Control of Epidemics: the impact of vaccination on strain dynamics

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Several articles in recent literature discuss the impact of vaccination on competing subtypes of one microorganism. In fact, the presence of multiple variants of a pathogen has a very important role on the effectiveness of vaccination strategies so that different vaccine strains must be used in order to control the same disease.

One of the established effect of vaccination on the strains dynamics is the switching of the competitive advantage from one of the pathogen subtype to the other with the result of pathogen replacement. The main mechanism producing this outcome is thought to be the differential effectiveness of the vaccine with respect to the two competing strains.

In this talk we show that in the case of super-infection (that is, when one strain can infect an individual already infected by the second strain) a perfect vaccine (that is a vaccine that provides complete protection against both strains) can indeed produce a competition switch in favor of the weaker strain.

In fact, the dynamics of the two strains is regulated both by their reproduction numbers and by the invasion numbers that depend by the vaccine rate in a non- symmetrical way so that different scenarios may be envisaged, including coexistence and switch of stability.

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