Numerical Analysis of the Influence of Heat Transfer and Relative Humidity on the Droplet Transmission through Coughing in Open Space and Isolation Room

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Abstract

This study theoretically investigates the influence of heat transfer and relative humidity on droplet transmission through coughing in open space and isolation room. A standardized indoor setting with a human subject is analyzed to examine airflow patterns and pathogen dispersion when individuals cough without wearing facial masks. The research further discovers the environmental parameters affecting germ spread, particularly through meteorological simulations of temperature fluctuations and humidity variations. Findings indicate that initial air temperature significantly impacts vertical particle movement. Lower temperatures increase air density, causing expelled particles to remain closed to the ground or incline. On the other hand, higher temperatures reduce air density, leading to buoyancy-driven upward particle movement. Relative humidity primarily affects horizontal dispersion, with low humidity restricting particle spread due to reduced moisture content. In enclosed, unventilated spaces, the initial air temperature has a limited effect on overall particle distribution, as droplets consistently settle on surfaces. However, temperature does influence vertical buoyancy, reinforcing trends observed in open spaces. Changes in relative humidity notably affect horizontal motion, mirroring findings from outdoor conditions. These results emphasize the crucial role of temperature and humidity in pathogen transmission, offering insights into airflow dynamics that can inform ventilation strategies and public health measures in confined environments.

Innovative Description: Unveiling cough droplet dynamics: Heat transfer, humidity, and airflow dictate droplet transmission through coughing in open spaces and isolation rooms.