall into three categories: gas-powered, battery-powered, and corded electrics. Each has advantages and limitations. "Battery-powered trimmers now make up the biggest share of the market because they're easy to use, and the better ones match the performance of gas tools," says Courtney Pennicooke, CR's market analyst for string trimmers. Even though gas is still perceived as being more powerful, our tests show that the performance of electrics is often on a par with gas and in some cases better. Here's what to consider.

Gas-Powered

BEST FOR: Large yards
NOISE LEVEL: Loud, typically exceeding 85 decibels at the operator's ear
MAINTENANCE: These models need the most TLC. Most run on a mix of gas and

oil, so you'll need to make fuel in the correct proportions (see your owner's manual) or purchase premixed fuel. You'll also need to replace the fuel filter and spark plug periodically, and the string as needed.

WHAT TO EXPECT: Gas trimmers tend to pack plenty of power, and every single straight-shaft gas trimmer in our ratings earns a Good or better in all of our performance tests. They can run indefinitely as long as you keep refueling, so they're ideal for large properties and/or yards with tall grass and weeds, where a battery trimmer would need to be recharged.

Gas models come in two styles: straight (which make up a majority of new gas trimmers) and curved (mostly offered on less expensive models). "A curved shaft can help the user to nimbly trim around obstacles and in hard-to-reach spots," says Kollontai, and shorter people may find them easier to maneuver. That said, our testing shows that curved trimmers lag behind nearly all of the straight-shaft trimmers in performance: None did well enough in our tests to be recommended. And in our first-ever member survey on string trimmers, a majority of curved gas trimmer brands, including major players like Bolens, Ryobi, and Troy-Bilt, received a Poor rating for owner satisfaction and only a Fair for reliability. Perhaps this explains why they're starting to disappear from the market.

If you're about 5 feet, 4 inches tall or shorter, our experts suggest that you look for a straight-shaft model with an adjustable handle that can be moved farther down the shaft toward the head to help balance the weight and make it more manageable.

Battery-Powered

BEST FOR: Small and medium-sized yards
NOISE LEVEL: Moderate
MAINTENANCE: Store the battery indoors during the winter, and

replace the string as needed.

WHAT TO EXPECT: Call them the Goldilocks of string trimmers. These tools split the difference between gas-powered and corded electric trimmers. They're quieter than gas models, require almost no maintenance, and start instantly. And unlike corded models, you can roam freely. You may be surprised to learn that many match the performance of their gas counterparts. Plus, battery-powered trimmers are generally the most reliable type in our ratings and earn the highest owner satisfaction marks.

While these trimmers can handle yards of any size, bear in mind that if you've got lots of grass, you'll probably need to recharge the battery for more run time. Most last about 15 to 35 minutes on a charge, but you can buy a second battery to have at the ready (usually \$100 or more). Or if you already own another battery-powered outdoor tool, "buy a string trimmer from the same brand," says Kollontai. "Chainsaws, lawn mowers, leaf blowers, and string trimmers from the same company typically have interchangeable batteries that can be swapped between them."

Corded Electric

BEST FOR: Small yards with an outdoor outlet
NOISE LEVEL: Moderate
MAINTENANCE: None, besides replacing the string as needed.
WHAT TO EXPECT: These are usually the cheapest to buy, quiet, and easy to use—but only a viable option if you have a small property and an outdoor outlet. The main drawback is that they have a very short cord, so you'll need an outdoor-rated extension cord, which is hard to find in lengths longer than 100 feet. Performance can be quite good, with one model from our ratings, the Ryobi RY41135, trimming every bit as well as the best gas or battery options.

DOUBLE DUTY: USE YOUR TRIMMER AS AN EDGER



IN ADDITION TO cutting tall grass in hard-to-reach spots, your string trimmer can also function as an edger to give your yard a professionally landscaped look. Edging creates a crisp line, free from grass and weeds, along the edge of a patio or walkway. “Edging elevates the look of your lawn, but not everyone knows that a string trimmer is the perfect tool to do it,” says Misha Kollontai, who tests them for CR. “It’s usually as easy as holding the tool on its side and making a few quick adjustments.”

To start, hold your string trimmer at a 90-degree angle so that the line spins top to bottom instead of side

to side. Lower the spinning line until it just comes into contact with the soil and grass along the edge of your walkway. It will dig out a crisp line of soil, removing grass and weeds, and prevent them from growing back by uprooting any seeds or roots in the process.

Some string trimmers are better suited to this task than others. When we tested models for how well they edge, many of the less powerful battery trimmers got bogged down by dirt. But some, like the BESTE620 from Black+Decker, have a small wheel (or wheels) so that you can easily roll the angled trimmer along the

edge, cutting as you go.

You’ll also need to take a few safety precautions. The tools may look harmless compared with a chainsaw or lawn mower, but string trimmers and other powered grass trimmers can cause injuries resulting from flying debris, like gravel. And their thick nylon cutting lines spin at up to 10,000 rpms, notes Don Huber, CR’s director of product safety. “That speed is easily dangerous enough to cause serious lacerations,” he says.

Every string trimmer comes with a shield to deflect grass trimmings and small rocks from shooting up at the user, but you also

need to make sure the string is spinning away from you as you work. Otherwise you can kick up small rocks and dirt toward your face. Never trim near children, pets, or bystanders. And always dress appropriately: long pants and closed-toe shoes, gloves, safety goggles or glasses to protect your eyes, and hearing protection.

If you use a gas-powered string trimmer, never start the tool in the garage—carbon monoxide can build to dangerous levels quickly, even if the door is open. If you use a corded model, be mindful that you don’t accidentally cut the cord or trip on it while trimming.

Ratings > **A Cut Above** Consumer Reports' latest tests of gas, battery-powered, and electric corded string trimmers reveal the models that make getting rid of stubborn weeds a breeze.

Brand + Model	Overall Score	Price	Survey Results		Test Results					Features			
			Predicted reliability	Owner satisfaction	Trimming	Edging	Tall grass and weeds	Handling	Ease of use	Weight (lb.)	Engine size	Four-cycle engine	Dual line
													
GAS STRAIGHT-SHAFT STRING TRIMMERS													
✓ Husqvarna 322L	74	\$250	↑	↑	↑	↑	↑	↑	↑	10.6	22.5-cc		•
✓ Cub Cadet SS 470	72	\$190	↓	↓	↑	↑	↑	↓	↓	15.3	25-cc	•	•
✓ Honda HHT25SLTA	72	\$330	↑	↑	↑	↑	↑	↑	↓	14	25-cc	•	•
Homelite UT33650A	69	\$100	↓	↓	↑	↑	↑	↓	↓	10.9	28-cc		•
Cub Cadet BC 280	67	\$170	↓	↓	↑	↑	↑	↑	↑	13.6	27-cc		•
Ryobi RY253SS	60	\$130	↓	↓	↓	↑	↓	↑	↑	12.2	25-cc		•
GAS CURVED-SHAFT STRING TRIMMERS													
Remington RM2510 Rustler	63	\$80	↓	↓	↑	↑	↑	↓	↓	10.2	25-cc		•
Bolens BL110	63	\$70	↓	↓	↑	↑	↑	↑	↓	10.2	25-cc		•
Ryobi RY252CS	59	\$100	↓	↓	↓	↑	↓	↑	↑	11.4	25-cc		•
Homelite UT33600A	59	\$70	↓	↓	↑	↑	↑	↑	↓	10.2	26-cc		•
ELECTRIC CORDED STRING TRIMMERS													
💰 Ryobi RY41135	77	\$70	↓	↓	↑	↑	↑	↑	↑	10	10-amp	NA	•
✓ Black+Decker BESTE620	71	\$55	↓	↓	↑	↑	↑	↓	↓	5	6.5-amp	NA	
Black+Decker GH3000	59	\$70	↓	↓	↑	↑	↓	↑	↓	6.9	7.5-amp	NA	
Toro 51480	55	\$50	↓	↓	↑	↓	↓	↓	↑	7.3	5-amp	NA	•
BATTERY STRING TRIMMERS													
✓ EGO ST1521S	89	\$230	↑	↑	↑	↑	↑	↑	↑	9.9	56-volt	NA	•
✓ Echo CDST-58V2AH	84	\$230	↑	↑	↑	↑	↑	↑	↓	10.2	58-volt	NA	•
✓ Milwaukee 2725-21HD	84	\$300	↑	↑	↑	↑	↑	↓	↑	11.1	18-volt	NA	•
✓ GreenWorks ST80L210	77	\$230	–	–	↑	↑	↑	↑	↓	9.7	80-volt	NA	•
✓ Stihl FSA 56	76	\$200	↑	↑	↑	↑	↑	↑	↓	7	36-volt	NA	•
Toro 51482	72	\$170	↑	↓	↑	↑	↑	↑	↓	9.2	40-volt	NA	•
Poulan Pro PPB40T	72	\$140	↑	↑	↑	↓	↓	↑	↓	12.5	40-volt	NA	•
GreenWorks ST60L210	72	\$190	–	–	↑	↑	↑	↑	↓	10	60-volt	NA	•
Stihl FSA 85	65	\$230	↑	↑	↑	↓	↓	↑	↑	9.5	36-volt	NA	•
Husqvarna 115iL	63	\$230	↑	↑	↓	↓	↓	↑	↑	10.1	40-volt	NA	•

Brand + Model	Overall Score	Price	Survey Results		Test Results					Features			
			Predicted reliability	Owner satisfaction	Trimming	Edging	Tall grass and weeds	Handling	Ease of use	Weight (lb.)	Engine size	Four-cycle engine	Dual line

BATTERY STRING TRIMMERS *Continued*

														
Worx WG191	58	\$170	↑	↑	↓	↑	↓	↓	↑	↑	8.8	56-volt	NA	
Toro 51481	54	\$160	↑	↓	↓	↓	↓	↓	↑	↑	8.5	40-volt	NA	
DeWalt DCST920P1	52	\$190	↑	↑	↓	↑	↓	↓	↓	↑	8.5	20-volt	NA	●
Ryobi P2030	49	\$70	↑	↓	↑	↓	↓	↓	↑	↓	4.1	18-volt	NA	
Stihl FSA 45	43	\$130	↑	↑	↓	↓	↓	↓	↓	↑	5.1	18-volt	NA	●
Black+Decker LST201	43	\$80	↑	↓	↓	↓	↓	↓	↓	↓	4.3	20-volt	NA	

HOW WE TEST: **Trimming** reflects how quickly and neatly a model cuts regular grass, and **Edging** is how well it creates a vertical line along a walkway. **Ease of use** reflects startup, string advancement,

controls, and handle comfort. **Overall Score** combines test results with survey data for predicted reliability and owner satisfaction. **Predicted reliability** estimates the likelihood that newly purchased models from

a given brand will develop problems or break within the first five years. **Owner satisfaction** reflects the proportion of CR members who are extremely likely to recommend the trimmer they bought. In cases where

we have insufficient survey data to provide a brand-level rating, indicated by a gray dash (-), we assume the model has average reliability and satisfaction.

STRING THEORY: WHICH TYPE OF TRIMMER HEAD LETS YOU CUT WITH EASE?

UNDER NORMAL USE, you need to advance your trimmer’s nylon cutting string whenever the tool isn’t cutting effectively. That happens every few minutes or even quicker in tall grass and weeds. What that entails varies from model to model, with some requiring far less work than others. In our tests, those that score well for ease of use reflect how simple it was for our experts to load a model’s head and advance the string. Some models also

allow you to swap the original head with a different aftermarket head (about \$20). No matter the type, the best-performing string trimmers cut with dual strings rather than a single string. Here’s a closer look at the different head choices.

Traditional Heads These are the most common—and often a major source of frustration. Inside is a spool that you need to wrap long lengths of string around. Some trimmers

come with the spool preloaded, but it may not be enough to get you through a season of cutting. Once the spool is loaded, you feed about 6 inches of line through holes on the trimmer head. Each time the string wears down, either the trimmer head will advance a bit of string automatically or you’ll need to advance more string manually. If a sharp object cuts your string down to the base or if the auto-feed isn’t keeping up,

you’ll need to open the head and advance the string manually.

Bump Heads These work much like traditional heads but they’re spring-loaded and have a large button on the outside of the housing. Once you’ve loaded the spool with string, you can simply bump the trimmer head against the ground while the head is spinning to auto-advance the line each time it wears down, without needing to take the head apart.

Locking Heads These are the fastest to reload. Instead of housing a spool, there’s a simple disc that has a hole through which you feed a shorter, precut length of string that locks into place. There’s no wrestling with long lengths of line. Then simply replace the line with another precut piece each time it wears down. But you need to buy packages of precut string or cut it yourself from a larger spool.



A CLEAR PROBLEM

Despite programs to ban plastic shopping bags, global plastic production is expected to almost quadruple by 2050.

THINK YOU DON'T EAT PLASTIC?

Actually, you do. Scientists say we each may be ingesting as much as a credit card's worth of plastic a week through contaminated food and water, to the likely detriment of our health. Learn how to minimize your exposure.

BY KEVIN LORIA

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Plastic may be one of the world's most ingenious inventions.

The first company to ever sell fully synthetic plastic—the Bakelite Corp., established in 1922—advertised it as “The Material of a Thousand Uses.”

They had that right: Today, beyond the plates we eat from, the straws we drink through, the furniture we sit on, and the toys our kids play with, there is plastic in the clothes we wear, in the cars we drive, even in the lifesaving medical equipment in our hospitals. And—more than anywhere else—plastic is in our packaging, encasing everything from laundry detergent to prescription pills, from the food we eat to the beverages we drink.

In fact, the world has produced more than 10 billion tons of the stuff, mostly since the 1950s, and we just keep making more. In 2018, manufacturers created almost 400 million tons of new plastic, and production is expected to almost quadruple by 2050. The vast majority of that plastic eventually ends up piled up around the planet. Some of it may last for hundreds of years—and when it does break down, it can become small particles of plastic—microplastics—that spread farther across the planet, entering our water and food supply.

Why is this a problem? After all, manufacturers and certain regulatory agencies have long assured us that plastics are safe for human health. “In the U.S., we have a robust system that looks at materials that are in contact with food, and that includes

plastics, managed by the [Food and Drug Administration],” says Karyn Schmidt, senior director of regulatory and technical affairs at the American Chemistry Council, an industry group that represents plastics and chemical manufacturers. “Consumers should feel very confident using any plastic coming into contact with food that they would buy in a grocery store.”

And yet there's growing concern. It's not just the photos of whales, albatrosses, and sea turtles washing ashore, stomachs clogged with the stuff, or the stories about swirling ocean vortexes collecting litter from around the globe—although these are sobering. Reliable research now shows that tiny bits of plastic are in our food, drinking water, the air we breathe, and, yes, inside our bodies.

“This credit card here, this is how much plastic you are consuming every week,” Sen. Tom Udall, D-N.M., holding up a Visa card, said when announcing legislation meant to reduce plastic pollution this past February. He was referencing a preliminary estimate by some scientists that the plastic the average person may be eating and drinking totals as much as 5 grams per week. One research review published in 2019 calculated that the average American eats, drinks, and breathes in more than 74,000 microplastic particles every year.

Some scientists say it's likely that ingesting these tiny bits of plastic could expose us to harmful chemicals. “There cannot be no effect,” says Pete Myers, Ph.D., founder and chief scientist of the nonprofit Environmental Health Sciences and an adjunct professor of chemistry at Carnegie Mellon University in Pittsburgh.

“People have this idea that plastic is clean,” a sterile object that doesn't come apart, says Sherri Mason, Ph.D., sustainability coordinator at Penn State Behrend in Erie, Pa., and a chemist who has studied the presence

of plastic in tap water, beer, sea salt, and bottled water.

