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An easy way to add some air filtration to your space is to attach the minimum efficiency reporting value, or MERV 13+ air filter to a box fan. It's a relatively inexpensive way to increase air filtration if an air purifier is out of your budget or unavailable. Click this link from the Colville Reservation Air Quality Program for step-by-step, illustrated instructions to make your own air purifier using two MERV 13+ filters and a box fan. Keep in mind, this is all with a basic filter literally rubber-banded to the most basic fan. It seems likely that someone could amplify the effect. Jim Wells, a retired economist in Maryland who has tinkered on fan-filter builds with his physicist brother, has a setting with two units to circulate air through the room. Why not? They're cheap. Physics is a certain obstacle here. A fan trying to push air through a thick medium like filter-stuff (or pull through it) can start overheating, or get too noisy for a church choir rehearsal or a classroom. (I built one with a HEPA filter a couple of years back to deal with smoke from a California fire season, and I didn't think any of these were much of a problem.) The Wellses attached a step-down transformer to their fans to reduce the standard 120-volt power supply to just 100 volts. It slowed them down and silenced them. They put a 5-inch MERV-13 filter on the front (not the back, as Rosenthal does; there is some conflict in this matter), and then measured levels of particles 2.5 microns or larger—that's PM2.5 in micrograms per cubic meter. Good air, fresh air, in Annapolis going 5 to 7, John Wells says. In a 10-foot with 12-foot bedroom, I got it down to .01 on the meter. It's obviously not peer-reviewed evidence over time, but it's a real difference. Like any kit-bashed solution, attaching a filter to a fan with tape will not end the pandemic. It's not the end of any story. Filters must be replaced regularly; that increases costs and management a little. And just reducing the total amount of particulate matter in a room doesn't guarantee that you reduce the amount of viruses enough to keep people from getting infected, said Lidia Morawska, director of the International Laboratory for Air Quality and Health at Queensland University of Technology. Other risk reduction measures, such as mask-bearing and physical distance, remain critical. I wouldn't stress the cleaner over other measures, she said. People tend to stick to something simple and easy and say, 'This is the solution.' But nothing is a single, simple solution that works for every environment, Morawska acknowledges that even before Covid-19 she practiced a level of social distancing from sick people and strategic positioning near and around valves and plumbing systems. All, including family, thought she was a little weird. Who's laughing now?) A One parameter in all this is time—how much time people spend sharing the environment, Morawska says. It opens up a panoply of options. Shorten the time people are in a space-child in a classroom, workers in an office or in a factory floor-and ventilate the space on their breaks, because that deals possibly infected air for fresh. This is perhaps an even more effective intervention, and cheaper, she says. But one filter, even a DIY one, she admits, is another layer of risk-reducing protection—another relatively easy addition. Someone could go crazy with this. It would be great if we could find a company to make cheap portable air cleaners out of the box fans and a well-designed box the filters fit in, said Corsi. There is a lot of attention on portable air cleaners now for classrooms. They can be 650 or 700 square meters, 25 children in them. Often they are underventilated. In these cases, portable air purifiers can release particle levels into the air by 50 percent. I like the idea of the makeshift one, because some school districts are so poor that they just don't have the money to buy 1,000 portable air purifiers. Home marijuana growers, surely you've come up with some smart air-purification and management tech. Makers, furloughed engineers, tinkers, where you are at? Remember how people wanted to build hospital-grade ventilators, and it turned out to be way too complicated? This isn't. The components here are the basic—the electric motor at the heart of a fan, perhaps stepped down with a transformer so as not to blow so hard, fan blades, a metal frame to hold a panel of filter media, or a larger box of panels on three or four sides, and a mount for fan parts. Now it's time. Make sure it all clips along with a good seal, and it will make... Something. We shouldn't have to, of course. The money should be there for schools to be well ventilated and have room for the children to be physically distant. They should be able to afford air purifiers, or have them provided. People shouldn't risk their lives to go to work. But even if we wish it were different, as a president once said, that's what it is. We all have to do something, because if no one else comes to help, we are. More major WIRED Stories Centers for Disease Control and Prevention recently released guidelines confirming that the virus causing COVID-19 is an aerosol, a very fine mist that travels much like smoke. Scientists and engineers have been saying this for months, and they know what is needed to handle smoke (which consists of small liquid particles): ventilation and filtration. Many in the community have come up with DIY designs for filters, including physicist Allison Bailes of Energy Vanguard, known for Treeshugger for everything from his composting toilet to his research on particles and his infamous service, People need to build science. But first, a little background. Filter diagram. National Air Filtration Association Most people are familiar with the filters that go into our home forced air heating and cooling system, which are great for removing dust. Filters are rated on a scale called MERV (Minimum Efficiency Reporting Value). Most home oven filters have a MERV rating around 8, which will take out pollen and dust. But a MERV 8 filter is not good enough to take out PM2.5 or virus; for that, you will need at least MERV 13. But the higher the MERV rating, the more air resistance and pressure drop over the filter, which is why we don't have MERV 13 filters in our furnaces; it would need a larger fan and larger channels. It is a compromise of filter efficiency and energy efficiency. Screen Capture Apollo 13 In response to the COVID-19 crisis, people started taping filters to cheap box fans, but not much air would get through the filter and there were concerns that the fan might overheat. So the challenge, much like the steel-eyed missile men had to do in Apollo 13, is how to get more air through more filters, using basic cheap materials. The difference is that our modern engineers have the entire Home Depot for their deliveries. The design that seems to be the most