DYNAMICS OF INFLUENZA TRANSMISSION IN VACCINATED AND NON-VACCINATED PIG POPULATIONS


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Introduction

The ecology of influenza virus is complex and pigs play a central role in it. In North America pig herds are endemically infected and influenza infections are observed year around. Despite its widespread prevalence limited information is available on the factors that contribute to the infection dynamics and transmission. Understanding the factors that contribute to influenza transmission in populations is crucial to prevent influenza spread between animals and from animals to people.

The objective of this study was to determine transmission parameters for an H1N1 influenza virus in vaccinated and non-vaccinated populations of pigs and assess the effect of vaccination on influenza transmission.

Materials and methods

One hundred influenza free 3-week-old pigs were distributed in replicates of 10 in 3 groups as follows: a) nonvaccinated (NV), b) heterologous (HE) vaccinated and c) homologous (HO) vaccinated. There were 3 replicates for the NV and the HO and 4 for the HE group. Pigs in the HE group were vaccinated with a commercially available swine vaccine containing one H3N2 and two H1N1 strains distinct from the challenge strain. Pigs in the HO group were vaccinated with a vaccine prepared with the challenge strain. The challenge strain was a triple-reassortant H1N1 strain (A/Sw/IA/00239/04 H1N1) recovered from a respiratory field case. In separate rooms, influenza negative pigs (“seeders”) were inoculated with the challenge strain intratracheally and intranasally and two days post challenge, the seeder pigs were placed in contact with the pigs in each replicate of the treatment groups. Transmission was evaluated by collecting nasal swabs from all pigs on a daily basis and up to 14 days post contact. Nasal swabs were tested by RT-PCR. Transmission parameters including R (reproductive ratio) were calculated using a generalized linear modeling (GLM) method using a complementary log-log link function as offset variable.

Results

Transmission parameters including the R values differed significantly between vaccinated and non-vaccinated pigs. A significant reduction in transmission was observed in the vaccinated groups where R (95%CI) was 1 (0.53-1.67) and 0 for the HE and the HO group respectively, compared to 10.66 (7.19-15.19) in unvaccinated pigs (p<0.001). Transmission in the HE group was reduced, delayed and variable
compared to the unvaccinated group. Transmission could not be detected in the homologous group. Figure 1 shows the time course of infection for control and vaccinated groups.

Discussion

Results from this study indicate that influenza vaccines can be used to decrease influenza transmission but they can also contribute to maintaining endemic infections in populations, especially when vaccine strains differ from the circulating ones. An $R > 1$ indicates that an infectious agent will be able to transmit and spread to other susceptible animals. In this study, the NV had an $R$ significantly higher than 1 while the HE group had an $R$ value around 1 with a confidence interval above and below 1 indicating the variability that populations with partial immunity represent. This is relevant because the results of the present study support field observations where a significant variability in transmission dynamics is observed in vaccinated herds. This is the first study that evaluates transmission rates for influenza in pigs.

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References