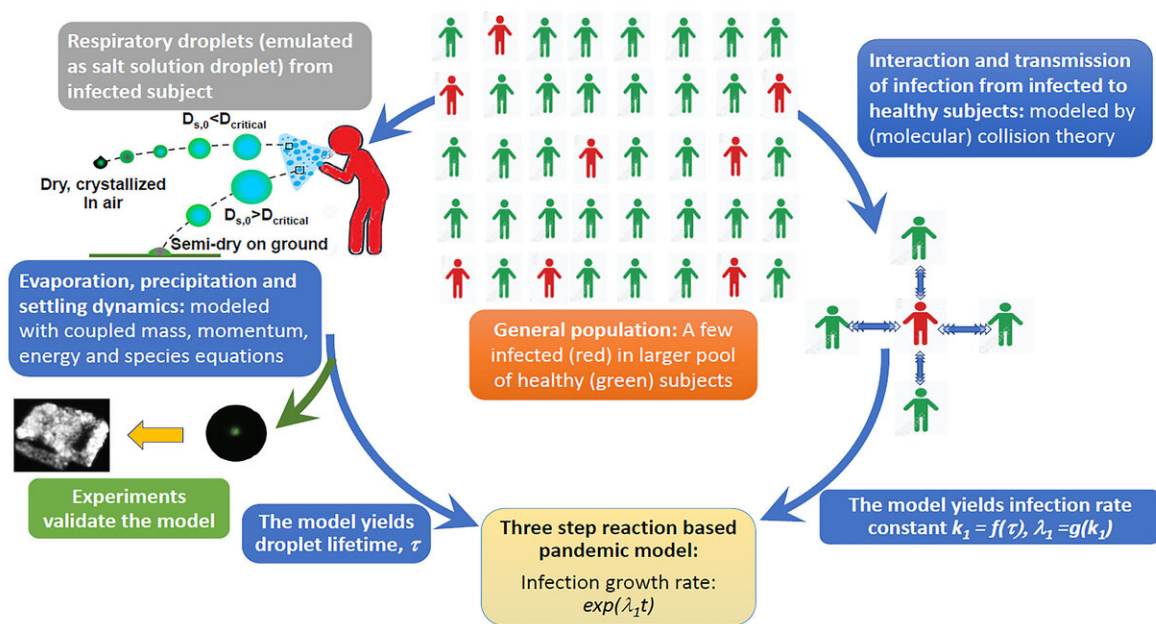


Respiratory droplet motion, evaporation and spread of COVID-19-type pandemics

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Flow diagram outlining the interconnections of the model developed. Credit: Swetaprovo Chaudhuri, Saptarshi Basu, Prasenjit Kabi, Vishnu R Unni and Abhishek Saha

It is well established that the SARS-CoV-2 virus responsible for the COVID-19 disease is transmitted via respiratory droplets that infected people eject when they cough, sneeze or talk. Consequently, much research targets better understanding droplet motion and evaporation to

understand transmission more deeply.

In a paper in *Physics of Fluids*, by AIP Publishing, researchers developed a mathematical model, proceeding from first principles, for the early phases of a COVID-19-like pandemic using the aerodynamics and evaporation characteristics of respiratory droplets.

The researchers modeled the pandemic dynamics with a reaction mechanism, where each reaction has a rate constant obtained by calculating the frequency of collisions between the infectious droplet cloud ejected by an infected person and one ejected a healthy person.

"The size of the droplet cloud, the distance it travels, and the droplet lifetimes are, therefore, all important factors that we calculated using conservation of mass, momentum, energy and species," said Swetaprovo Chaudhuri, one of the authors.

The model could be used to estimate approximately how long droplets can survive, how far they can travel, and which size of droplet survives for how long. Though, as Chaudhuri adds, "The actual situation could be complicated by wind, turbulence, air-recirculation or many other effects."

"Without wind and depending on the ambient condition, we found droplets travel between 8 to 13 feet before they evaporate or escape," said Abhishek Saha, a co-author.

This finding implies that social distancing at perhaps greater than 6 feet is essential.

Furthermore, the initial size of the longest surviving droplets is in the range of 18-50 microns, meaning masks can indeed help. These findings could help inform reopening measures for schools and offices looking at

student or employee density.

"This model is not claiming to predict the exact spread of COVID-19," said Saptarshi Basu, another author. "But, our work shows that droplet evaporation or desiccation time is highly sensitive to the ambient temperature and relative humidity."

More broadly, this multiscale model and the firm theoretical underpinning that connects the two scales—macroscale pandemic dynamics and the microscale droplet physics—could emerge as a powerful tool in clarifying the role of environment on infection spread through respiratory droplets.

More information: "Modeling the role of respiratory droplets in COVID-19 type pandemics," *Physics of Fluids*, [aip.scitation.org/doi/10.1063/5.0015984](https://doi.org/10.1063/5.0015984).

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