

Efficacy of foot-and-mouth disease emergency vaccination: A meta-analysis

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Objective:

A meta-analysis study was conducted to provide a comprehensive assessment of the efficacy of foot and mouth disease (FMD) emergency vaccination, based on the available literature, which may facilitate further economic analysis on the use of FMD emergency vaccination.

Procedures:

1- Inclusion criteria:

Experimental research and symposium papers published in English and unpublished data were considered. Each experiment must have 2 groups: challenged vaccinated (cases), and challenged non-vaccinated (controls).

2- Outcome parameter (relative risk-RR):

- a. Clinical protection (absence of clinical disease):

$$RR = \frac{\text{Incidence of clinical disease in cases}}{\text{Incidence of clinical disease in controls}}$$

- b. Virological protection (absence of virus shedding)

$$RR = \frac{\text{Incidence of infection in cases}}{\text{Incidence of infection in controls}}$$

3- Meta-analysis procedure:

The RRs were pooled over studies; separately per protection parameter and animal species and classified on virus serotype, using a random effects model. Meta-regression and tests for publication bias were carried out.

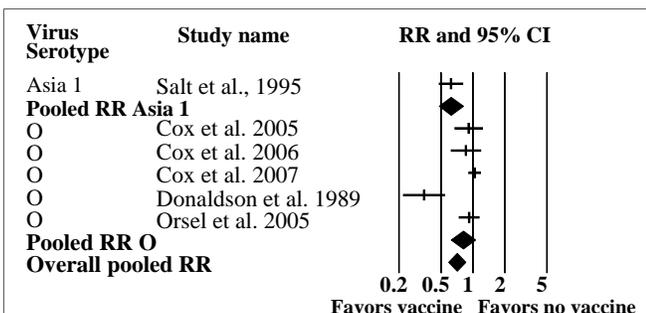


Fig. 1. Forest plot of the relative risk (RR) with the 95% confidence interval (CI) per study, the pooled RR per virus serotype and the overall pooled RR for the virological protection against FMD in cattle following vaccination.

Results:

Ninety six studies were identified, of which 27 were included in the analysis. Table 1 shows the vaccine efficacy per animal species and protection parameter, e.g. vaccinated cattle have on average 0.13 lower chance of developing FMD clinical signs compared to non-vaccinated cattle.

Animal species / parameter	Pooled RR and 95% CI
Cattle	
Clinical protection	0.13 (0.09-0.18)
Virological protection	0.71 (0.59-0.85)
Swine	
Clinical protection	0.48 (0.36-0.65)
Virological protection	0.67 (0.51-0.87)
Sheep	
Clinical protection	0.31 (0.18-0.53)
Virological protection	0.59 (0.44-0.80)

Fig. 1 shows that vaccinated cattle are generally protected against FMD infection significantly more than non-vaccinated cattle, but the protection may be serotype dependent. Fig. 2 shows that small studies (with large standard error) may have been published, only because they show large and interesting effects. This is an indication of potential publication bias. However, correcting for this bias would not alter the results significantly.

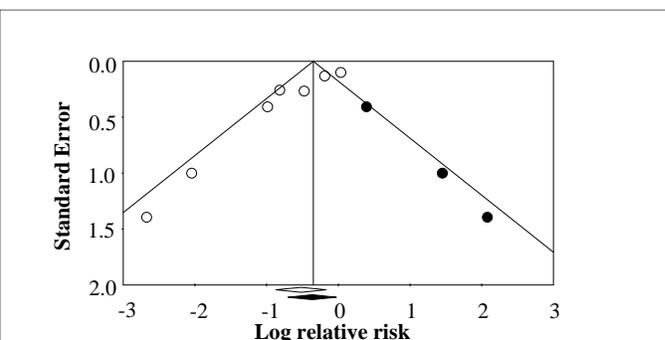


Fig. 2. Funnel plot of the logarithm pooled relative risk of 7 studies (empty circles) quantifying the effect of FMD vaccination against infection in sheep. The dark spots are the potential missing studies (if they had existed, the effect would have shifted from 0.59 (0.4-0.8); the white diamond under the X-axis, to be 0.68 (0.50-0.99); the black diamond under the X-axis, and complete symmetry would have been reached, removing the effect of publication bias).



Conclusions:

- Emergency vaccination against FMD provided protection against clinical disease and against FMD infection in cattle, swine and sheep.
- No significant publication bias was observed in the corresponding literature.
- The results can be used in simulation modeling to assess the economic consequence of FMD emergency vaccination.

