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Seasonal, pandemic, and emerging influenza viruses transmit with similar efficiency over sequential rounds of airborne contact in ferrets

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Statement of the Problem: A hallmark of epidemiologically successful influenza viruses is their ability to spread from person-to-person by the airborne route, and the pandemic potential of viruses is assessed by evaluating airborne transmission between ferrets. Some avian influenza viruses that have crossed the species barrier transmit in ferrets but have not spread among humans. In contrast, seasonal and pandemic influenza viruses transmit efficiently from experimentally infected ferrets to contacts via the airborne route. Therefore, we evaluated whether onward transmission from ferrets infected by respiratory contact would be more informative and hypothesized pandemic viruses would transmit over two sequential rounds of respiratory transmission in ferrets, while emerging avian viruses would fail to transmit during a second round of transmission.

Methodology & Theoretical Orientation: Influenza A/California/07/2009 (H1N1pdm09), A/Texas/50/2012 (H3N2), A/Anhui/1/2013 (H7N9) and A/seal/ New Hampshire/179629/2011 (H3N8) viruses were evaluated as representative pandemic and seasonal, and emerging viruses, respectively. Donor ferrets (n=5-6) were inoculated and housed adjacent to a respiratory contact ferret (RC-1). When the RC-1 ferret became infected, this animal was housed adjacent to a second RC (RC-2) ferret, and nasal washes were collected every other day for viral titration.

Findings: All four viruses transmitted over two rounds of respiratory contact. For the H1N1pdm09 and H3N8 viruses, 5/6 RC-1 ferrets shed virus, followed by transmission to 5/5 RC-2 ferrets. For the H3N2, 4/5 RC-1 ferrets and 3/4 RC-2 ferrets shed virus, while for the H7N9 virus, 3/6 RC-1 and 2/3 RC-2 ferrets shed virus.

Conclusion & Significance: We found that influenza viruses that transmit by the airborne route transmit onward to new respiratory contact ferrets with similar efficiency. These results demonstrate that a single round of respiratory transmission in ferrets is equally informative as two sequential rounds of transmission. This research was funded by the Intramural Research Program of the NIH.

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