

# Facemasks block expired particles, despite leakage at edges

8 June 2021



A new study from UC Davis and the Icahn School of Medicine at Mount Sinai confirms that surgical masks effectively reduce outgoing airborne particles from talking or coughing, even after allowing for leakage around the edges of the mask. Professor Chris Cappa of UC Davis tests a mask by speaking in front of a particle counter. Credit: Chris Cappa, UC Davis

A new study from the University of California, Davis and the Icahn School of Medicine at Mount Sinai confirms that surgical masks effectively reduce outgoing airborne particles from talking or coughing, even after allowing for leakage around the edges of the mask. The results are published June 8 in *Scientific Reports*.

Wearing [masks](#) and other [face coverings](#) can reduce the flow of airborne particles that are produced during breathing, talking, coughing or sneezing, protecting others from viruses carried by those particles such as SARS-CoV2 and influenza, said Christopher Cappa, professor of civil and [environmental engineering](#) at UC Davis and corresponding author on the paper.

High-efficiency masks such as N95 respirators are

designed to have a tight seal to the face, while surgical and most cloth face masks leave small gaps around the sides, which can be reduced when they are worn correctly.

The researchers looked at particles flowing from these gaps by sitting volunteers in front of an instrument that counts airborne particles down to a size of half a micron. The 12 volunteers read aloud or coughed, with and without a surgical mask of the type widely used by the public, either with their mouth directly in front of the funnel of the particle counter, turned to the side or with their head lowered or raised to count particles passing directly through the mask or leaking around the sides.

The researchers found that wearing a mask while talking reduced particles directly through the mask by an average of 93%, from the bottom by 91%, the sides by 85% and the top by 47%, although with substantial variability between individuals. They got similar results for coughing.

## Models to measure leakage

The team used simulations to model the overall reduction in particles due to wearing a mask, allowing for leakage around the edges. They calculated that the overall efficiency of masks was about 70% for talking and 90% for coughing.

"While air escape does limit the overall efficiency of [surgical masks](#) at reducing expiratory particle emissions, such masks nonetheless provide substantial reduction," Cappa said. "Our results confirm that mask wearing provides a significant reduction in the probability of disease transmission via expiratory particles, especially when both infected and susceptible individuals wear masks."

Masks also redirect the flow of air from a high-velocity plume from the talker or cougher towards anybody in front of them, Cappa said.

**More information:** Christopher D. Cappa et al, Expiratory aerosol particle escape from surgical masks due to imperfect sealing, *Scientific Reports* (2021). DOI: [10.1038/s41598-021-91487-7](https://doi.org/10.1038/s41598-021-91487-7)

Provided by UC Davis

APA citation: Facemasks block expired particles, despite leakage at edges (2021, June 8) retrieved 12 September 2022 from <https://medicalxpress.com/news/2021-06-facemasks-block-expired-particles-leakage.html>

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