NATURE | NEWS: EXPLAINER

Will the Ebola virus go airborne?

Experts say the possibility remains remote.

Dina Fine Maron

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Could Ebola go airborne? That's the fear set off last week by a *New York Times* op-ed entitled "What We're Afraid to Say about Ebola" from Michael Osterholm, director of the Center for Infectious Disease Research and Policy at the University of Minnesota. Although clinicians readily agree that the Ebola virus leaps from one person to the next via close contact with blood and other bodily fluids, Osterholm warned that the risk of airborne transmission is "real" and "until we consider it, the world will not be prepared to do what is necessary to end the epidemic."

But interviews with several infectious diseases experts reveal that whereas such a mutation — or more likely series of mutations — might physically be possible, it's highly unlikely. In fact, there's almost no historical precedent for any virus to change its basic mode of transmission so radically. "We have so many problems with Ebola, let's not make another one that, of course, is theoretically possible but is pretty way down on the list of likely issues," says infectious diseases expert William Schaffner of Vanderbilt University.

"Everything that is happening now can easily be comprehensively explained by person-to-person spread via body contact. We don't have to invoke anything else."

Here is what it would take for it to become a real airborne risk: First off, a substantial amount of Ebola virus would need to start replicating in cells that reside in the throat, the bronchial tubes and possibly in the lungs. Second, the airborne method would have to be so much more efficient than the current extremely efficient means of transmission that it would overcome any genetic costs to the virus stemming from the mutation itself

Currently, Ebola typically gains entry into the body through breaks in the skin, the watery fluid around the eye or the moist tissues of the nose or mouth. Then it infects various cells of the immune system, which it tricks into making more copies of itself. The end result: a massive attack on the blood vessels, not the respiratory system.

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Even viruses that are well adapted to attacking the respiratory system often have a hard time getting transmitted through the airways. Consider the experience so far with avian flu, which is easily transmitted through the air in birds but hasn't yet mutated to become easily spreadable in that fashion among people.

What's the hold-up? "The difficulty is that those [flu] viruses don't have the protein attachments that can actually attach to cells in the upper airway. They have to develop attachments to do that," Schaffner says. So even if a virus were exhaled, it would need to lodge onto something in another person's cells that are already prepared for it in the upper airway. "Since the virus doesn't have attachment factors that can work in the upper airway, it's very rare for it to go human to human, and then it almost always stops and doesn't get to a third person," Schaffner notes. Similarly for Ebola, the virus would have to develop attachments that would allow it to easily attach receptors in the upper respiratory pathway — something that neither it (nor any of its viral cousins) has been known to do in the wild.

And yet Ebola already spreads very easily without such mutations. The delicate lock-and-key protein–virus fit required for the virus to successfully latch onto and replicate in the airway has not developed because there is no evolutionary pressure for it to do so; it simply would not be an efficient option. Epidemiologists can take some comfort in that.

As the virus continues to circulate through west Africa, it may like any other pathogen continue to acquire genetic mutations. So far, however, there is no indication that Ebola is mutating in a way that could allow it to make the leap from becoming transmissible via contact with body fluids (as it is now) to become a germ that could be transmitted by breathing the same air, according to WHO. With Ebola, "I don't think we have the information at this time to know what the real risk is but it is probably not zero," says Ebola expert Thomas Geisbert, a virologist at The University of Texas Medical Branch at Galveston.

The incident that put the specter of airborne Ebola on the map was chronicled in the book *The Hot Zone*, wherein, in 1989, the virus was apparently spread via the air from monkey to monkey (although it did not make the leap to humans working in the lab). But experts have subsequently wondered if that lone circumstance of primate-to-primate air transmission was fueled by the lab setting and man-made systems. As Osterholm notes in his piece, in 2012 researchers found that a strain of Ebola was spread from pigs to nonhuman primates via the air in a different lab setting. The virus, however, did not then spread from monkey-to-monkey in those circumstances.

Questions remain about the current strain of Ebola thriving in west Africa. Apart from the environmental, economic and social circumstances that have fueled its spread, does the virus itself have special characteristics that set it apart? Is it, for example, growing faster or at higher viral concentrations than previous strains? But the jury is still out on this and other questions. Right now we have few answers about this Ebola strain, yet we do know that a massive injection of finances and personnel will be needed to contain it in the months ahead. As of Friday it had claimed more than 2,400 lives.

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