But, in fact, the raw materials of plastic are created from fossil fuels including oil and natural gas. And thousands of chemicals, depending on the product, are used to make it harder, softer, or more flexible. These chemicals include bisphenols, such as bisphenol A (BPA), and phthalates, which can flow or leach into the foods touched by plastic, especially when that plastic is warmed.

“It's ironic that as public attention to this issue is really growing, global plastic production is increasing,” says Judith Enck, a former regional administrator for the Environmental Protection Agency, now a visiting professor at Bennington College in Vermont and president of Beyond Plastics, a nonprofit focused on ending plastics pollution. And as more plastic is produced and discarded, contaminating our water, food, and air, exposure levels for the average person will continue to rise.

The Menace of Microplastics

Any plastic item—bag or bottle, toy or chair—starts to come apart with use and time, breaking down into tinier and tinier fragments. Most of the plastic ever produced hasn't been recycled (see “What's Gone Wrong With Recycling,” on page 31). But it's not just old plastic that has disintegrated into particles that make their way into lakes, rivers, and oceans. Cracking open a brand new plastic bottle or tearing a wrapper off a sandwich releases fragments of plastic that we might end up ingesting. Household dust can be full of microplastics—and it's possible that you might kick this up into the air from your carpet and breathe it in. Plastic fibers even wash off clothes into our water supplies.

Fragments of plastic smaller than 5 millimeters in length are known as “microplastics,” and scientists

6 WAYS TO USE LESS PLASTIC

While it's practically impossible to eliminate plastic from modern life, there are a number of steps you can take right now to cut back.



DO: Drink tap water.
DON'T: Rely on bottled water.

Water from plastic bottles has about double the microplastic level of tap water on average, according to a 2018 study published in the journal *Frontiers in Chemistry*. So unless your tap water is contaminated with unsafe elements, such as lead, it's probably best to drink tap. Fill up a metal reusable bottle for when you go out. You can always filter your tap water—depending on the filter, that may further reduce microplastic levels. (For CR ratings of water filters, All-Access and Digital members can go to [CR.org/filters0620](https://www.consumersreport.org/filters0620).)



DO: Heat food in or on the stove, or by microwaving in glass.
DON'T: Microwave in plastic.

Some heated plastics have long been known to leach chemicals into food. So if you're warming up food, use a pan in the oven or on the stove, or if you're microwaving, use a glass container. Also, avoid putting plastics in the dishwasher because of the high heat involved in cleaning.



DO: Buy and store food in glass, silicone, or foil.
DON'T: Store food in plastic, especially plastic that may contain harmful chemicals.

The American Academy of Pediatrics has said that plastic food containers with the recycling codes 3, 6, and 7 may contain potentially harmful chemicals, unless they're labeled "biobased" or "greenware." Don't store food in these types of containers. Instead, use containers made of glass or silicone, or wrap your food in aluminum foil. If you're storing food in or eating food out of plastic containers, know that plastics with recycling codes 1 and 2 are more likely to be recyclable—though they are usually recycled into lower-quality plastics. And there still may be harmful or unknown chemicals in any type of plastic.



DO: Eat fresh food as much as possible.
DON'T: Rely on processed food wrapped in plastic.

The more processed or packaged a food is, the higher the risk that it contains worrisome chemicals. Food cans are often lined with bisphenol A (or similar compounds). Buy fresh food from the supermarket, and—as much as possible—try to use refillable containers if your market allows. (Of course, with shopping made difficult by the coronavirus pandemic, prioritize your health and shop however is most feasible and safest.) Certain markets let you fill up cardboard or reusable containers with bulk items and weigh them, or you can use your own mesh bags for produce. Raw meat and fish need to be kept separate for safety reasons, but ask the store fishmonger or butcher to wrap these foods in wax paper instead of plastic. Take cloth—not plastic—reusable bags to the store to take your groceries home.



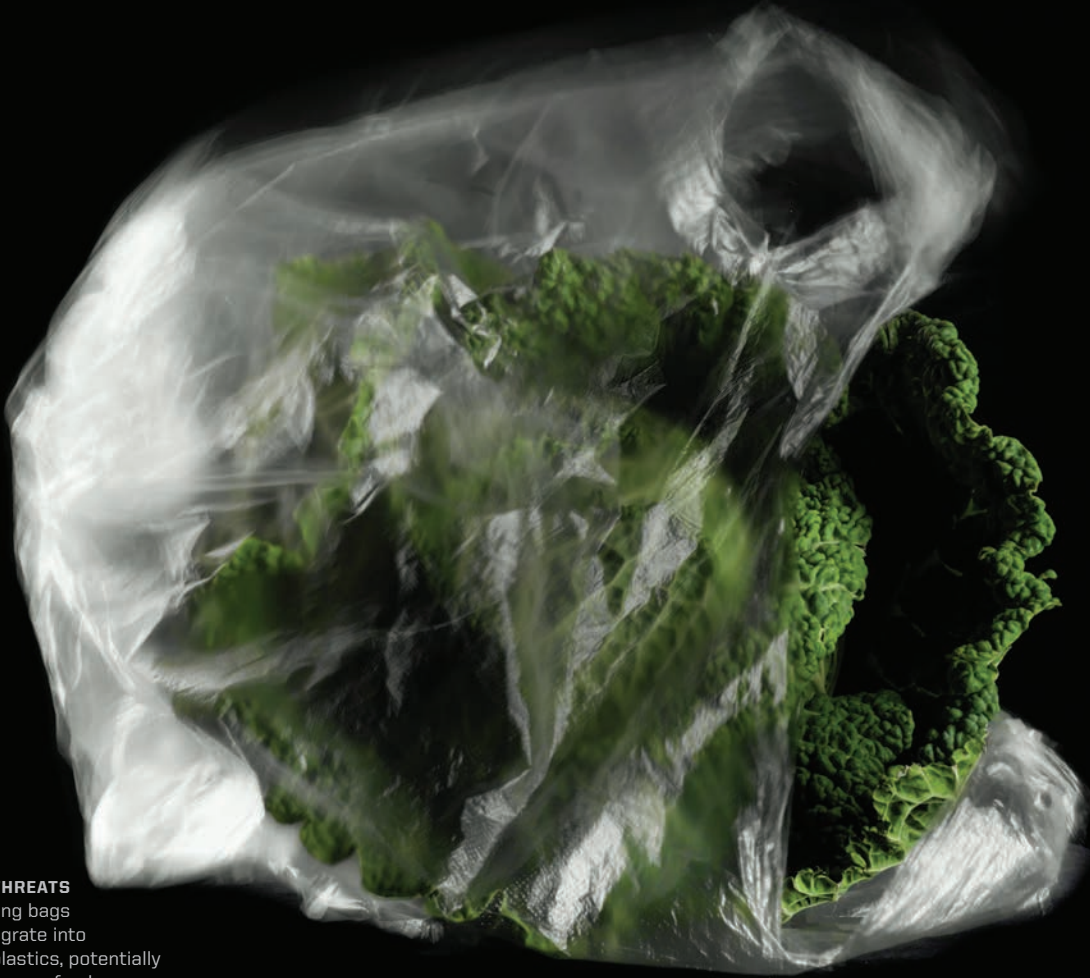
DO: Vacuum regularly.
DON'T: Allow household surfaces to get dusty.

The dust in your house could be loaded with microplastics and chemicals that are found in plastic, such as phthalates. Cleaning up dust may help reduce the amount of plastics you inhale, especially if you are stuck inside for long periods of time during a period of social distancing. CR recommends vacuuming regularly with a HEPA filter, which is best for trapping dust. (For CR ratings of vacuums, All-Access and Digital members can go to [CR.org/vacuums0620](https://www.consumersreport.org/vacuums0620).)



DO: Work with your community.
DON'T: Assume your impact is limited to what you do in your personal life.

Legislation to limit the use of single-use plastics and plastic production may pull the biggest levers, but joining forces with community-level recycling groups can truly make a difference. Look for so-called zero-waste groups, which can offer guidelines for how to recycle or compost all your garbage—and which lobby for local rules that can restrict throwaway items. When possible, shop at markets that source goods locally, so they don't require as much packaging and shipping. Seek out groups such as Upstream, a nonprofit working to create reusable takeout packaging for restaurants. And when possible, educate yourself about and support any city, county, and state legislation limiting single-use plastics.

**TINY THREATS**

Shopping bags disintegrate into microplastics, potentially entering our food supply and, eventually, our bodies.

have started to refer to even more microscopic fragments—generally smaller than 1,000 nanometers—as “nanoplastics.” In a 2019 report, the World Health Organization found that we’ve unknowingly ingested microplastics for decades without clear negative consequences, saying that research into potential health effects is needed. While there’s much we don’t yet know, we have learned that micro- and nanoplastics are everywhere. Snow in the Arctic carries substantial amounts of microplastic, according to a 2019 study in the journal *Science*

Advances, and even more has been detected in the Alps. Microplastics can even be found in the seemingly pristine sand of Hawaiian beaches.

Given this, researchers are concerned that these plastics can make their way into the tissues of our bodies, according to Linda Birnbaum, Ph.D., the recently retired director of the National Institute of Environmental Health Sciences (NIEHS) and the National Toxicology Program. “Nanoplastics can easily cross all kinds of barriers, whether it’s the blood-brain barrier or the placental barrier, and

get into our tissues,” Birnbaum has said. Breathing in nanoplastics might introduce them into our cardiovascular system and bloodstream, for example.

It’s also possible that nanoplastic particles might create a systemic inflammatory response, according to Phoebe Stapleton, Ph.D., an assistant professor of pharmacology and toxicology at Rutgers University in New Brunswick, N.J. Her research has previously shown that inhaled metal particles can harm the cardiovascular health of a developing fetus. And her

[CONT. ON PAGE 34]

WHAT'S GONE WRONG WITH RECYCLING

Of all the plastic ever produced—more than 10 billion tons of it—less than 10 percent has been recycled.

In the U.S., about 76 percent of plastic garbage goes into landfills, where it eventually breaks down into microplastics that contaminate the environment and potentially release problematic chemicals. An estimated 16 percent more is burned at very high temperatures, which produces greenhouse gases both during the incineration process and when those fossil fuels are used. An additional 1 percent of that total ends up littering our oceans, where sea life feeds and chokes on it, it breaks down into microplastics that end up in seafood, and it spreads even to the depths of the ocean floor.

Why isn't more plastic recycled? Most plastic is less recyclable than people think. The very idea that recycling makes plastic use acceptable comes from plastics manufacturers, says Judith Enck, a former regional administrator at the Environmental Protection Agency, now a visiting professor at Bennington College in Vermont and president of Beyond Plastics, a nonprofit focused on ending plastics pollution.

"The reason the public thinks recycling is the answer is that the plastic industry has spent 30 years on multimillion-dollar campaigns saying that," she says. "That was absolutely the wrong message. The message should have been: Don't use so much plastic."

Most products are composed of mixtures of different plastics and chemicals, which can make

recycling impossible. What's more, these products are often covered with food waste that can further complicate the process. Even the two recycling codes considered most recyclable, 1 and 2, are "downcycled" most of the time, which means they're turned into lower-quality products that will end up in a landfill because those materials can't be recycled again. Big brands often use cheaper new plastic instead of recycled plastic.

Today, the percentage of what's recycled is going down. Much of what's collected now is unlikely to be recycled because in 2018, China, where most of the world's plastic was sent to be recycled, stopped accepting it from other countries.

A FINGER IN THE DAM

There are more programs aimed at reducing the avalanche. On March 1, New York state enacted a ban on many of the single-use plastic bags in grocery stores and shops—an effort to cut back on the estimated 23 billion plastic bags New Yorkers use yearly, after bans in seven other states and a number of cities.

Yet while efforts like these are laudable, they aren't enough to overtake the reality that companies keep pumping out more and more plastic. Global plastic production is expected to almost quadruple by 2050, according to a 2016 report from the World Economic Forum. And because plastic is made from fossil fuels such as oil and natural gas, the

report calculated that by 2050, 20 percent of oil production would be for making plastic.

PLASTIC PROFITS

Much of the current plastic boom is the result of a technology known as ethane cracking, which uses a byproduct of fracking to create the sorts of plastics used in packaging, often single-use plastic packaging, according to Enck. A new ethane cracking plant being built by petrochemical company Shell is expected to produce 1.6 million tons of polyethylene plastic each year. Plastic production is a way for petrochemical companies to continue to profit even as countries turn from fossil fuels to renewable energy. And it comes at a high price: By 2030, plastic-linked emissions are expected to equal nearly 300 coal power plants. And the resulting products will continue to pollute waterways and hurt wildlife—while the human health risk from microplastics remains unknown. A 2016 United Nations report showed that more than 800 marine and coastal species are affected by marine debris, including plastic.

Many companies that sell the most plastic—Coca-Cola, Nestlé, and PepsiCo—have signed on to a nonprofit partnership between international organizations and corporations called the New Plastics Economy, whose stated goals include eliminating unnecessary plastics; ensuring that all plastic packaging is

reused, recycled, or composted; and making sure that plastic packaging is free of hazardous chemicals. (Many health experts, though, are unsure that we can create plastic packaging without hazardous chemicals.) But gas and oil companies, which make most of the plastic, have not signed on to the New Plastics Economy's goals. Gas and oil industry representatives still say that their products are safe and that recycling will improve.

"Plastics play an essential role in safety, in sanitary food packaging that reduces food waste, and food waste is a huge issue," says Keith Christman, managing director of plastics markets at the American Chemistry Council, an industry group representing plastics manufacturers. "Work needs to be done to dramatically increase plastics recycling, particularly packaging. Our goal is to recycle and recover all plastic packaging by 2040. There's a lot of work that needs to be done to get there."

Yet according to Enck and other experts, recycling doesn't work if you keep making more plastic the whole time—you need to make less of it in the first place. "We can't recycle our way out of the problem," says Enck, who says consumers can pressure companies to move away from plastics, especially single-use plastics, altogether. "The only solution is reducing the generation and use of plastic."

PLASTIC THROUGH THE AGES



1869 John Wesley Hyatt, a printer, develops celluloid—one of the first forms of plastic, made by modifying natural materials. His aim was to win a \$10,000 prize offered by a billiard ball manufacturer to come up with a cheaper way to make the balls, which at that time used ivory.



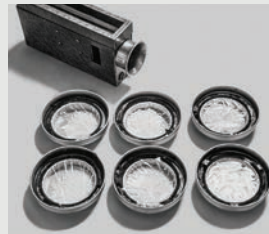
1939 The world's first fully synthetic fiber, nylon, is developed by Wallace Carothers, Ph.D., at DuPont. It was first used in women's hosiery, but after the U.S. entered World War II in 1941, it was quickly channeled into the war effort, for use in parachutes, ropes, tents, and B-29 bomber tires.

1949 Dolls are increasingly made from plastic, CR says in an article about gifts in a Christmas shopping guide. Up to this point, most dolls had been made of china, and then from a resin mix in the 1940s.



1951 Saleswoman Brownie Wise, who pioneered the concept of Tupperware parties, becomes vice president of the newly formed Tupperware Home Parties, in which saleswomen could demonstrate products in consumers' homes. Wise is credited with transforming a heretofore unsuccessful product (Earl Tupper filed the patent for Tupperware in 1947) into a staple of American life.