popular has become known as the Comparetto Cube, following home performance entrepreneur Neil Comparetto, who recently posted instructions posted on YouTube. Allison Bailes describes the process in words, but as he notes, it's pretty simple: Get a box fan and four MERV 13 filters and tape them together. (More detailed instructions on the Energy Vanguard website.) Two notes: First, make sure you tape the filters together with the arrows pointing into the center of the square. The fan will sit on top, pull air through the filters and send it up and out through the top. Secondly, arrange the filters into a square, as you see below, not a rectangle. Allison Bailes Shawna Henderson (who writes an important post on the subject, 3 Principles of Good IAQ: Eliminate, Vent, & Filter) wonders what the MERV rating of a Persian rug is, but the bottom should be sealed with cardboard. Passive House Consultant and Building analyst John Semmelback tested his own Comparetto Cube with various filters to figure out how much air they actually filtered, and the large surface of the cube gets twice as much air to pass, compared to patterns where the filters are simply taped to the fan. This is really impressive for something that is so easy to do. At the end of his post on building his Comparetto Cube, Allison Bailes complains about Twitter being a hellscape. But I've consistently been impressed by the transparency, exchange of information, collaboration and credit exchanged between the entire building science community, much of it on Twitter and Facebook. It is social media at its best, designs, improves and tests such a simple method. Allison Bailes Bailes also reminds us that the filter on its own is not enough. He describes the other steps his family is taking: The number one thing you can do to prevent the spread of COVID-19 in your own home is not having other people in it. My wife and I have been doing it since mid-March now, with only a few exceptions. We've had some people come into our house, though, and we've worn masks, run the ventilation more, and opened windows when the weather is nice enough. And now that we have a Comparetto Cube, we run it whenever others are in the house (with masks on) and for a while afterwards. As mentioned earlier, keeping portable air cleaner in the middle of the room should greatly reduce the risk of transmission, if someone happens to be infected. Allison Bailes lives in Atlanta, where some people don't take COVID-19 very seriously. But he has a PhD in physics, he understands science, and is a good role model here. We still need to separate, we still have to vent, and it helps to filtrate. On Friday, the world learned that President Donald Trump has contracted Covid-19, just two days after his adviser Hope Hicks tested positive. Trump and Hicks traveled together this week on Air Force One, including to and from the presidential debate in Cleveland on Tuesday. The turnaround reinforces the idea that spending time indoors with others nearby can be risky. So when the weather turns and people spend more time indoors, what can you do to reduce the risk of contracting Covid-19? In addition to continuing to social distance and wear a mask, buying a portable home air purifier is a popular choice right now, and for good reason. The virus that causes Covid-19 is spread mainly by breath drops that are expelled when an infected person speaks, coughs, sneezes or breathes, and is inhaled by another person. But the virus can also spread through smaller airborne particles that have been aerosolized and linger in the air for minutes or hours. I think pretty sure there are some elements [of airborne transmission], White House adviser Dr. Anthony Fauci said Wednesday. Using a portable air purifier can reduce airborne viruses and bacteria in your home and other indoor spaces. While furnace filters and HVAC systems have built-in filters, these portable devices add a layer of air cleaning to individual rooms. Just driving an air purifier isn't enough to protect you from the Covid-19. Here's what you need to know about air purifiers and pandemics: Air purifiers filter airborne pollutants and clean the air in an indoor space, Shelly Miller, professor of mechanical engineering at the University of Colorado Boulder who studies urban air pollution, tells CNBC Make It. (Many Make It. (Many Make It. (Many in the scientific community prefer the term air cleaner, because they clean the air, not purify it, she adds.) These devices usually consist of a filter and a fan. The air purifier pulls in air, passes it through a filter that removes small airborne particles and then dumps clean air back into the room, she said. Outside of the pandemic, air purifiers can be useful during forest fires, as they reduce smoke inside your house, Miller said. They can also remove common indoor allergens in the air, such as dust and animal dander. And air cleaners can even come in handy if you cook in a small apartment, because they reduce emissions from cooking, she adds. According to the Centers for Disease Control, poorly ventilated spaces increase the risk of Covid-19 transmission, since the virus can linger in the air and be inhaled by others. Air purifiers can be a useful tool to use in homes and confined indoor spaces as they increase air circulation, introducing fresh air into a space while removing potentially contaminated air. But portable air purifiers alone can't prevent the Covid-19 transmission. Air purifiers with HEPA, or high-efficiency particle air filters are the best option for consumers, as they can capture at least 99.97% of airborne particles that are at least 0.3 microns in size, Miller said. But the Covid-19 virus is about 125 nanometers or 0.125 microns in size, so it's technically smaller than what the consumer cleaner would catch. But experts say that once the virus is encapsulated in a respiratory droplet, a HEPA filter can be able to capture and remove the particles. However, air purifiers do not replace the need to wear a face mask, maintain social distance and practice hand hygiene. There are lots of air purifiers on the market, many including extra bells and whistles beyond just filtering, said Miller. Look for an air purifier that uses a HEPA filter, and think about the size of the room you're going to use it for, she says. A unit's clean air delivery speed (or CADR) will tell you how large of a room it can clean at the highest setting, according to the Environmental Protection Agency. Miller proposes to choose air cleaners that have been checked by the U.S. Home Appliance Manufacturers. Not sure which model to pick? The Coway Airmega AP-1512HH (\$250) is a solid pick because it contains four layers of filtration, including a HEPA filter, and works in rooms up to 361 square feet. For a more budget-friendly option that is ideal for smaller rooms up to 185 square feet, consider the \$139 Blueair Pure 411+ 411+.

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