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A Comprehensive Breath Plume Model for Disease Transmission via Expiratory Aerosols S.K. HALLORAN, Dept. Chemical Engineering and Materials Science, Univ. California Davis, A.S. WEXLER, Dept. Mechanical and Aerospace Engineering, Univ. California Davis, W.D. RISTENPART, Dept. Chemical Engineering and Materials Science, Univ. California Davis — The peak in influenza incidence during wintertime represents a longstanding unresolved scientific question. One hypothesis is that the efficacy of airborne transmission via aerosols is increased at low humidity and temperature, conditions that prevail in wintertime. Recent experiments with guinea pigs suggest that transmission is indeed maximized at low humidity and temperature, a finding which has been widely interpreted in terms of airborne influenza virus survivability. This interpretation, however, neglects the effect of the airflow on the transmission probability. Here we provide a comprehensive model for assessing the probability of disease transmission via expiratory aerosols between test animals in laboratory conditions. The spread of aerosols emitted from an infected animal is modeled using dispersion theory for a homogeneous turbulent airflow. The concentration and size distribution of the evaporating droplets in the resulting "Gaussian breath plume" are calculated as functions of downstream position. We demonstrate that the breath plume model is broadly consistent with the guinea pig experiments, without invoking airborne virus survivability. Moreover, the results highlight the need for careful characterization of the airflow in airborne transmission experiments.

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