1963 Plastic wrap is first rated by CR; we find that it provides a tighter seal than aluminum foil or wax paper.



1869



1907 Chemist and inventor Leo Baekeland invents Bakelite, the world's first fully synthetic plastic, meaning it contained no molecules found in nature. This heat-resistant substance proved to be particularly useful in the electrical and automotive industries and was soon used in radios, cars, telephones, and other products.

1939 Pontiac's famous Ghost Car—a show model, made mostly out of a new plastic called Plexiglas, which was designed to be hard, transparent, and hard to shatter—is displayed at the World of Tomorrow exhibit during the 1939 World's Fair in New York City.



1941 With the defense department requisitioning metals like aluminum and steel for the WWII war effort, plastic parts in consumer products, such as refrigerator trays and door handles, become increasingly common.



1951 Consumer Reports tests newly popular plastic dishes for the first time, to see how tough they are. The conclusion? They're easily melted, scratched, and stained.

1957 Plastic sandwich bags and supermarket plastic bags on a roll are introduced.



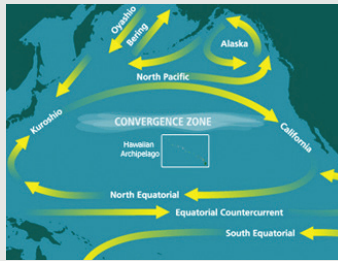
1955 A Life magazine article features an array of disposable paper and plastic items, such as plates, buckets, mats, and even a hunting decoy, with the headline "Throwaway Living: Disposable Items Cut Down Household Chores."

1966 Space blankets—made from plastic insulating materials developed for space missions—go on sale to consumers. CR's assessment is that these could work well as a windbreaker or sunshade but should not replace a sleeping bag while camping, because they wouldn't be warm enough.



1982 The first artificial heart successfully implanted in a human is the Jarvik-7, made mainly of polyurethane plastic.

1988 The Great Pacific Garbage Patch, a region of the ocean that naturally accumulates debris (much of it plastic) because of swirling currents and is more than twice the size of Texas, is first described by researchers in Alaska.



2002 Bangladesh is among the first countries to ban the thinnest plastic shopping bags, after discovering that bags clogged drainage ditches and worsened devastating floods.



2012 The FDA prohibits the use of BPA in baby bottles and sippy cups.

2014 Dutch researchers successfully replace the skull of a 22-year-old woman with a plastic 3D-printed replacement.



2020

1973 Nathaniel Wyeth, an engineer at DuPont, patents the polyethylene-terephthalate (PET) plastic soda bottle—the first one capable of holding carbonated beverages.



1967 In "The Graduate," Dustin Hoffman's character, Benjamin Braddock, receives some famous career advice from an older mentor: "Just one word: plastics. There's a great future in plastics."



1988 An industry group launches the triangular recycling codes still seen on products today to make it easier to sort containers. (For more on recycling, see "What's Gone Wrong With Recycling," on page 31.)

1996-1998 Researchers link bisphenol A exposure to health problems in animals, including reproductive dysfunction and prostate changes in mice. These researchers raise some early concerns about the potential human health effects of BPA on adults, developing fetuses, and young children. In 1999, CR warns parents about phthalates and BPA in plastic children's products.



2007 San Francisco becomes the first U.S. city to ban single-use plastic shopping bags. By 2020, the rest of California, seven other states, and many cities have followed suit.

2020 Some scientists call our present era the Anthropocene, the geological time that humanity reshaped the Earth and its climate. Within that era, some think future scientists might look back on this time, starting in the 1950s, as the Plasticene, defined by the enormous amount of plastic that human beings have layered around the Earth.

[CONT. FROM PAGE 30]

animal research has also confirmed that when a mother breathes in nanoplastics, the particles can be found in many places inside the fetus. “We know that after exposure, the plastic particles are everywhere we look,” Stapleton says. “We don’t know yet what those particles are doing once they’re deposited there.” Other researchers, like Myers at Environmental Health Sciences, are concerned that nanoplastics could possibly release harmful chemicals (such as BPA) into our bodies.

Another area of inquiry focuses on the fact that microplastics act like magnets for additional toxins, picking up pollutants such as polychlorinated biphenyls (PCBs), chemicals now banned for manufacture in the U.S. but still present in the environment. According to Linda Birnbaum, formerly at the NIEHS, if we later ingest or inhale contaminated microplastics, they may release these substances they’ve picked up into our blood or organs, along with whatever chemicals are also in the plastic itself.

A Trail of Chemical Harm

No matter what new information scientists discover about the potential danger from microplastics, we already have sufficient evidence that the chemicals found in various plastics can have serious adverse effects on our health, says Leonardo Trasande, M.D., director of the Center for the Investigation of Environmental Hazards at New York University and the author of “Sicker, Fatter, Poorer” (Houghton Mifflin Harcourt, 2019), a book about endocrine-disrupting chemicals.

“What we know raises serious red flags about chemicals used in plastic containers,” he says. They affect brain and organ development in children, and are linked to infertility and cardiovascular problems. Around 10,000 adult men die from

cardiovascular disease linked to phthalates every year, he says.

There’s essentially no limit on the types of plastic that can be produced from thousands of types of chemicals, leading to products that range from flimsy high-density polyethylene grocery bags to bullet-stopping Kevlar. These chemicals are added to different plastics to give them various properties. Most people are familiar with better-known villains, such as BPA, which has been used since the 1950s to make hard, clear plastic like that used for some beverage bottles. But many other chemicals in plastics have been linked to serious health

effects, including other bisphenols (in the same family as BPA), phthalates, and styrene. These chemicals can seep from packaging into food and then into the human body, Trasande says.

The shape and structure of chemicals such as BPA and phthalates cause them to interfere with the endocrine, or hormonal, system, which is why they are known as endocrine disrupters. Tiny amounts of hormones, measured in parts per billion or even per trillion, affect the function of a wide range of systems throughout our bodies. And that’s what makes even a low dose of BPA or these other endocrine disrupters a focus of medical concern.

HEALTH HAZARD

Thousands of chemicals are used to give plastics a variety of textures; the effects of these on human health worry some scientists.



Bisphenols are believed to affect reproduction; some experts have suggested a link to the significant decline in sperm count in high-income countries over the past few decades. But there is also concern that they may affect brain development and the immune system, and can increase obesity and cancer risk—especially cancers influenced by the endocrine system, such as mammary and prostate cancer, says Laura Vandenberg, Ph.D., an associate professor at the University of Massachusetts Amherst School of Public Health and Health Sciences. Phthalates are also known to disrupt hormones, and prenatal exposure to phthalates is associated with lower testosterone in male offspring. Styrene, another chemical found in plastic and food packaging, has been linked to nervous system dysfunction, hearing loss, cancer, and more.

“BPA is the poster child for these types of chemicals,” says Patricia Hunt, Ph.D., a professor at Washington State University’s School of Molecular Biosciences in Pullman. The outcry around BPA created enough consumer pressure that by 2008, some manufacturers started to remove it from certain products. However, when companies removed it, they often replaced it with other chemicals that are structurally similar to BPA, such as bisphenol S and bisphenol F.

“We’re starting to realize that the BPA replacements have very similar biological effects as the original chemical,” Vandenberg says. That means a product touting its BPA-free status might be just as harmful. Worse, these replacements face less scrutiny—“a byproduct of the lax regulatory framework in which we live,” says Trasande, who describes the efforts to keep up with these replacements as “chemical whack-a-mole.”

Recent research has also revealed that we may have underestimated

our exposure to these chemicals all along, Hunt says. Scientists have typically measured the presence of BPA in our bodies by analyzing the products of metabolized BPA in urine and converting them back to the original substance; these efforts found BPA in more than 90 percent of people studied. Hunt and colleagues have developed a new way to directly measure not just the BPA in urine but also its metabolic products processed by the body. In doing so, they found BPA levels in the human body that may be 44 times higher than a national survey found using the older method.

Our exposure to other chemicals has normally been measured in the same indirect way, Hunt says. That may mean we’ve also underestimated our exposure to phthalates and other chemicals of concern. “Our data is suggesting some people—[and] some pregnancies, some fetuses—are in fact exposed to quite high levels [of BPA],” she says.

The Nonplastic Path Forward

If chemicals in plastic have been linked to all these health concerns, many people may ask why the FDA permits them to be used in food packaging.

Vandenberg says that’s because there are flaws in our regulatory system. We often don’t know which chemicals are being used because the FDA doesn’t require companies to release toxicological data on all chemicals that can transfer into food, according to a consensus statement published in March in the journal *Environmental Health*. “As new chemicals get put onto the market, we have to know that they’re there” before they can even be assessed for risk, Vandenberg says.

Yet perhaps the most fundamental problem, Trasande says, is that our federal agencies use a risk-assessment method that hasn’t been updated since the late 1950s. It measures the dangers

of high doses of a chemical but doesn’t account for the fact that low doses may have different harmful effects. Those old methods are good for calculating what happens if you’re exposed to a high dose of a chemical, like “if you fall into a vat of it,” Vandenberg says. But as the statement in *Environmental Health* says, they don’t take into account what we’ve since learned about how low doses of a chemical over time can affect the endocrine system and disease risk.

“The agency’s safety reviews continue to be conducted based on long-standing academic standards and demonstrated principles of toxicological and chemical safety assessment,” says a spokesperson for the FDA.

As plastic production continues to rise, assessing whether our current system is protective enough has become more urgent than ever. Nearly 200 nonprofits have released a call to action, asking regulatory bodies around the globe—such as the FDA—to create a system that’s more transparent about the chemicals in packaging and that takes a more restrictive approach toward the sorts of chemicals allowed.

“Half of the plastic ever made was made in just the last 13 years,” says Judith Enck, the former EPA regional administrator. To reverse the trend will take concerted effort from many quarters, with people striving to use less plastic, companies committing to efforts that would truly improve reuse and recycling, and legislation that would eliminate most single-use plastics, such as shopping bags, for health and environmental reasons.

Enck supports Sen. Udall’s newly proposed Break Free From Plastic Pollution Act, which would phase out many single-use plastics, put a pause on the launch of new plastic production, and require sellers of plastic to cover the cost of collection and recycling.

“We have a fighting chance to stop this,” she says.

PAYING

FOR

HEALTHCARE

IN THE

AGE OF

CORONAVIRUS

Diagnosing and treating this virus can get expensive, even if you're working and insured, but especially if you've lost your job and your coverage. Here are strategies that can help keep your costs under control.

by **LISA L. GILL** / Illustrations by **BEN SHMULEVITCH**

\$11,504.53

\$9,678.24

\$2,661.77

\$1,892.30

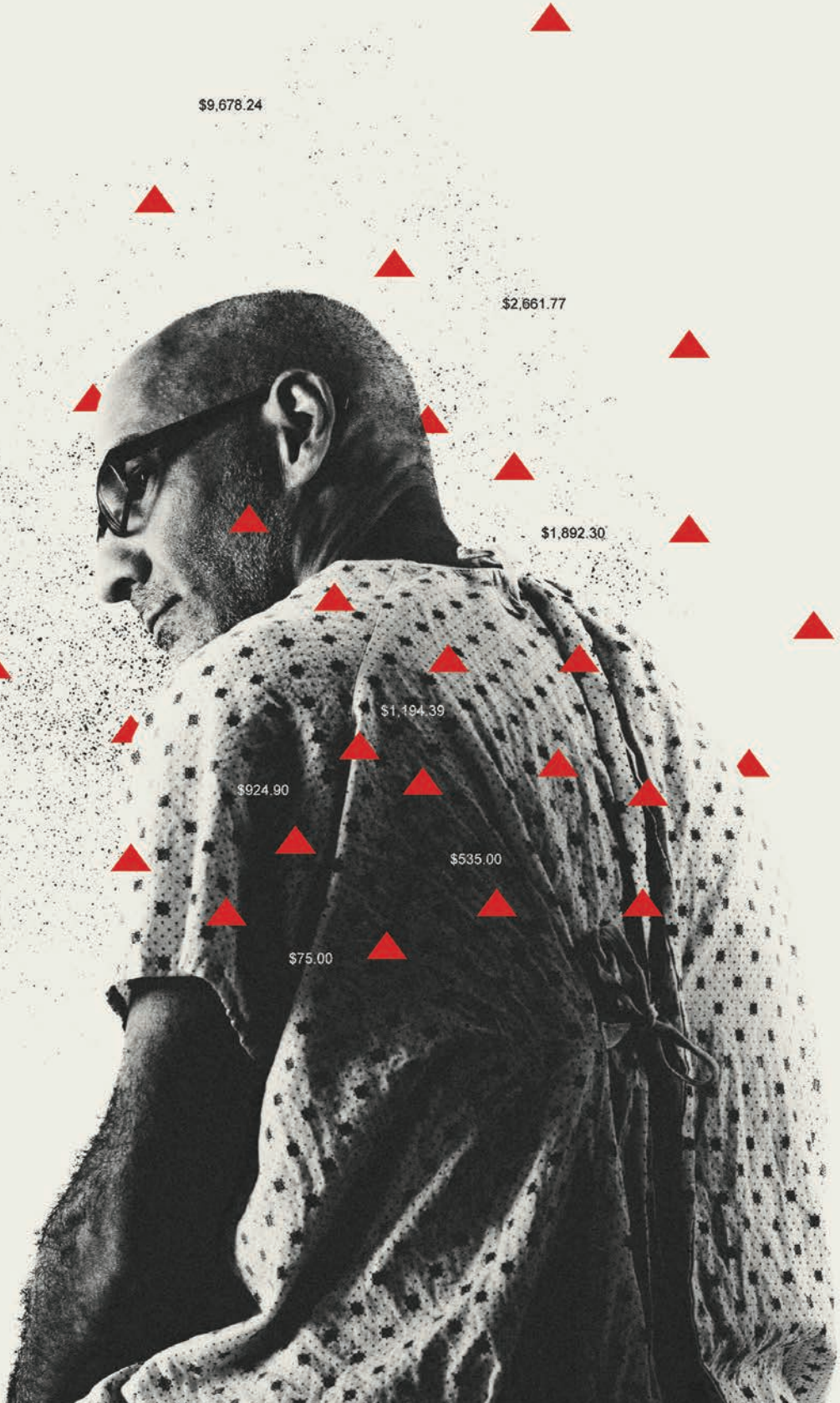
\$1,194.39

\$924.90

\$535.00

\$75.00

Dollar amounts shown here are out-of-pocket costs for people with different degrees of COVID-19 symptoms being evaluated at doctor's offices, urgent care centers, and ERs in several U.S. cities.
SOURCE: Castlight Health.





E

EVEN BEFORE THE CORONAVIRUS

outbreak hit earlier this year, Americans' finances were fragile. Four in 10 people in the U.S. said that in the previous two years they'd had an out-of-pocket medical bill of at least \$400, and half said they were extremely or very concerned about being able to afford it, according to a nationally representative Consumer Reports survey of 1,079 adults fielded in early March.

As the coronavirus continues its destructive path, the financial situation has become even more dire: By early April, more than 16 million Americans had already lost their jobs—and often the health insurance that comes with their employment.

These realities put the shortcomings of our healthcare system—how care is paid for, who has access—into even starker relief. A Kaiser Family Foundation (KFF) poll published in mid-March—before much of the country shut down to stem the spread of the virus—found that one-third of people worried they couldn't afford coronavirus testing or treatments if they were sickened by the virus.

The uninsured are the most financially vulnerable. But cost can also be a struggle for the estimated 81 million Americans who have high-deductible health plans (HDHPs); they must first pay at least \$1,400 out of pocket for an individual or \$2,800 for a family before coverage begins.

Another problem, even for people with health coverage, is surprise medical bills, which people can face when

they get care from an out-of-network provider, as can happen in emergencies.

