Influenza is responsible for an estimated 36,000 deaths, 3.1 million hospitalization days, and 31 million outpatient visits per year in the US. While the infectivity and pathogenicity of influenza viruses are well understood, very little is known about transmission and the dynamics of the virus in the environment. By employing the latest in aerosol science and technology, we have shown that airborne transmission of influenza is indeed possible and that environmental conditions may play a key role in the transmissibility of the virus. Specifically, evaporation-induced changes in the chemical composition of aerosols carrying the virus, such as lowered pH, increased salt and protein concentrations, crystallization, or phase separations, may affect the viability of the virus. Results of this research have the potential to promote improved prediction of the pandemic potential of influenza virus strains, forecasting of disease dynamics, and development of infection control strategies.