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Both innate and adaptive immune responses are critical to the control of influenza

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Both innate and adaptive immune responses play an important role in controlling influenza virus infection, according to a study, published in the Open Access journal *PLoS Computational Biology*, by researchers from Oakland University, Michigan, and Los Alamos National Laboratory, New Mexico, USA.

Influenza, as a contagious respiratory illness remains a major public health problem worldwide. Seasonal and pandemic influenza results in approximately 3 to 569 million cases of severe illness and approximately 250,000 to 500,000 deaths worldwide. Although most infected subjects with intact immune systems are able to clear the virus without developing serious flu complications, the biological factors responsible for viral control remain unclear.

To investigate the factors for viral control, the researchers developed mathematical models that included both innate and adaptive immune responses to the virus. These models were used to study the viral dynamics of the influenza virus infection in horses. After infection, viral levels rise rapidly, reach a peak and fall, then they attain a low plateau that can be followed in some animals by a second peak. Ultimately, viral levels decline and the infection is cleared. By comparing modeling predictions with experimental data, researchers examined the relative roles of availability of cells susceptible to infection, so-called target cells , and innate and adaptive immune responses in controlling the virus.

The research showed that the two-part innate immune response,

generated by natural killer cells, and the antiviral effect caused by interferon, a naturally produced protective molecule, can explain the first rapid viral decline and subsequent second viral peak. The second peak comes about because as the viral level falls, the immune response also falls allowing the virus the opportunity to grow back before the adaptive ultimately clears it.

However, for eventual viral clearance it is the body's adaptive immune response that is needed.

The data analyzed were from equine influenza virus infection in horses. However, similar viral kinetic profiles have been observed in humans infected with the influenza virus. The authors conclude that the study can be used to explain the viral and interferon kinetics observed during a typical influenza virus infection.

More information: Pawelek KA, Huynh GT, Quinlivan M, Cullinane A, Rong L, et al. (2012) Modeling Within-Host Dynamics of Influenza Virus Infection Including Immune Responses. *PLoS Comput Biol* 8(6): e1002588. doi:10.1371/journal.pcbi.1002588

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