To blunt some of the financial fallout, President Donald Trump in March signed the Families First Coronavirus Response Act. The law mandates that all insurance plans—Medicare, Medicaid, military, Affordable Care Act (ACA), and employer—cover the cost of a coronavirus test, roughly \$50, and any related doctor's appointment copays or fees. But it might not address all other healthcare or hospital costs related to the coronavirus or the surprise medical bills a consumer may face.

Those additional costs can be substantial, even just to get a diagnosis. That's because in addition to the coronavirus test, doctors sometimes need to administer other blood tests and sometimes X-rays to rule out the flu or pneumonia.

For example, a person in Seattle with severe symptoms of the coronavirus—high fever, cough, and significant trouble breathing—who goes to a doctor's office can expect to pay about \$1,000 for the appointment and testing, according to an analysis from Castlight Health, a group that works with employers to lower healthcare costs. In some places, such as New York City and Miami, prices could be even higher.

“Treatments for COVID-19 could be especially expensive if you need to go to the ER or are admitted to the hospital,” says Loren Adler, associate director at the USC-Brookings Schaeffer Initiative for Health Policy at the University of Southern California in Los Angeles.

Of course, for some families it doesn't take the rampage of the coronavirus for a medical situation to topple their finances. In September 2019, in Grass Valley, Calif., Bridget Brandstad's 9-year-old son had three of his fingers accidentally crushed by a slammed door. The family rushed to the emergency room. While their plan had only a \$500 ER fee, Brandstad says, the family wound up with bills from the hospital and doctor for nearly

\$2,000. They're still paying in \$50 installments. “I have to triage my bills every month,” she says.

Whether you face high healthcare costs because of the coronavirus or another medical condition, here's what you can do to lower your financial risk.

If You've Lost Your Health Insurance

Given that about half of Americans get insurance through an employer, the huge numbers of people losing their jobs may suddenly find that they no longer have coverage, says Christen Linke Young, a fellow at USC-Brookings Schaeffer.

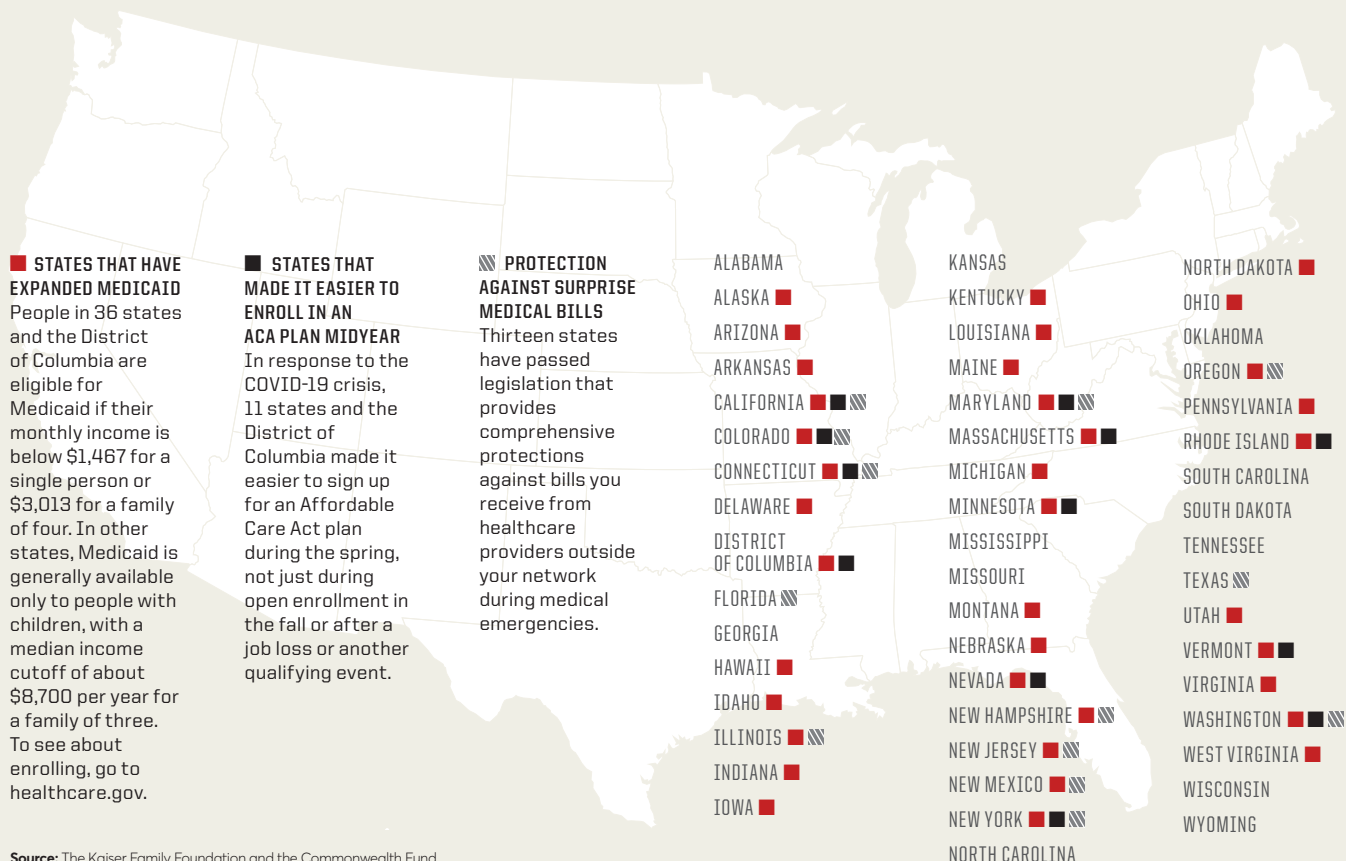
If that happens to you, time is of the essence because you don't want to be caught uninsured during this period of high peril and because, in some cases, you must sign up for new insurance within 60 days of losing your job, Young says. Here are some options.

See whether you qualify for Medicaid. The ACA, passed in 2010 to provide insurance to more people, allowed states to expand their Medicaid programs, something 36 states and the District of Columbia have done. (For details see the state-by-state guide, on the facing page.) In those locations, individuals with a monthly income of up to \$1,467 and families with a monthly income of up to \$3,013 qualify, according to the KFF. In other states, the annual median income limit for Medicaid is about \$8,700 for a family of three.

To establish eligibility—based on current monthly income, not income before you lost your job—check with the Centers for Medicare & Medicaid Services (CMS), at [healthcare.gov](https://www.healthcare.gov), says Cheryl Fish-Parcham, director of access initiatives at Families USA, which helps consumers with health insurance problems. The rules vary by state, she says, and requirements may be different if you are pregnant, have children, or are disabled.

You can apply for Medicaid at any time after you lose employer-

HEALTH INSURANCE HELP: A STATE-BY-STATE GUIDE



Source: The Kaiser Family Foundation and the Commonwealth Fund.

provided insurance. If you're approved, coverage will begin on the date of application or the first day of the month you applied, according to the CMS.

Families with children under age 19 not covered by health insurance should look into CHIP—the Children's Health Insurance Program. Go to healthcare.gov to determine eligibility.

See if you qualify for a reduced-cost ACA plan. If your income is too high for Medicaid, you may still qualify for a subsidized ACA plan. Individuals who earn up to \$51,040 and families of four that earn up to \$104,800 get reduced rates on those plans. In 2019, 87 percent of people in ACA plans sold through the federal marketplace got subsidies and had an average monthly premium of \$87.

In response to the crisis, 11 states and Washington, D.C., opened special

enrollment periods during the spring so that uninsured people could sign up for an ACA plan to cover them for the rest of 2020. Previously, you could do this only if you experienced a qualifying event, such as job loss or divorce.

If you previously enrolled in an ACA plan and have experienced a loss of income, check to see whether you now qualify for a larger subsidy.

Consider COBRA. If you lose your insurance and worked for a government agency or company with more than 20 full-time employees, you must be offered an extension of your coverage under the Consolidated Omnibus Budget Reconciliation Act. But you will pay the full amount because your employer will no longer contribute to your monthly premiums. "That's not great if you've just been laid off and have little money

to pay for a premium," Fish-Parcham says, "but if your healthcare needs are better served by remaining on the same plan, at least for a while, this is an option."

The monthly cost varies widely but averages about \$610 for an individual or \$1,750 for a family, according to an analysis by USC-Brookings Schaeffer.

You'll have 60 days to enroll after you lose your employer coverage. Ask your employer when coverage through your job ends so that you know when to sign up.

If You Have a High-Deductible Health Plan

In 2018, almost half of Americans insured through employers or an ACA plan had HDHPs. These policies tend to have lower monthly premiums but much higher deductibles. When a family



faces big medical bills, HDHPs offer less financial protection.

The IRS defines an HDHP as one with a minimum deductible of \$1,400 for an individual or \$2,800 for a family. But on average, these deductibles can be much higher. For people with combined medical and pharmacy deductibles, the average is \$2,114 for an individual or \$4,250 for a family, according to a 2018 employer survey by the Pharmacy Benefit Management Institute, a research group.

For people who have ACA plans, deductibles can be even steeper: According to the KFF, deductibles for silver plans that include prescription drugs average \$4,544 for an individual; bronze plans, \$6,506. Among those who purchased insurance on their own (and not through a federal or state marketplace), two-thirds said that if they were hospitalized with the coronavirus they would be unable to pay their deductible all at once, according to a March 2020 survey by eHealth, an online marketplace where people can

purchase private health insurance.

Although you can't change the deductible once you sign up for a plan, you might be able to limit what you pay out of pocket, particularly if you need tests or treatments because of the coronavirus.

Here's how.

Find out whether drugs and treatments are covered before the deductible has been met. A 2019 federal rule allowed insurers to cover certain treatments before a deductible is met. The rule includes several common drugs, such as those used to treat high cholesterol or blood pressure, heart failure, osteoporosis, and asthma, as well as insulin for diabetes. Certain insurers have already implemented this change, and more may soon, says Brian Marcotte, CEO of Business Group on Health, an organization that helps large employers manage healthcare quality and cost.

Given the urgency of the pandemic, insurers have been able to adopt a similar rule to cover the coronavirus treatments before a deductible is met, says Loren

Adler at USC-Brookings Schaeffer.

For example, Aetna announced in late March that it was waiving copays for people hospitalized at in-network facilities for COVID-19 treatment or related complications. Most Aetna employer plans will automatically offer this benefit, says Ethan Slavin, spokesperson for Aetna. Blue Cross Blue Shield, Cigna, and Humana have also said they will waive copays and cost-sharing for testing or treatment related to COVID-19 in some of their plans.

Use your Health Savings Account.

An HSA, which allows you to sock away tax-free funds to pay for future medical expenses—up to \$3,550 for an individual or up to \$7,100 for a family per year—is one of the best ways to manage your healthcare costs. If you have one, you can use this money to pay for any qualifying medical service, including deductibles. You can also roll over unspent funds from year to year.

Shop around. For medical care that you can plan ahead for, shopping around can save you money because the price of medical services can vary substantially depending on the provider, says Courtney Lamie at Castlight Health.

For example, a patient in Cleveland needing blood tests and an X-ray to screen for the coronavirus could pay as little as \$241 or as much as \$2,570 at different urgent care centers. In Dallas, someone could pay from \$231 to \$4,510.

A price comparison website such as Guroo or an app like MyMedicalShopper can help you compare the prices of various procedures, tests, or surgeries among providers in your area.

If You Get a Surprise Medical Bill

These are charges billed to you when you receive a service or treatment from a provider not in your insurer's network. That can happen in emergencies, when you can't always control where or from whom you get care.

That was the case for Melissa Janeiro of Lockhart, Texas, when she experienced complications during childbirth. She says she was told that the hospital was in-network, but it turned out that the anesthesiologist was not, nor were the providers in the neonatal intensive care unit. Janeiro received bills for more than \$30,000. It took two years and the help of an attorney to get the bill down to \$10,000.

About half of all states have enacted consumer protections against surprise bills, but only 13 provide comprehensive protections, according to an analysis for the Commonwealth Fund, a nonprofit health policy research group.

For almost a year Congress has been considering legislation to offer protection nationally, says Chuck Bell, programs director for advocacy at CR. Because COVID-19 treatments could be a big source of these bills, the need to address the problem is now even more urgent, Bell says. “In a slowing economy, people will have even less income and resources to deal with surprise medical bills,” he says. “The emerging COVID-19 public health crisis underscores the need for Congress to pass comprehensive legislation to fix this serious national problem.”

To avoid surprise bills, whenever possible find out ahead of time what providers your insurance does and does not cover. Should you still receive a bill, as Janeiro did, take these steps.

Hold off on paying the bill. Patients often receive bills from doctor’s offices, hospitals, and other providers before they are even sent to a person’s insurance company, says Caitlin Donovan, senior director for public relations at the Patient Advocate Foundation, which helps consumers with health insurance problems. When you get a bill, don’t pay it right away. Instead, Donovan says, “wait until you receive your explanation of benefits, or EOB. That will ensure that your insurer has received your provider’s claim and

it hasn’t been sent straight to you.” **Make sure charges and coverage are correct.** Donovan says fully half of all medical bills contain errors—lab tests you never had or providers you never saw, for example. Contact the provider or facility to point them out and ask for a revised bill. Also, confirm with your insurer what is considered in-network and out-of-network and whether the coverage decision was a mistake. It’s even worth asking whether your insurer will cover an out-of-network charge as an in-network service, Donovan says. “It never hurts to ask,” she adds.

Know your rights. Depending on the type of insurance you have, your state may have protections against surprise billing, Bell says. These either ban surprise billing outright or “hold consumers harmless,” so they

aren’t responsible for the bill. But just because a state has banned surprise billing doesn’t mean you won’t receive a surprise bill anyway, Bell says, “so be prepared to fight.”

Negotiate with the provider and appeal to the insurer. If you’re stuck with an out-of-network charge, go on the offensive, Bell says.

Contact the provider and explain that your insurer is charging you the full out-of-network rate and you must pay entirely out of pocket. Ask whether the provider will charge you its discounted in-network rate instead, Donovan says.

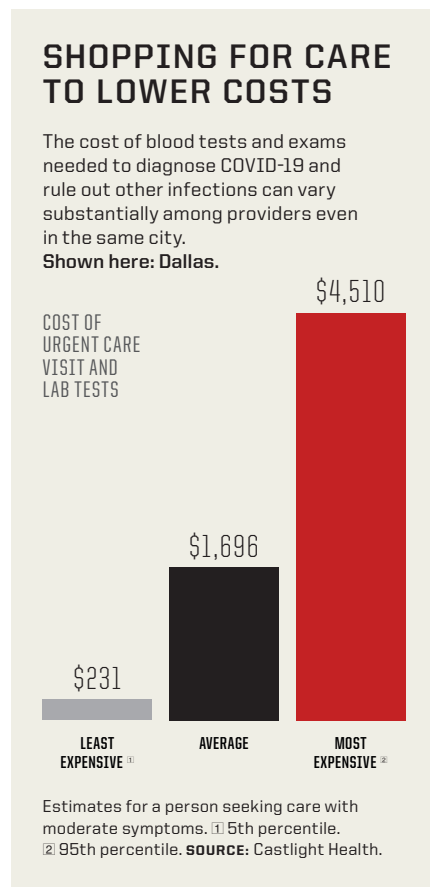
Also, find out whether the hospital or provider offers any financial assistance, or if it will let you pay the charge over time, says Cheryl Fish-Parcham at Families USA. You can also ask whether it would consider offering a discount if you paid a lump sum.

