Impact of risk-perception on decision-making for FMD control

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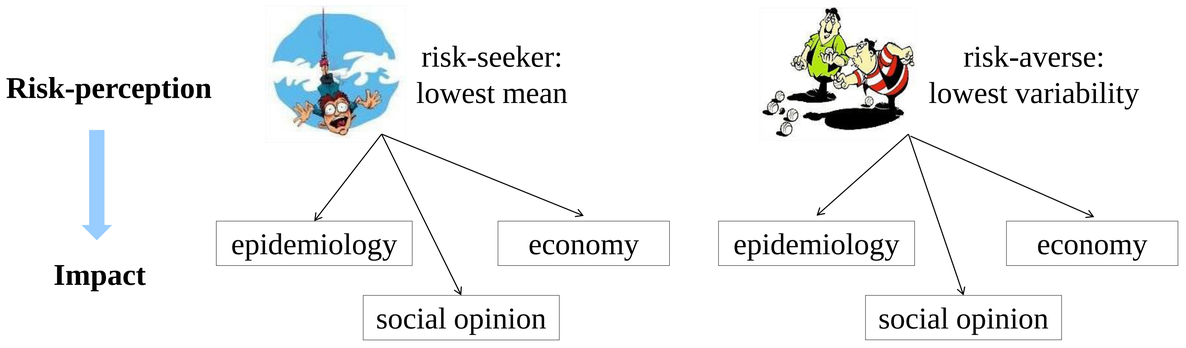
INTRODUCTION

- Foot and mouth disease (FMD) represents a major threat for developed countries
→ economic losses + epidemiological impacts + social impact (massive slaughter acceptability)

- Models on FMD investigate the **mean** effect of control measures against outbreaks, and not their **variability**, which is linked to the risk-perception for decision-makers

- How do decision-makers choose a control strategy in case of FMD epizootics ?
→ according to their **risk perception**: risk-averse decision-makers prefer low variable strategies, whereas risk-seeker prefer strategies with the minimal mean impact
→ according to the **epidemiological, economical or social impact** of control strategies



Question 1: strategy with lowest mean impact for risk-seeker?

Question 2: strategy with lowest impact variability for risk-averse?

according to epidemiology, economy and social opinion

MATERIALS AND METHODS

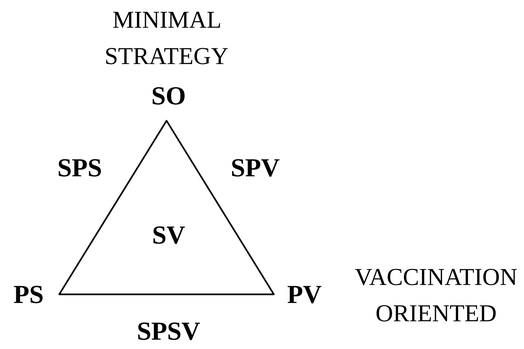
Control strategies

- 7 fixed control strategies against FMD epizootics

		slaughter		vaccination	
	strategy	infected premisses	preemptive	preemptive	suppressive
SO	stamping-out	yes	no	no	no
PS	preemptive slaughter	yes	1 km (1)+(2)	no	no
PV	preemptive vaccination	yes	no	10 km (1)+(2)	no
SPS	selective PS	yes	1 km (2)	no	no
SPS	selective PV	yes	no	10 km (1)	no
SPSV	selective PS + PV	yes	1 km (2)	10 km (1)+(2)	no
SV	suppressive vaccination	yes	no	no	1 km (1)+(2)

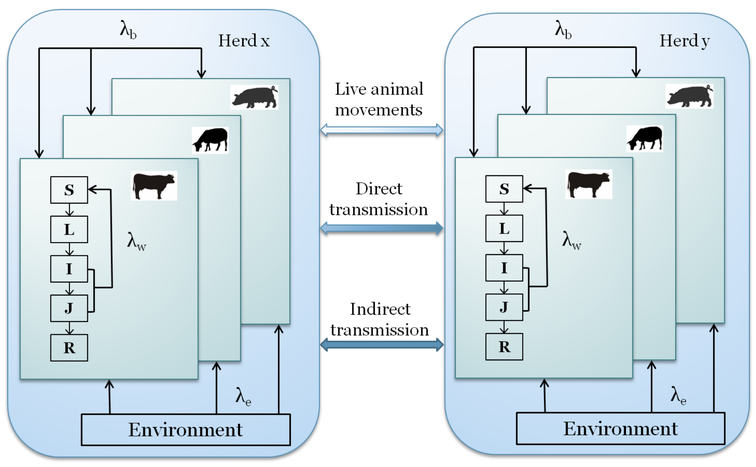
(1) cattle + breeding pigs
(2) small ruminants + non-breeding pigs

