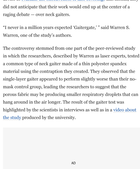
DAILY SHOW WITH TREVOR NOAH ELECTION 2020
COMEDY CENTRAL TONIGHT 11/10C

Wellness

'A lot of variables': New research into popular gaiters highlights challenges of testing mask safety



Kristen Jones a gaiter has covered with a scarf, Friday, July 24, 2020 in New York. (Frank Franklin II/AP)

By Alyssa Gilbo

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When a team of scientists from Duke University unveiled a simple device to evaluate the effectiveness of face coverings this month, they did not anticipate that their work would end up at the center of a raging debate — over neck gaiters.

"I never in a million years expected 'Gaitergate,'" said Warren S. Warren, one of the study's authors.

The controversy stemmed from one part of the peer-reviewed study in which the researchers, described by Warren as laser experts, tested a common type of neck gaiter made of a thin polyester spandex material using the contraption they created. They observed that the single-layer gaiter appeared to perform slightly worse than their no-mask control group, leading the researchers to suggest that the person fabric may be producing smaller respiratory droplets that can hang around in the air longer. The result of the gaiter test was highlighted by the scientists in interviews as well as in a video about the study produced by the university.

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"It's not the case that any mask is better than nothing," chemist and physicist Martin Fischer, the study's lead researcher, said in the video. "There are some masks that are actually worse than no mask."

But amid heightened concerns about the efficacy of gaiters, other experts are now pushing back against the characterization that such face coverings may be "worse than nothing," as one of the Duke study's authors told CBS News.

[Wearing a neck gaiter may be worse than no mask at all, researchers find]

A gaiter worn by Linsey Marr, a civil and environmental engineer at Virginia Tech, who studies aerosols. (Courtesy Linsey Marr/Virginia Tech)

In response to the Duke study, several scientists have conducted their own gaiter experiments, studying the face covering's ability to block droplets and whether it is possible to produce smaller particles similar to what the Duke researchers saw. The new research showed that when a single-layer gaiter is worn doubled up, it is highly effective at blocking a range of particle sizes, according to the results of tests done by Linsey Marr, a civil and environmental engineering professor at Virginia Tech who studies aerosols. (In the Duke study, the gaiter tested was not folded over.) Marr's work has been supplemented by research from Ryan Davis of Trinity University in Texas, who shot water droplets at a strip of seven polyester spandex material taken from a gaiter and did not see any particle breakup or transmission. Meanwhile, Christopher Cappa, a professor at the University of California at Davis, suggested that the high number of particles detected during the Duke gaiter test may be partly due to fibers shedding from the fabric.

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The results of the separate experiments were shared by the scientists on Twitter and not peer-reviewed. Experts said the findings support the argument that even thin gaiters are "better than nothing."

"Gaiters are as effective as a mask made out of a similar material," Marr said. "If you double over a neck gaiter, you can get very good protection."

Marr tested two neck gaiters using a method that is similar to a procedure developed by the National Institute for Occupational Safety and Health to certify N95 masks. One of the gaiters was thin and not patterned polyester, while the second was a thicker, double-layer microfiber covering made of polyester and elastane, a material commonly known as Lycra or spandex.

Each gaiter was placed on a mannequin head inside a chamber with purified air, and a liquid salt solution and medical nebulizer was used to simulate saliva. The nebulizer generated a fine mist that was shot through the mouth of the mannequin at a speed that mimics talking. The droplets were aimed at another mannequin head a foot away and "gold-standard equipment," usually reserved for aerosol science labs, tracked the particles, Marr said.

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Neither gaiter performed well when very small particles measuring 0.13 microns were sprayed, blocking only about 20 percent of the particles of that size, Marr's research found. (Hospital-grade N95 masks are typically tested using particles that are 0.3 microns.)

But at one micron, the particle size that experts say is relevant to transmission, Marr observed that the two gaiters were both able to stop at least 50 percent of the droplets.

"Once you get up to three microns, they block over 90 percent," she said, adding that there were no statistically significant differences between the gaiters tested and a cotton cloth mask that meets the requirements for the non-sewn mask design promoted by the Centers for Disease Control and Prevention.