If you can’t reach an agreement with the provider, appeal the insurer’s decision, Donovan says. You’ll want a letter that explains your situation, why you believe the insurer should cover your health problem, and if possible, why covering the cost now could prevent future medical expenses. Be advised that this can take up to 60 days for most employer-provided and ACA health plans.

If the appeal doesn’t work, you can request a review by a third party, Donovan says. The insurer is required to send you information on how to initiate the process.

Get help. If you’re still having trouble after appealing to the insurer, you can contact your state’s consumer assistance program, if it has one, or insurance department. Go to localhelp.healthcare.gov for more details. Also, contact the Patient Advocate Foundation for help at 800-532-5274 (8:30 a.m. to 5 p.m. EDT Monday through Thursday) or online at patientadvocate.org.

For up-to-date information on paying for healthcare during the ongoing pandemic, go to CR.org/pay0620.



SAVE HUNDREDS



ON CABLE BILLS

... PHONE BILLS,
STREAMING SERVICES,
COMPUTERS,

and more with this advice
from CR's experts, often
without sacrificing any
convenience or pleasure.

by James K. Willcox
Illustrations by Sam Island



Review Your Monthly Fees

When confronted by line after line of itemized charges on a bill, it's tempting to skip to the balance due and write a check. But doing a deeper dive can net big savings. For example, you might find a \$15-per-month charge on a cell-phone bill for insurance on a phone that's now 4 years old. On a cable bill, it could be \$12 per month for a DVR you no longer use, now that you stream your favorite shows.

POTENTIAL SAVINGS:

More than \$100 per year for canceling just one unnecessary charge.

Go All-In on Amazon Prime

If you're paying \$119 per year for free shipping, why not take advantage of the thousands of free movies and TV shows that come with it? Prime members also have access to free digital editions of select magazines (including National Geographic and

Better Homes & Gardens), books, and comic books—plus more than 2 million songs. Video fare includes award-winning series, like “The Marvelous Mrs. Maisel,” and HBO classics, such as “The Sopranos,” “The Wire,” “Curb Your Enthusiasm,” and “Deadwood.”

POTENTIAL SAVINGS: If there's enough to coax you into cutting HBO, Netflix, and other streaming services, you could save hundreds per year.

Break Up With Netflix

Netflix is an enormous general store of movies, TV shows, and hugely popular original series like “The Crown” and “Ozark.” But if you can live without Her Majesty, you may be able to drop this \$9- to \$16-per-month streaming habit without feeling much pain. Disney+ costs just \$7 per month and features “Star Wars,” Marvel, NatGeo, and, of course, Disney content. Hulu offers heaps of shows (with advertisements) for \$6



Buy Your Cables and Dongles Online

Some retailers will give you a deal on a TV or a laptop, then try to make up part of the difference by selling you overpriced accessories. Need a high-speed HDMI cable for your new set? The store might try to sell you a 10-foot cable for \$20 or more that you could buy on a site such as monoprice.com or [Blue Jeans Cable](http://BlueJeansCable.com) for less than \$10.

POTENTIAL SAVINGS: At least \$10, and probably much more.

per month. Amazon Prime members get a hefty library of free video content. And there are loads of other free options (see “14 Ways to Stream Shows for Free,” on page 49). If you subscribe to Netflix because you've always subscribed to Netflix, it could be time to make a change.

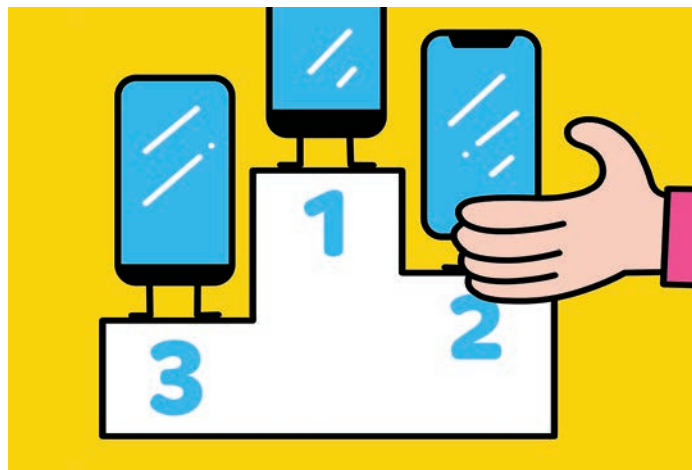
POTENTIAL SAVINGS:

At least \$108 per year.

Sign Up With a Low-Cost Cell-Service Provider

A mobile virtual network operator (MVNO) is a relatively new form of cellular service that operates on the same networks used by AT&T, Verizon, and T-Mobile but can offer cheaper plans because it doesn't have to build and maintain towers.

How much cheaper? Straight Talk offers unlimited talk, text, and data for \$55 per month. For the same service at AT&T, you pay \$65. Visible has an unlimited plan for \$40 per month. At Verizon, it's \$70.



GO SECOND TIER, WITHOUT REGRETS

Top-of-the-line products rarely disappoint, but they do come with hefty prices. If you can live without the latest and greatest features, you can often find less expensive, excellent alternatives from the brands you trust. Here are a few smartphones that offer great value and performed well in our testing.

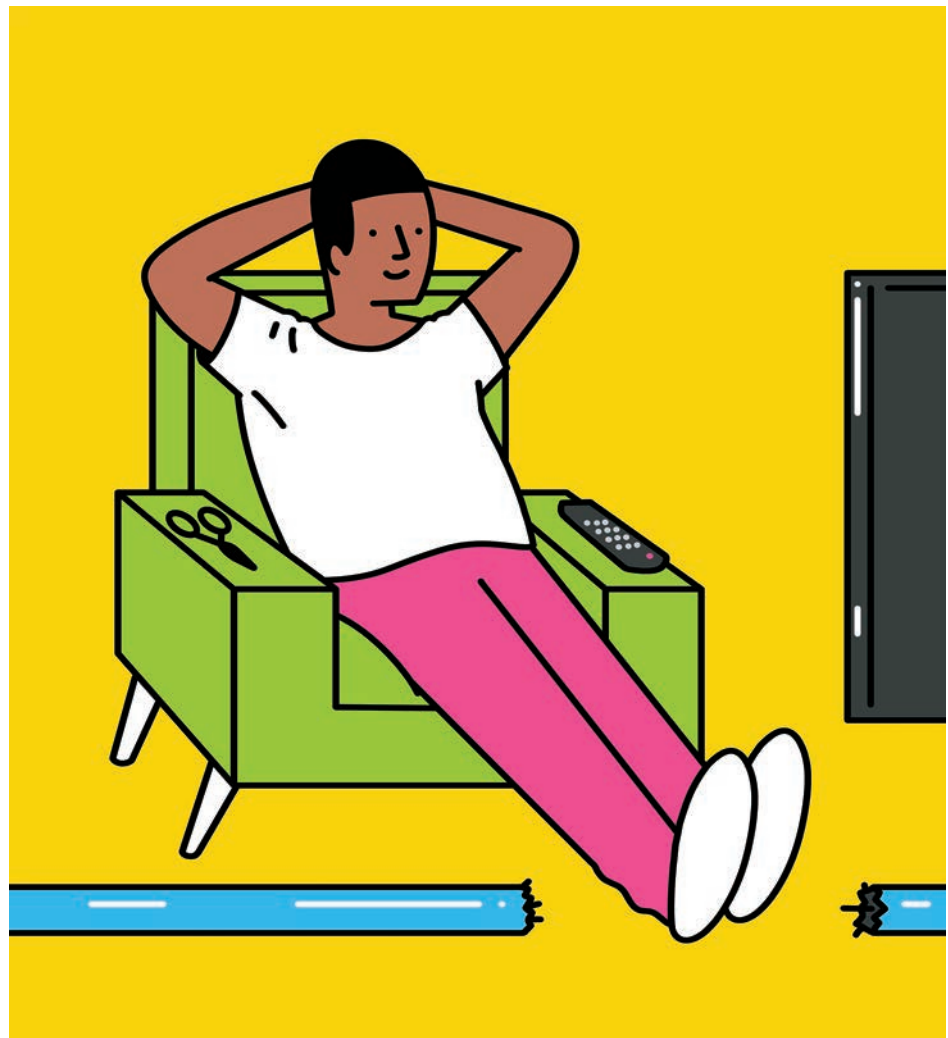
CR members tend to give high marks to customer support provided by MVNOs. This could help explain why Consumer Cellular, Google Fi, and Ting routinely finish atop our cell-phone service ratings.

MVNOs do have drawbacks. During peak demand, MVNO customers may experience slower service than those of AT&T, Verizon, and other major players. And very few MVNOs have a physical location for in-person tech support.

POTENTIAL SAVINGS:
Up to \$360 per year.

Cut That Cord, Once and for All

Deciding to cut the cord used to be simple: Most any live TV streaming service was cheaper than cable. But now that live TV streaming providers have raised their prices, the math is trickier. Even so, cord-cutting still makes sense for many, especially if you can use an antenna to get free network



Samsung Galaxy S10e \$600

85 OVERALL SCORE

This model falls just a point shy of the Galaxy S10 in Overall Score. So what are you sacrificing? Mostly the 2X zoom in the rear-camera setup. But that

doesn't mean you sacrifice image quality—it still rates Very Good. Most of the other features on this model measure up. **SAVINGS:** \$150, compared with the Galaxy S10.

Apple iPhone XR \$600

84 OVERALL SCORE

Only 1 point separates this model from the iPhone 11. What's the difference? Instead of the fancy OLED screen found on the iPhone 11,

the XR uses a traditional LCD screen. Even so, the model still earns an Excellent rating for display quality. **SAVINGS:** \$100, compared with the iPhone 11.

Samsung Galaxy A50 \$350

76 OVERALL SCORE

Though it lags a full 10 points behind the S10 in our ratings, it's also significantly cheaper and still nets a Very Good Overall Score. The main difference? The A50's

cameras are just okay. So if you're not addicted to Instagram, this might be a stellar, money-saving choice. **SAVINGS:** \$400, compared with the Galaxy S10.



content, or are satisfied with limited TV streaming packages from companies such as Sling, which offers a limited selection of networks starting at \$20 per month.

POTENTIAL SAVINGS: Easily \$700 or more per year, depending on the cost of your current service and what you replace it with.

Spruce Up Your Phone

In an age when a brand-new phone can cost \$800 or more, it's tempting to hold on to the model you have for as long as you can. One way to extend the life of your phone: Replace the battery, which often fails to hold a full charge after about two years. At the Apple Store, the out-of-warranty cost for the repair is \$69 for newer models (the iPhone X and later) and \$49 for earlier versions. Best Buy's Geek Squad will provide the service for Galaxy models from the Note5 to the Note9 for \$60. Toss in a shiny

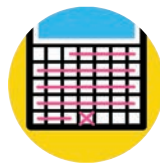
new phone case and you're still saving yourself a chunk of money by waiting another year to upgrade.

POTENTIAL SAVINGS: Close to \$300—probably many times more by deferring the purchase of a CR Recommended phone.

Buy Refurbished

Apple, Dell, and Samsung all sell refurbished laptops, smartphones, and tablets. Buying one is a great way to save money. On Apple's website, for example, you can purchase a refurbished iPhone X for \$599. A new X costs \$899. Interested in headphones or speakers? Bose and Sonos also have programs. According to a 2018 survey, 82 percent of more than 3,000 CR members with a refurbished smartphone said they were highly satisfied with it. But before you begin, do a little homework.

▪ **Look for products that are "certified pre-owned."**



Embrace the 30-Day Trial

Amazon Prime, Disney+, Netflix, and Spotify Premium are just a handful of the services that offer free trial periods (some are only seven days, but you get the idea). Taking advantage of these is a good way to decide whether a service is worth paying for, but if you're strategic, you can use a free trial period to, say, entertain visiting grandkids, save big on Amazon Prime Day, or catch the Tour de France. Be sure to mark your calendar so that you don't forget to cancel the service before you have to start paying for it.

Make sure the refurbishment includes a new rechargeable battery and all of the standard accessories.

▪ **Insist on a warranty.**

Without one, you have no protection.

▪ **Ask about the returns policy.** Some problems take time to surface, so it's best to buy from a retailer that gives you at least a month to return the product.

POTENTIAL SAVINGS: You can easily save \$100—much more depending on the product.

Skip the Extended Warranty

CR research shows that members who purchase extended warranties and service contracts for laptops rarely use them for repairs. Not only that, but the median cost of the extra coverage is about the same as the median cost of a single repair. The survey results for desktops and tablets are very similar. Bottom line: If you have a habit of dropping your phone,



STOP RENTING YOUR ROUTER

Instead of paying \$5 to \$10 per month to lease a router from your cable company, consider buying one. You'll find options that practically pay for themselves in a year's time. The OnHub AC1900 from Google and Asus, for example, sells for \$85. If you have a modest-sized home, choose the TP-Link Archer C7, which costs only \$60.

POTENTIAL SAVINGS: Up to \$120 per year.

**OnHub
AC1900**
\$85

74 OVERALL
SCORE

**TP-Link
Archer C7**
\$60

70 OVERALL
SCORE

it might make sense to spring for the added protection. Otherwise, put the money into your savings account just in case you need it. The stats say you'll probably get to keep it.

POTENTIAL SAVINGS: \$100 or more for a laptop or smartphone.

Shop at the Right Time

The holiday deal season in November and December is generally the best time to shop for electronics, but you don't have to wait until year's end to get a good deal. Here are the other times you can save, based on a CR analysis of pricing data.

January: Sound bars and TVs.

February: Smartphones and tablets.

March: Cameras.

May: Portable Bluetooth speakers, camcorders,

and smartwatches.

July: Home security cameras.

August: Chromebooks, desktops, headphones, laptops, and printers.

POTENTIAL SAVINGS: 25 percent or more off regular prices.

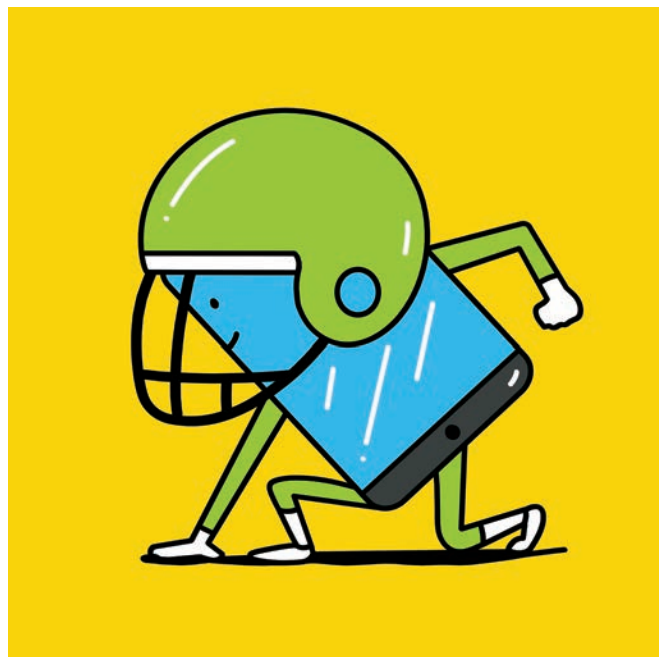
Buy a Phone Case

Dropping an unprotected phone can be a costly fumble.

The out-of-warranty cost to replace a cracked screen on the iPhone 11 Pro Max is \$329.

For an iPhone X, it's \$279. And Best Buy's screen replacement service for Samsung phones starts at \$200. Inexpensive cases are available for less than \$20, and CR's testing shows that even a flimsy case can confer enough protection to keep a screen from cracking in many instances.

