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Quantification of Bird-to-Bird and Bird-to-Human Infections during 2013 Novel H7N9 Avian Influenza Outbreak in China

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Quantification of Bird-to-Bird and Bird-to-Human Infections during 2013 Novel H7N9 Avian Influenza Outbreak in China

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概 要

During February-May 2013, 132 human avian influenza H7N9 cases were identified in China resulting in 37 deaths. We develop a novel but simple compartmental modelling framework for transmissions among (wild and domestic) birds as well as from birds to human, to infer important epidemiological quantifiers (i.e., basic reproduction number for bird epidemic, bird-to-human infection rate, and turning points of the epidemics) for the bird and human epidemic via human H7N9 case onset data in order to acquire useful information regarding the bird-to-human transmission dynamics. Assuming no human transmission of the disease had occurred, we obtain the basic reproduction number for infections among birds and the mean daily number of human infections per infected bird from data fitting. The turning point of 2013 H7N9 epidemic is pinpointed at April 16 for bird epidemic and at April 9 for bird-to-human transmissions. Our result reveals very low level of bird-to-human infections, thus indicating minimal risk of widespread bird-to-human infections of H7N9 virus during the outbreak. Moreover, the turning point of the human epidemic, pinpointed at shortly after the implementation of full-scale control and intervention measures initiated in early April, further highlights the impact of timely actions on ending the outbreak.

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RESEARCH INTERESTS:

Mathematical Biology, Modeling and Analysis of Infectious Diseases Epidemiology, Ordinary Differential Equations, Population Dynamics, Mathematical Ecology