The thin gaiter's effectiveness increased when Marr folded it over to create two layers. For all the particle sizes tested, the doubled-up gaiter was more than 90 percent effective, according to the research.

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Marr said she "absolutely" would wear a neck gaiter herself as long as it is doubled over.

"I had my kids wearing them early on," she said.

[Face masks with valves or vents do not prevent spread of the coronavirus, CDC says]

Based on her findings, Marr concluded that gaiters, even single-layer ones, are "better than nothing" and cast doubt on the Duke researchers' theory that the breathable fabric was somehow responsible for creating the smaller droplets their device detected.

"Filtration doesn't work like a sieve," Marr said.

Over in San Antonio, Davis, an assistant professor of chemistry, conducted his own test, shooting 100-micron water droplets at a strip of material taken from a fluff-brand gaiter. He saw no evidence of the droplets breaking up upon impact.

"We actually observed the opposite: hundreds of thousands of droplets accumulated on top of the mask material and coalesced into a single, larger drop," Davis said in an emailed statement. "This really suggests the neck gaiter material is efficient at filtering the majority of large droplets generated during speaking and is still much better than no mask at all."

One possible explanation for the higher particle count recorded during the gaiter test performed at Duke is that the fabric itself was shedding fibers, said Cappa, who has been studying mask efficacy and aerosol particle emission.

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Using a thin gaiter made out of 100 percent polyester microfiber, Cappa ran tests in which he wore the covering while performing various actions such as speaking aloud, mouthing words silently and moving his jaw around in a motion similar to chewing.

The tests showed more particles being emitted when Cappa was wearing the gaiter compared with trials of the different scenarios done barehanded.

Cappa said he and his team believe that the friction between people's faces and masks while they are speaking or moving their mouths may cause some of the fibers in the fabric to break down. In a lab setting, the airflow ends up carrying the particles to the detector.

"So what we're actually looking at is a combination of the particles that we are actually capturing or exhaling and the particles that are getting produced from friction with the mask, from fibers on the mask or even skin cells as well," he said.

The issue is that the researchers have been unable to distinguish the particles based on their origins, Cappa said. But, he noted, mask effectiveness can probably be inferred when the findings are combined with results from other experiments, such as the tests conducted by Marr.

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"It allows us to say that even if the gaiters are shedding those fibers, that they're doing as good a job as many other cloth masks on reducing secretory particle emissions," he said.

Though Warren stressed that the Duke study — a proof-of-concept paper presenting the simple testing device — never intended to "decimate an industry based on one person and one gaiter," he said he and the other authors "hugely stand behind our experimental data."

"The measurements are what they are," Warren said, adding that the Duke team is "delighted" to see the emergence of new research.

In response to Cappa's alternative explanation of fiber shedding, Warren said the suggestion is "certainly not a crazy idea," But it's not necessarily a reassuring one, he said. "It still scares me as an explanation, because it means that stuff is getting through there that wouldn't get through for other masks."

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For instance, Cappa noted that there is the possibility that if some of the fibers coming off the masks are contaminated, then it could be a potential source of infectious particles. It is critical that people regularly wash their cloth masks, he said.

[FAQ: How to care for your face mask (and why you shouldn't hang it from your rearview mirror)]

The continued debate over the effectiveness of gaiters highlights the challenges faced by researchers who are aiming to provide answers to the public amid a pandemic plagued by widespread uncertainties. Testing non-medical-grade coverings has been especially difficult, said Christopher Solomon, project manager for the Biocontainment Unit at Johns Hopkins Medicine.

"We're looking at types, we're looking at materials, but it's also how those materials are formed into the mask or how many layers the mask has," Solomon said. "There's a lot of variables that have to be considered."

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When choosing a mask, Solomon urged people to prioritize fit, function and frequency: whether the mask fits properly with little to no gaps, whether the material is opaque and layered, and whether it can be worn consistently.

[When, why and how to wear a mask during this pandemic, according to the experts]

Solomon said he wears a two-layer cotton mask with a filter and ear loops, and he would recommend similar masks over a neck gaiter. By design, gaiters are harder to remove safely, because pulling them down involves touching the fabric, which may be contaminated, he said, adding: "So, from an infection-control standpoint, that could be a little less effective."

"The big thing is that we know that there are masks that work better," he said.

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