POTENTIAL SAVINGS: \$200 or more.



Mohu ReLeaf
\$30

74 OVERALL
SCORE

USE AN INDOOR ANTENNA

Chances are good that you can get dozens of over-the-air channels using an indoor TV antenna. In a recent CR test of antennas, the Mohu ReLeaf came out on top. It costs about \$30—much less than a single month of basic cable.

The number of channels you'll be able to receive depends largely on where you live. To find out how many channels an antenna in your home is likely to pick up, enter your address at the Federal Communications Commission's DTV Reception Maps website (fcc.gov/media/engineering/dtvmaps). Be sure to buy a model from a retailer with a liberal return policy, just in case. Last, placing the antenna close to a window and higher up tends to optimize reception.

POTENTIAL SAVINGS: Hundreds of dollars per year, based on the cost of the cable subscription you cancel.



14 WAYS TO STREAM SHOWS FOR FREE

You won't have to pay a penny to watch any of the thousands of movies, TV shows, and other programming that these no-cost services offer. The only downside: You'll probably have to sit through advertisements.

Crackle

Crackle offers mainstream titles, including popular bygone TV shows ("All in the Family," "Walker, Texas Ranger," "Who's the Boss?") and older movies ("Lethal Weapon," "Big Fish," "Pineapple Express," "Dead Man Walking"). It has also developed series, including "StartUp," essentially a darker version of HBO's "Silicon Valley," and a few original movies. Crackle is

available on Amazon Fire TV, Apple TV, Chromecast, Roku, and other streaming players, as well as some smart TVs.

Hoopla

Hoopla has a catalog of movies, music, audiobooks, comics, and more that is free to members of participating local and university libraries. Your library sets the limit on

how many movies you can borrow each month, and you have 72 hours to watch a title after checking it out. You can access Hoopla on a computer, on Android and iOS mobile apps, and via streaming players such as Amazon Fire TV, Apple TV, Chromecast, and Roku. The mobile app even offers a download option for offline viewing.

IMDb TV

IMDb TV, owned by Amazon, is a free, ad-supported streaming service powered by the IMDb movie and TV show database. It offers relatively recent movies (Oscar winner “La La Land”), plus older ones (“Memento,” “Crouching Tiger, Hidden Dragon”) and TV series (“The Middle,” “Schitt’s Creek”). It also has original content, including the 10-episode animated series “You’re Not a Monster.” Last year, the company signed deals with studios such as MGM, Sony Pictures Entertainment, and Warner Bros. that tripled the amount of available content. You can watch IMDb TV via the IMDb website, as well as on Fire TV devices or through Amazon Prime Video apps on smart TVs, mobile devices, tablets, Echo screen devices, and Apple TV. To watch, you’ll need to sign in using your IMDb or Amazon account, or create one. You can also sign in with your Google or Facebook account.

Kanopy

Like Hoopla, Kanopy requires a membership at a participating library, university, or other learning institution. Its cerebral collection of 30,000 films comes from sources including the Criterion Collection, the Great Courses, New Day Films, and PBS. If you access Kanopy through a library membership, you may be able to watch a limited number of titles per month.

Pluto TV

In addition to more conventional content, including modern movies (“Whiskey Tango Foxtrot,” “The Big Short”) and earlier-era classics (“Clue,” “True Grit,” “The Way We Were”), Pluto TV offers CNN and other live news networks and channels that draw content from BET, Comedy Central, MTV, Nickelodeon, Spike, Paramount, and others. Pluto TV Latino has 22 curated channels in Spanish and Portuguese, including comedy, movies, music, reality TV, sports, telenovelas, and true crime. “Dr. Who” and “Antiques Roadshow” fans can watch episodes 24/7. Pluto TV is available on many streaming devices and smart TVs, and with the app for smartphones and tablets.

Redbox

This service offers celebrity and entertainment news from TMZ, national and

world news from USA Today, and viral videos from FailArmy, plus movies, TV shows, and comedy specials from various providers. You can access it via a “Free Live TV” link at the top of its website, as well as on many streaming devices and smart TVs, and with the app for smartphones and tablets.

The Roku Channel

Consumers with a Roku streaming media player or a Roku TV have been able to stream free shows and movies on The Roku Channel. Now, with The Roku Channel for the Web, anyone can access free programming from a computer, smartphone, or tablet. Go to therokuchannel.com and log in or create a Roku account to start streaming free movies and television content from providers including ABC, the CW, and Fox, and streaming services such as Crackle, Pluto TV, and Tubi TV.

SnagFilms

SnagFilms offers more than 2,000 on-demand movies, TV show episodes, documentaries, and original comedy shorts in outside-the-mainstream categories, including Climate Change & the Environment, Refugee & Immigrant Stories, and Celebrate Pride. You can access the service via a computer; Android and iOS smartphones and tablets; Amazon Fire TV, Apple TV,

Google Chromecast, and Roku streaming players; and PlayStation and Xbox game consoles.

Stirr

Stirr offers local and national news, plus a mix of sports, entertainment, and digital-first channels, as well as a library of on-demand video titles. Channels include Cheddar, FailArmy, NASA TV, Stadium, and World Poker Tour, among others. You can also watch chef Gordon Ramsay on “Hell’s Kitchen” and “Kitchen Nightmares,” as well as classic movies on the American Classics channel. Series include shows such as “The Greatest American Hero,” “Hunter,” “The Commish,” and “21 Jump Street.” Stirr is available on Apple TV and Roku streaming players, Android and iOS smartphones and tablets, and computers.

Tubi TV

This ad-supported service has more than 20,000 titles, including old Chuck Norris films, classic indie titles (“Memento”), and acclaimed movies (“Bull Durham,” “Citizenfour”). Seasons of TV shows (“Dog the Bounty Hunter,” “Merlin,” “Hoarders”) are also available. Tubi Kids, a family-focused area of Tubi, features a free library of children’s content—more than 1,200 age-appropriate movies and television shows,



according to the company. Tubi TV is the exclusive home for all 15 seasons of “The Apprentice” franchise. The company says it will spend more than \$100 million in 2020 to expand on its current library of movies and TV series. The service is available on Apple TV, Roku, Amazon Fire, and other streaming devices, as well as Xbox and Android and iOS apps.

Vudu

Vudu, Walmart’s online video site, offers a rotating collection of thousands

of free choices that include popular older movies (“The Karate Kid,” “Lethal Weapon,” “Nothing But Trouble”) and TV shows (“Roseanne,” “3rd Rock from the Sun,” “Alf”). Original programming scheduled for release includes a sci-fi series starring Evangeline Lilly (who appeared in “Lost” and “Ant-Man and the Wasp”), a travel/comedy show produced by Queen Latifah, and a documentary-style interview series with Randy Jackson. The service is available on

Roku, Chromecast, and TiVo streaming devices, as well as game consoles and Android and iOS apps.

WatchYour.TV

Fans of classic TV shows and movies might want to check out watchyour.tv, a free, ad-supported service from TVS Television Network. The site is organized by “networks” based on interests and genres, such as sports, movies, entertainment, and kids and family, then by subcategories.

For example, there are six sports channels, including TVS Sports Network, TVS Classic Sports, TVS Women’s Sports Network, and TVS Boxing Network, and six movie channels, including TVS Classic Movies, TVS Drive In Movie, and TVS Nostalgia Movie Network (a Fred Astaire movie was playing recently). The service also has a “DVR,” but it’s more like a catch-up feature that lets you scroll through each channel’s offerings over the past seven days, then stream.

At press time, you could watch older movies (“Zulu”) as well as classic TV shows (“Ozzie and Harriet,” “Bonanza,” “Lassie,” “The Beverly Hillbillies”).

Watchyour.tv is available on iOS and Android smartphones and tablets, Amazon Fire TV and Roku players and televisions, Apple TVs, and Android TVs.

Xumo

Xumo offers live and on-demand content from more than 190 channels from providers including Funny or Die, TMZ, GQ, Vogue, NBC News, and Sports Illustrated. Xumo continues to expand its channel lineup. In addition to content from the History Channel, Xumo also recently signed a deal to bring the Fubo Sports Network, plus 13 other genre-based channels, to the service. Xumo also offers the PGA Tour’s first ad-supported streaming channel, which includes live coverage of matches as well as highlights and interviews. You can watch Xumo on some smart TVs, iOS and Android smartphones and tablets, Apple TVs, and Amazon Fire TV and Roku streaming players and televisions.

YouTube

You might think of YouTube mainly as the home of user-created content, but the site has more than 350 free movies, which can be found in the Free to Watch section under Movies & Shows. The mix ranges from older, bigger-budget Hollywood fare (“Half Light,” “Trespass”) to animated movies (“Khumba”) to documentaries (“Jiro Dreams of Sushi”). The lineup changes periodically, so be sure to check back to see which new movies have appeared.

IS IT TIME TO SWITCH UP HOW YOU STREAM?

These new options from some of the world's biggest tech and entertainment companies may offer more and better content than you have now. Subscribing to one won't automatically save you money. But if you cut a current subscription service or two to add one of them, you could break even, or maybe even end up ahead.

Apple TV+

COST: \$5 per month.

Apple's streaming service is a bargain, although its content right now is less robust than most of its competitors'. Choices include "The Morning Show," with Reese Witherspoon, Jennifer Aniston, and Steve Carell; "See," a post-apocalyptic drama starring Jason Momoa and Alfre Woodard; and "Dickinson," a fanciful coming-of-age story from the perspective of 19th-century poet Emily Dickinson. Also available, or launching soon, are a reboot of Steven Spielberg's 1980s series "Amazing Stories"; "Little Voice," about an up-and-coming singer, from director J.J. Abrams and singer-songwriter Sara Bareilles; and a series of documentaries from Oprah Winfrey. The Apple TV app, which provides access to Apple TV+, is now available on several smart TV brands, as well as on Roku and Amazon Fire TV streaming devices.

AT&T TV

COST: Starting at \$50 per month for the first year, \$93 per month for the second year. AT&T TV is basically a streaming version of its DirecTV satellite service. AT&T TV doesn't require

a satellite dish, but it does require a contract and an Android-based set-top box provided by AT&T (one set-top box is included free, but additional ones cost \$10 per month, or \$120 if you want to buy them outright). The least expensive plan has about 75 channels. Three step-up plans are available at additional cost and can include regional sports networks, Cinemax, HBO, Showtime, Starz, and Epix. The new system supports 4K videos and includes 500 hours of DVR storage. AT&T says that one box will support up to three streams and that customers can use an app to stream content on a smartphone or tablet.

Discovery/BBC

COST: Not yet announced at press time. Discovery says it will launch a new streaming service in partnership with the BBC in 2020. The Discovery-branded service will feature all of the BBC's natural history programs, including "Planet Earth" and "Blue Planet," as well as new series developed by the two companies. It will also include top shows from Discovery's portfolio, as well as

new original shows. At press time, no price or launch date had been announced.

Disney+

COST: \$7 per month (\$70 if you pay annually).

Disney's new Disney+ subscription streaming service has a vast array of new original shows and movies, as well as a deep catalog of other titles. A bundled plan that combines Disney+, ESPN+, and Hulu is available for \$13 per month. Disney owns all the "Star Wars" movies (via Lucasfilm) as well as Marvel, Pixar, and 20th Century Studios, and is the majority owner of the National Geographic channel. Among the highlighted new original content is "The Mandalorian," an 8-episode Jon Favreau-directed series in the "Star Wars" universe. A second season will be coming this fall. The Disney+ app is available on lots of devices, including LG and Samsung smart TVs, plus Android and Roku TVs. You can also access the service from most streaming players, game consoles, and Android and iOS smartphones, and via web browsers.

HBO Max

COST: \$15 per month.

At press time, the new HBO Max streaming service was set to launch in May. This could be a compelling option for many because it includes the premium HBO service, a slate of new original programs, and a deep catalog of titles from the Warner Bros. television and film library, the Cartoon Network, CNN, DC Entertainment, TBS, and Turner Classic Movies, among others.

At launch, the service will have exclusive streaming rights to every episode of "Friends" and "The Big Bang Theory." It will also have new original movies from producer

Greg Berlanti and Reese Witherspoon, and original series such as "Love Life," starring Anna Kendrick, and "The Flight Attendant," starring Kaley Cuoco.

NBCUniversal/Peacock

COST: Free for limited content, \$5 per month for premium content, \$10 per month for ad-free streaming.

At press time, Peacock, a new streaming service from NBCUniversal, was slated to launch in select markets in April before debuting nationally July 15. The basic option, Peacock Free, will be an ad-supported free service that features some NBCUniversal content. Peacock Premium costs \$5 per month for access to a more robust library of ad-supported content; a \$10-per-month ad-free option will also be available. Programming will include movies and programs from other NBCUniversal properties; popular prime-time shows, such as "Law and Order: SVU"; A&E and History channel shows, such as "Cold Case Files"; and original programming, including a music-themed comedy produced by Tina Fey.

Quibi

COST: \$5 per month with advertising, \$8 per month without, both after a 90-day free trial.

Quibi, which launched in April, is a streaming service offering original series and films told in episodes of 10 minutes or less.

Unlike many other new services, Quibi is meant to be viewed on a mobile device rather than a TV, and it supports both horizontal and vertical videos. Big names producing content or starring in series for the service include Steven Spielberg, Idris Elba, Andy Samberg, and Chrissy Teigen.



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& ADVICE™

ROAD REPORT

ASK OUR EXPERTS

How can I keep coronavirus out of my car?



In addition to washing your hands, cleaning high-touch areas of your car (including the steering wheel, door handles, gear selector, and screens) can help keep the new coronavirus at bay. Here's how to keep interiors clean:

Alcohol: Almost every surface inside

a vehicle can be safely cleaned with isopropyl alcohol, and solutions containing at least 70 percent alcohol should kill the virus. But because the sustained use of alcohol can leave leather susceptible to damage and discoloration, use a leather conditioner after applying it.

Soap and water: Vigorous washing with soap and water can reduce the presence of the virus and is safe for cloth, leather, and most other car interior surfaces. Scrub with a small amount of water and laundry detergent—too much can leave fabric damp and lead to mold growth—preferably using a microfiber cloth to prevent scratching.

Bleach, peroxide, and ammonia: Don't use these. They can damage your car's upholstery as well as the nonglare coatings on touch screens.

TIP FROM OUR TEST TRACK

Staying Safe at the Gas Pump

Follow these precautions to avoid viral contamination when filling up.



CREATE A BARRIER.

Wear latex or nitrile gloves or use a paper towel to grip the pump handle and press the keys. Dispose of the gloves or paper, then thoroughly wash your hands for at least 20 seconds with soap and water. (Hand-washing is most effective, but an alcohol-based hand sanitizer with at least 60 percent alcohol is the next best option.)



WIPE DOWN SURFACES.

While the measures above should be sufficient, some drivers may want to start by cleaning the pump handle and keypad with Clorox disinfecting wipes (or another bleach- or alcohol-based brand) or a solution of at least 70 percent isopropyl alcohol to eliminate any of the coronavirus that may be present.

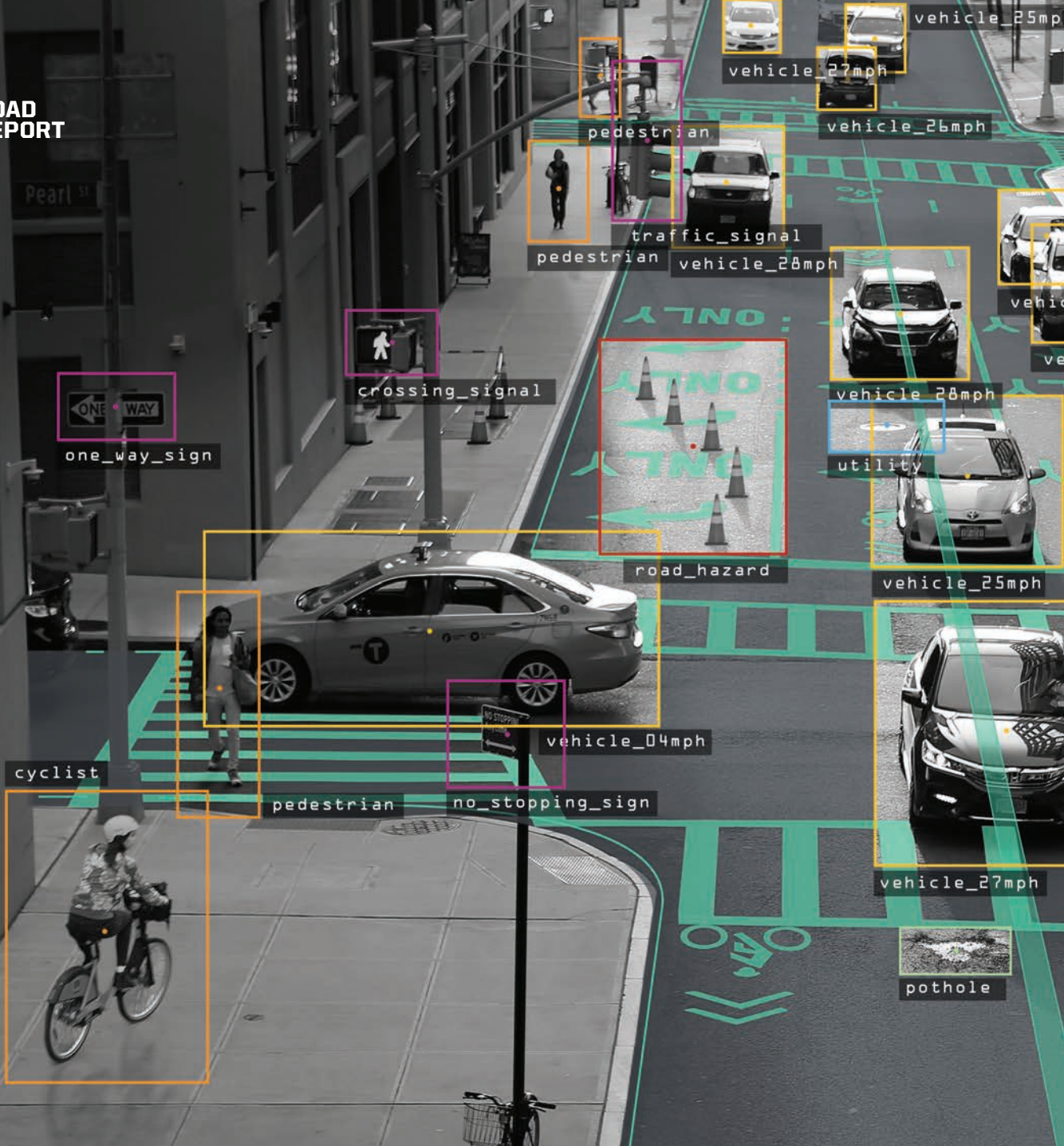
TRENDS

Automakers Switch Gears Due to Coronavirus

At press time, Ford, General Motors, and other automakers were temporarily slowing or ceasing production due to decreased demand linked to the coronavirus fallout. Hyundai had reinstated its

Assurance Job Loss Protection program, which will make up to six months of payments for qualified new owners who lose their job. Several other manufacturers were asking customers experiencing

financial hardship to contact them to discuss modifying payment plans. Ford and GM were preparing to manufacture ventilators and perhaps other equipment to address critical shortages.

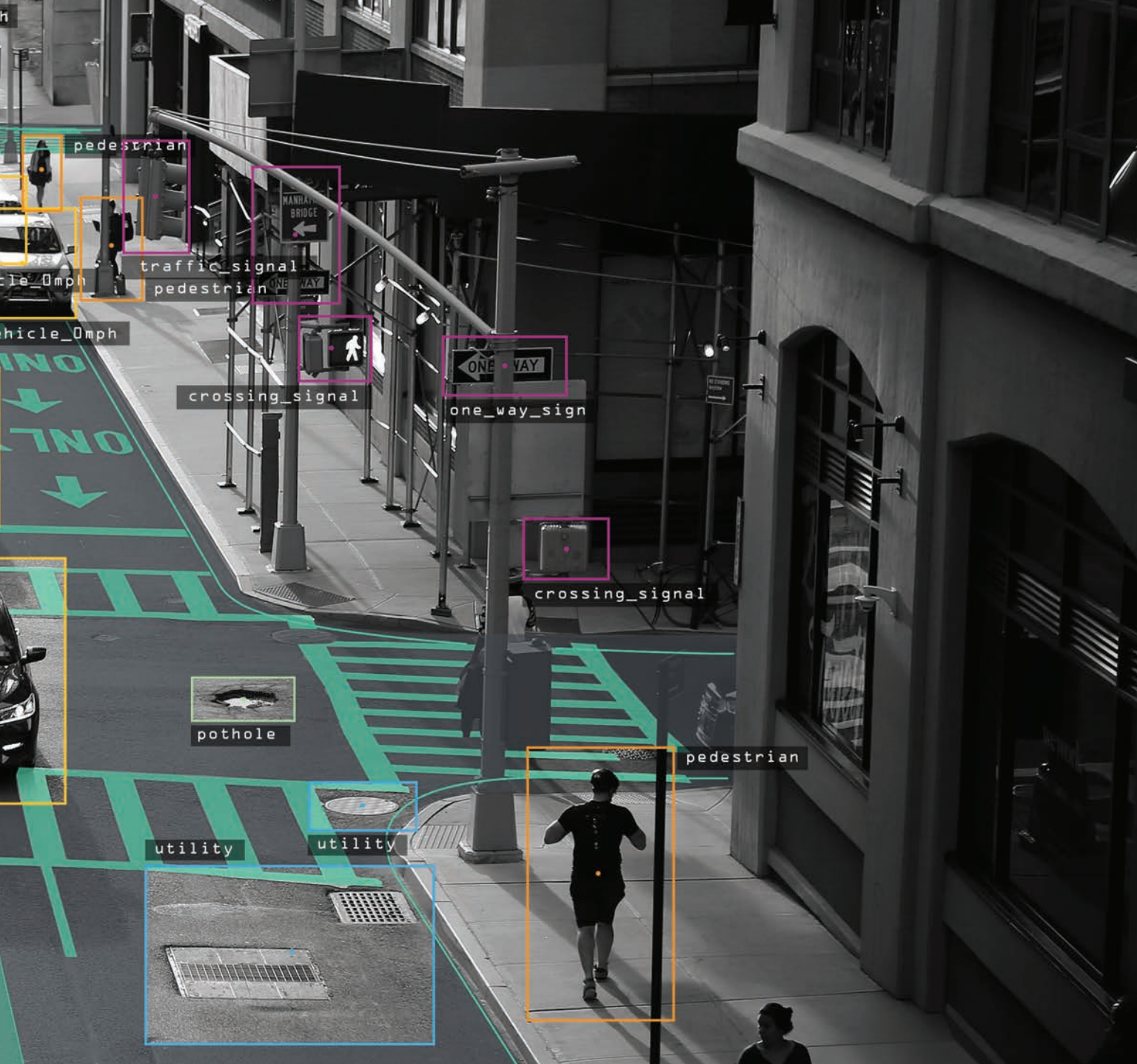


What Your Car 'Sees'

Your new car is no longer just feeding you directions and tracking your mpg. Its high-tech sensors are now reading the road—from off-ramps to intersections, from sidewalks to potholed streets. But who's buying, selling, and using that data? You have a right to know. **by Keith Barry**

EYES ON THE STREET

While you drive, your car's safety sensors and cameras may be scanning the road for information to send back to car companies with partners that trade or sell the data to map makers, city planners, and utility companies. These sensors may not send live video, but they do share raw data about the roads and their surroundings, which is then aggregated with information from millions of other cars. Here's what many modern vehicles can scan.



■ Lane Markings and Road Boundaries
 Onboard cameras scan the lines on the road and look for curbs while you drive. This information is used to refine high-definition maps so that vehicles can always know if they're in a lane, even if markings are faded or obscured. It can also be sold to public works departments to let them know where to repaint.

■ Vehicle Speeds
 Vehicles broadcast speed data, which can be aggregated and sent to law enforcement to focus patrols where drivers tend to speed.

■ Potholes
 Sensors can scan roadways for potholes so that cities can identify damaged roads that need repair.

■ Construction Areas
 Information can be sent in real time to connected navigation systems so that they can reroute drivers to avoid roadwork.

■ Traffic Signs and Lights
 Sensors that can read traffic signs and signals can tell public works departments if lights aren't working or signs are missing.

■ Utility Infrastructure
 Utility companies can maintain inventory of telephone poles, manholes, drains, and electrical boxes instead of sending employees to survey them.

■ Pedestrians and Cyclists
 Sensor software that's programmed to detect pedestrians and cyclists and avoid collisions with them can also "see" where groups of walkers and bikers tend to travel. It can then share that information with city planners so that they can make changes to improve safety.

T

THERE'S A PROBLEM with a bike lane in Brooklyn, N.Y. City officials painted it along part of Manhattan Avenue, a major thoroughfare between the Greenpoint and Williamsburg neighborhoods. But the lane suddenly ends at a busy intersection. It picks up one block east, but that isn't obvious to cyclists. Most of them continue down Manhattan Avenue, where their path is often blocked by traffic and double-parked cars.

A few miles away on the New Jersey Turnpike in East Rutherford, N.J., there's another problem: Drivers heading to the Meadowlands are taking a sharply curved off-ramp so fast that they have to slam on the brakes.

These and plenty of other problems around the world (in Barcelona, Tel Aviv, and Tokyo, for example) are clearly visible on digital maps put together by a company called Mobileye. Speeding cars turn roadways red, and groups of cyclists glow like flames along bike routes. It's a top-down view of all the traffic problems that drivers, cyclists, and pedestrians encounter and complain about every day.

The maps aren't being used by city planners—at least, not yet. Instead, they're part of Mobileye's unique pitch to investors, journalists, and potential customers. The company, a subsidiary of Intel, can compile those red lines and glowing bike lanes because it has access to millions of sensors in privately owned cars that share data from commuters whether they realize it or not.

If you drive a newer car, it probably has at least one built-in camera or sensor that powers important safety systems like automatic emergency braking (AEB) and blind spot warning (BSW), or that makes driving easier with features like adaptive cruise control and lane centering. Most of the software and algorithms that control those systems were developed by Mobileye.

But those same cameras and sensors might also be watching for potholes on the road and pedestrians on the sidewalk, then sending that information over a cellular connection you might not know your car has to a company you've probably never heard of so that it can create detailed data profiles of every roadway in the world. Every time you drive to work, take your kids to school, or go shopping, your car may be fitting another tile into the mosaic of a detailed, composite map that can be sold in the growing market for car data.

"This type of data has enormous potential for public good, provided its collection is limited and handled in a way that protects drivers' privacy," says David Friedman, vice president of advocacy at Consumer Reports. "The problem is that currently there are no federal laws limiting the collection and use of that data, or even requiring clear disclosure of what is being shared, and with whom. It's the Wild West out there."

So far, Mobileye has mapped more than 180 million miles of roads worldwide, and it's scaling up. As soon as this year the company plans to use the sensors built into vehicles from BMW to collect data about their immediate surroundings, a process Mobileye calls "harvesting." Similar sensors are being built into vehicles from Ford, Nissan, and Volkswagen, and Mobileye says it will be harvesting data from them in the U.S. by 2021.

And Mobileye isn't alone. A startup

called Carmera that collects roadway data from commercial vehicles plans to do the same with sensors already built into production vehicles from Toyota. Tesla says it's improving its partial autonomy software by using video data it collects from private vehicles. And other companies are close behind.

Sensors are also crucial to the development of the autonomous cars of the future, which will require highly detailed, up-to-the-minute maps to help them "see" the world around them.

And these maps may end up influencing city planning, development, and policing decisions where you live, work, and travel. How that data is used will depend on who gets their hands on it, and could lead to massive profits. Analysts say that control of data collected from cars could turn into a \$750 billion industry over the next decade.

Carmera and Mobileye are targeting urban planners as potential users of these high-definition, or HD, maps. They say that cities will be able to use the data to discover where crashes take place and where drivers tend to speed, find out which buildings aren't accessible to disabled people, identify roads where burned-out streetlights need to be replaced and potholes need to be fixed, and see where cyclists and pedestrians are concentrated so that infrastructure can be built to keep them safe.

But privacy and data collection experts tell CR that insurers could use data gleaned from HD maps to raise rates for drivers who travel on streets where other drivers tend to exceed the speed limit, landlords could choose to raise rents in neighborhoods with lots of luxury cars, credit reporting firms could make inferences about people who live on streets with less lighting or more potholes, and law enforcement could target pedestrians, homeless encampments, or public gatherings.

Ben Green, author of "The Smart



SPEED DEMONS
Data from car sensors can show where traffic moves too fast and where vehicles slam on the brakes.

Enough City” (MIT Press, 2019) and a researcher at the Berkman Klein Center for Internet and Society at Harvard University, says the same data collected from cars to make cities “smarter” could have unintended consequences when used by other sectors, such as healthcare, human resources, or the media.

“Maybe that data is then going to lead to profiles of you that then make an assessment when you apply for a job or apply for healthcare or any number of things,” Green says. “These systems can find ways, without breaking the law as it stands, of redlining people or excluding people.”

Raising a Car’s IQ

Today, most cars use cameras and radar sensors so that advanced driver

‘AMERICANS DESERVE SOME BASIC LEVEL OF PRIVACY LAW TO ENSURE THAT DATA ISN’T BEING COLLECTED AND SHARED IN WAYS THAT ARE CONTRARY TO OUR INTERESTS.’

JUSTIN BROOKMAN, DIRECTOR OF CONSUMER PRIVACY AND TECHNOLOGY POLICY AT CONSUMER REPORTS

assistance systems (ADAS) such as AEB can prevent potential crashes before they happen. As these systems become more complex and take over more functions from the driver, they’re starting to double-check what their sensors “see” against HD maps that are accurate to within a few centimeters.

“HD maps are crucial as you start to get into higher-level automation,” such as when cars are able to automatically steer within lane lines, says Sam Abuelsamid, a mobility analyst at the consulting firm Navigant. “If there’s snow on the road and you can’t see the lane, GPS is neither precise enough or reliable enough for that kind of application.”

In order for HD maps to work, they must be updated constantly, so ADAS systems are trained to spot differences

between existing HD maps and the real world their sensors are seeing. If there's been a change—say, if temporary lines are painted due to road construction—the sensors can send an update to the HD mapmaker over a car's built-in cellular connection.

Mobileye is creating HD maps in a project called Road Experience Management, or REM. The company says that as few as 10 cars passing down a newly modified road could send back enough data to build an updated map. Outside the U.S., both Nissan and Volkswagen are already using REM data to improve their driver assistance

to measure air quality, tree canopy coverage, and street lighting. The REM project, however, marks the first time this kind of data is being collected from private vehicles, Abuelsamid says. But he predicts it won't be the last.

Who Stands to Profit?

For companies like Mobileye and Carmera, the depth of data collected by their sensors opens up numerous potential new revenue streams. That's because HD maps aren't useful just for improving automotive safety and self-driving systems. They can also be used to create inventories of electrical

gives sensors to fleet operators so they can monitor their drivers in real time in exchange for unlimited access to the data those sensors collect. It also shares some of that data with cities. (The company doesn't share which fleet operators it works with.)

Mobileye talks about utility companies, city planners, public transit agencies, and law enforcement as potential customers for its HD map data.

"There's absolutely a significant revenue source," Abuelsamid says. The company has already made a deal with a major U.S. city that it has yet to reveal. It says that its maps can cost in the hundreds of thousands of dollars each year, but that they're more cost-effective than other methods of collecting similar data.

The Focus on Privacy

How much control drivers have over the information their cars share largely depends on the privacy policies of the companies collecting it and—for now—the technical limitations of the equipment involved, including cameras, processors, and cellular networks.

Babaioff says that REM-equipped cars are intentionally designed to protect a driver's privacy. "No images leave the camera," he notes. Data points are stripped of any identifiable information, and REM collects only segments of individual drives.

"We will throw away the start and end of the drive," Babaioff says. "If you drove from home to work, I would actually get segments that aren't close to your home and not close to your work. This gives us the ability to collect the data without you sacrificing any of your privacy."

Carmera, however, does broadcast video clips from its small fleet of partner vehicles so that humans can verify that its object-identification algorithms are working properly. Gupta says it will eventually be possible to use data from cameras installed in



programs. And a spokesperson for the map provider HERE Technologies told CR it will debut HD maps in BMW and Mercedes-Benz vehicles next year.

Tal Babaioff, who heads up the REM program, says the data collected from cars is not only anonymized but also extremely pared down. "We're not sending images, we're not sending license plates," he says. "We're sending semantic information about the world." Neither images nor the data derived from them are stored on the vehicles.

Even without HD maps, cities can already access an unprecedented amount of information from vehicles. For example, 70 cities including Austin, Texas, and Los Angeles collect data from shared e-scooters and bikes. Boston and other cities have installed sensors on municipal fleet vehicles

boxes and poles for utility companies, find potholes or faded lane markings, or alert cities to where new bike lanes or crosswalks should be built—what Carmera's CEO, Ro Gupta, calls a "byproduct" of HD map creation.

For example, the company uncovered an unexpected source of pedestrian data when it took the privacy-protecting step of blurring the faces of bystanders its cameras captured. "We realized, 'Hey, we're counting a person each time,'" Gupta says. "We could create this very granular block-level indexing score across the city of how dense any block in the city is on a given month, day of the week, or time of day."

Gupta says that Carmera has abandoned its early plans to sell that data to focus instead on HD maps for automotive customers. Now, Carmera

privately owned Toyota vehicles. But because of privacy laws, which he says are “good things,” and technical hurdles, he says “it’s going to take a long time for that to be available en masse.”

(The Toyota Research Institute, which is partnered with Carmera, didn’t respond to CR’s inquiries about the project.)

Even Tesla—which isn’t planning to rely on HD maps and instead sends what it calls “short video clips” from built-in cameras in its vehicles back to the company to improve its Autopilot driver assistance software—can’t collect that much data, Abuelsamid says. Although the company has released data from an owner’s car after a crash, a Tesla vehicle doesn’t save or broadcast everything it sees. “It’s selectively picking small tidbits of data and saving that,” Abuelsamid says. “There just isn’t enough storage space on the vehicle to store that data, and it would be prohibitively expensive to transmit it all back to Tesla.”

Drivers can opt out from harvesting REM data, although Mobileye says how they do that depends on rules set by a car’s manufacturer. BMW says that drivers automatically opt in to REM when they activate the car’s connected services, and that they might lose certain connectivity features if they opt out, such as getting warnings about slippery roads or traffic signs.

(Nissan and Ford didn’t respond to CR’s questions about REM, Tesla didn’t respond to requests for comment, and a spokesman for Volkswagen told CR the company doesn’t “go into detail on specific technology suppliers and their specific hardware and software solutions.”)

But if how automakers communicate about privacy is any guide, drivers may not even realize they’ve opted in, says Johanna Zmud, a senior research scientist at the Texas A&M Transportation Institute who has studied automotive data privacy.

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DAVID FRIEDMAN,
VICE PRESIDENT OF ADVOCACY
AT CONSUMER REPORTS

In most cases, these policies might flash across the screen for a few seconds when a car is started. Or they might be included in the stack of documents buyers have to sign at a dealership, buried between odometer disclosures and finance applications.

“I’ve seen some of the agreements that, for instance, automakers have for a purchaser, and they’re very, very long,” Zmud says. “Most people just go to the last page and sign.”

Lorrie Cranor, director of CyLab, the security and privacy research institute at Carnegie Mellon University, says that even if it seems like Mobileye and other companies are handling the data they collect responsibly, that doesn’t answer the question of what other groups might do.

“If the data is going into algorithms to figure out where we need new traffic lights, and it’s never going to be released as a data set and deleted after

a certain amount of time, it seems like it’s relatively low risk,” Cranor says. That’s especially true when compared with more revealing data sets, such as information collected from mobile phone apps or traffic cameras.

But Cranor says there’s no guarantee that HD mappers won’t sell data to third parties that might use it for purposes other than traffic planning.

Take law enforcement, for example. Depending on how the police choose to use HD maps, they could either address existing inequalities or reinforce them, says Vinhcent Le, telecommunications and technology legal counsel at the Greenlining Institute, an advocacy group that aims to advance economic opportunities for people of color. “That’s where you need to flip the script,” he says. It’s especially true when maps show homeless encampments or broken streetlights. “That’s not where you need to send police, that’s where you need to send more services.”

Justin Brookman, CR’s director of consumer privacy and technology policy, says that ultimately it’s up to lawmakers to develop provisions that protect people against the misuse of data collected by this new technology.

“Real-time data collection can do a tremendous amount to promote safety and facilitate repairs, but people are right to worry about what their cars are sharing, and with whom,” Brookman says. “We shouldn’t have to trust companies to do the right thing, since their first obligation is to their shareholders, not drivers.”

Under current privacy laws, Brookman says, Americans will be none the wiser if HD maps are used for purposes other than road safety and maintenance.

“Americans deserve some basic level of privacy law to ensure that data isn’t being collected and shared in ways that are contrary to our interests,” he adds. “Right now, all bets are off.”



ROAD TEST

WE CONDUCT 50+ TESTS ON EACH VEHICLE AT OUR 327-ACRE AUTO TEST CENTER. FOR COMPLETE ROAD TESTS, ALL-ACCESS MEMBERS CAN GO TO [CR.ORG/CARS](https://www.cars.com).



2-ROW SUVs

Mazda CX-30

Sleek, But Cramped and Finicky

61

OVERALL SCORE

ROAD-TEST SCORE 64

HIGHS Fit and finish, fuel economy

LOWS Controls, engine noise, tight quarters, visibility

POWERTRAIN 186-hp, 2.5-liter 4-cylinder engine; 6-speed automatic transmission; all-wheel drive

FUEL 27 mpg on regular fuel

PRICE \$21,900-\$29,600 base price range \$28,645 as tested

THE CX-30 IS a new addition to the Mazda lineup. It's based on the Mazda3 and slots between the smaller CX-3 and larger CX-5 SUVs. The CX-30 is quieter, more stylish, and more refined than its competitors, but it costs more.

While the CX-30's handling is responsive and secure, it isn't as nimble as you'll find in the CX-3 or Mazda3. The ride is rather firm and can feel jumpy over bumps, and the engine sounds raspy, especially at low revs. This unexpected coarseness detracts from an otherwise quiet cabin.

The CX-30's 27 mpg overall is commendable for an AWD SUV. It's quicker than the similar-sized Subaru Crosstrek when accelerating flat-out from 0 to 60 mph. But the Mazda requires a heavy foot on the accelerator to wring power out of the engine, so around-town driving doesn't feel particularly brisk.

The cockpit and center console are nicely trimmed and have room to store small items, but the snug interior encroaches on the driver and front passenger. The rear seat is tight, and small side windows hurt outward visibility.

We found Mazda's rotary-knob-based infotainment system frustrating because it requires multiple taps and twists to execute basic tasks, taking the driver's focus off the road.

FCW and AEB with pedestrian detection are standard, but options come packaged in ways that drive up the price. For example, a power driver's seat is available only as part of a \$2,300 package with heated front seats and an upgraded audio system. A well-equipped CX-30 costs nearly as much as the more appealing CX-5 with similar features.

3-ROW SUVs

Toyota Highlander

Well-Rounded and Family-Friendly

86

OVERALL SCORE

ROAD-TEST SCORE 86

HIGHS Smooth engine, ride, controls, second-row seats

LOWS Agility

POWERTRAIN 295-hp, 3.5-liter V6 engine; 8-speed automatic transmission; all-wheel drive

FUEL 22 mpg on regular fuel

PRICE \$34,600-\$50,200 base price range \$42,843 as tested

REDESIGNED FOR 2020, the Highlander still shines as a high-scoring, CR-recommended vehicle, even gaining a bit more refinement than the previous version. The new Highlander benefits from incremental improvements across the board. All told, it's a smart choice for families looking for a do-it-all vehicle.

As before, the smooth-running, lively V6 engine serves up lots of power for passing or climbing hills. It's paired with a responsive, smooth-shifting eight-speed automatic transmission. The Highlander's ride is compliant and controlled, and the 2020 version feels a bit more agile than last year's model. The soft suspension allowed pronounced body roll when driving the Toyota on our track and through our accident-avoidance maneuver.

We like the high-end

materials and subtle details in the nicely appointed cabin, but the Kia Telluride and Subaru Ascent have more impressive interiors.

The Highlander's front seats are comfortable for many body types. Forward visibility is good, but the view gets pinched toward the rear, a consequence of the styling. The second-row bench seat provides good support and affords a lot of leg and elbow room. The seat slides fore and aft, and also reclines in two independent sections, enabling plenty of passenger and cargo flexibility. The third row is snug, low, and firm.

The infotainment system is much improved; Android Auto and Apple CarPlay compatibility are standard. The SUV also comes with FCW, AEB with pedestrian detection, LDW, LKA, and adaptive cruise control.

PHOTOS: JOHN POWERS/CONSUMER REPORTS

Ratings ➤ **All Aboard** For this issue we looked at two different types of SUVs: compact models that work well on urban streets and three-row models for big families.

Make + Model	Overall Score	Survey Results		Road-Test Results										Advanced Safety						
		Predicted reliability	Owner satisfaction	Road-test score	Overall mpg	Seat comfort front/rear	Usability	Noise	Ride	Fit + finish	Routine handling	Avoidance-maneuver speed, mph	Acceleration, 0-60 mph, sec.	Dry braking, 60-0 mph, ft.	Cargo volume, cu. ft.	FCW	AEB, city	AEB, pedestrian	AEB, highway	BSW
2-ROW SUVs \$25,000 & UNDER																				
✓ Subaru Crosstrek 2.0L	85	↑	↑	87	29	↓ / ↑	↑	↑	↑	↓	↑	54.5	10.2	125	27.5	0	0	0	0	0
✓ Hyundai Kona 2.0L	78	↑	↑	71	26	↑ / ↓	↑	↓	↓	↓	↑	56.0	11.1	129	22.5	S	S	0	S	0
✓ Nissan Rogue Sport 2.0L	78	↑	↓	72	26	↑ / ↓	↑	↑	↑	↓	↑	52.5	10.3	134	24.5	S	S	S	S	S
✓ Mazda CX-3 2.0L	73	↑	↓	64	28	↓ / ↓	↓	↓	↓	↓	↑	53.5	9.6	135	18.0	S	S	S	S	S
Honda HR-V 1.8L	66	↑	↓	66	29	↓ / ↑	↑	↓	↓	↓	↑	55.0	10.5	132	32.0	0	0	0	0	-
Mazda CX-30 2.5L	61	↓	↓	64	27	↑ / ↓	↓	↓	↓	↑	↑	54.0	8.7	133	21.5	S	S	S	S	0
3-ROW SUVs \$35,000-\$45,000																				
✓ Kia Telluride 3.8L	92	↑	↑	97	21	↑ / ↑	↑	↑	↑	↑	↓	53.5	7.2	127	47.5	S	S	S	S	S
✓ Hyundai Palisade 3.8L	87	↑	↑	88	21	↑ / ↑	↑	↑	↑	↑	↓	52.5	7.1	132	47.5	S	S	S	S	0
✓ Toyota Highlander 3.5L	86	↑	↑	86	22	↑ / ↑	↑	↑	↑	↑	↓	50.0	7.3	132	41.0	S	S	S	S	0
✓ Mazda CX-9 2.5T	86	↑	↑	80	22	↑ / ↑	↓	↑	↑	↑	↑	50.0	7.9	139	34.0	S	S	S	S	S
✓ Subaru Ascent 2.4T	82	↓	↑	93	22	↑ / ↑	↑	↑	↑	↑	↓	52.0	8.0	129	40.5	S	S	S	S	0
✓ Honda Pilot 3.5L	75	↓	↓	80	20	↑ / ↑	↓	↑	↑	↑	↓	49.5	7.5	136	48.0	S	S	S	S	0
✓ Kia Sorento 3.3L	74	↑	↓	78	22	↑ / ↑	↑	↑	↑	↑	↓	49.0	8.1	137	37.5	0	0	0	0	0
Ford Explorer 2.3T	69	↓	↑	78	21	↑ / ↑	↑	↑	↓	↑	↑	51.5	7.4	136	44.5	S	S	S	S	S
Nissan Pathfinder 3.5L	68	↓	↓	72	18	↑ / ↑	↑	↑	↑	↑	↓	47.0	7.7	137	39.5	S	S	-	S	0
Chevrolet Traverse 3.6L	65	↓	↑	95	20	↑ / ↑	↑	↑	↑	↑	↑	50.5	7.3	130	54.5	0	0	0	0	0
Toyota 4Runner 4.0L	65	↑	↑	55	18	↑ / ↑	↑	↑	↓	↓	↓	48.0	7.7	131	44.5	S	S	S	S	-
Dodge Durango 3.6L	63	↓	↑	83	18	↑ / ↑	↑	↑	↑	↑	↓	48.0	8.3	134	44.0	0	0	-	0	0
Volkswagen Atlas 3.6L	61	↓	↓	84	20	↑ / ↑	↑	↑	↑	↑	↑	51.0	8.7	135	50.5	S	S	S	S	S

HOW WE TEST: Recommended models did well in our Overall Score, which factors in Road-Test Results, Predicted reliability, Owner satisfaction, and Advanced Safety,

which includes crash-test results and the availability of crash-prevention features, such as forward collision warning, automatic emergency

braking, pedestrian detection, and blind spot warning. - means no such safety system is offered; 0 means it's available but not as standard equipment; S means it's standard on

all trims. We deduct points if a model's gear selector lacks fail-safes. Digital or All-Access members can go to [CR.org/cars](https://www.cars.com) for complete ratings.

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Signs of the Times

These mixed signals will have you all turned around

Inquiring Signs Want to Know

We're worried if even the road sign doesn't have a sense of direction!
Submitted by Sharon G., via email



Yes, Thanks. We're Happy to Go It Alone

How awkward if a hostess wanted to seat us instead!
Submitted by Pam Suess, Soquel, CA

Push Your Luck

So what happens if we press the big red button?
Submitted by Gary Rubin, Morton Grove, IL



What a Relief!

No matter how you cut it, looks like there won't be any fumes here.
Submitted by Randy DiBella, seen in West Cornwall, CT



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