- 3 main strategies
- 4 alternative strategies



Stochastic state-transition model of FMD

Reference: Rautureau et al. 2012 Trans Em Dis, 59:4 311-322



S = exposed and susceptible
L = infected but not infectious
I = subclinically infectious
J = clinically infectious
R = removed or recovered

3 forces of infection:
- within-batch λ_w
- between-batch λ_b
- environmental λ_e

Main model output variables

Epidemiology	Economy		Social opinion
number of infected herds	direct costs for state	export losses $	number of slaughtered herds

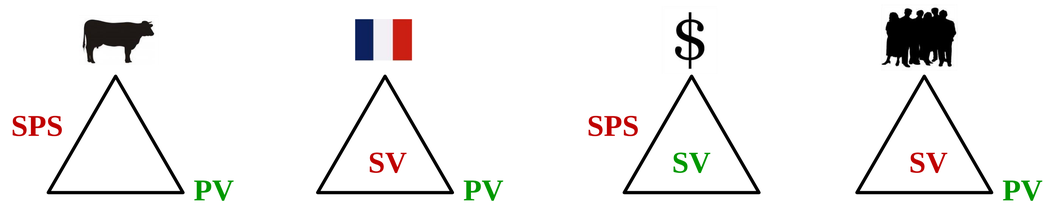
Data analysis

→ 7350 simulations (7 strategies x 21 regions x 50 introduction points)
→ for the 7 strategies, evaluation of the mean output variables at the national and regional level + national variability of the log-transformed output variables (Linear Mixed Models, function lmer)

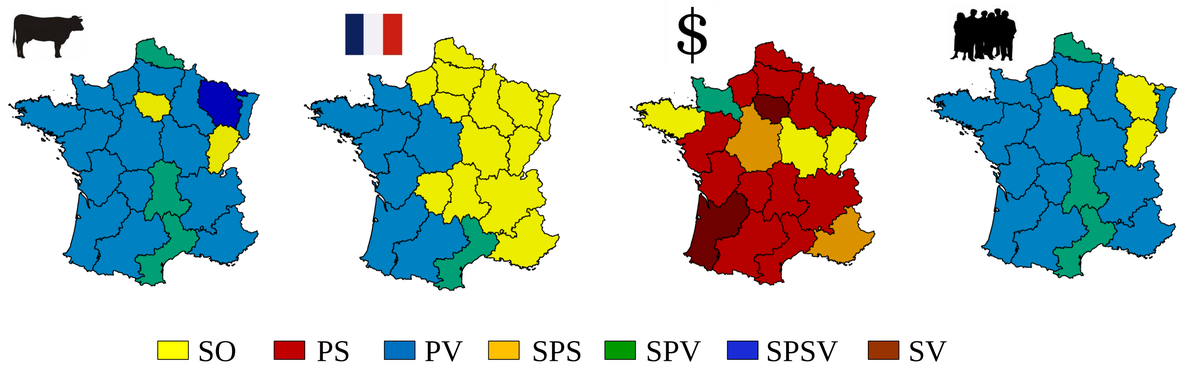
RESULTS

Question 1: strategy with lowest mean impact for risk-seeker?

National level: in green, optimal mean strategy; in red, worse mean strategy



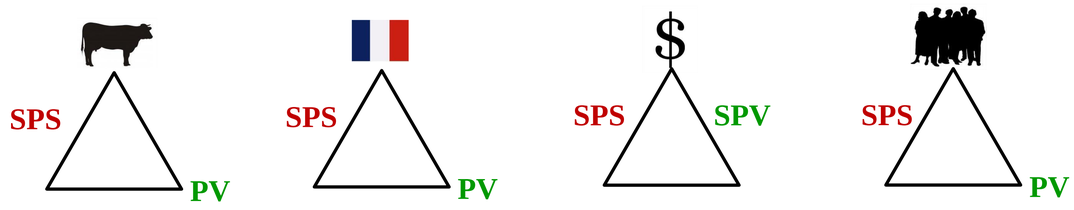
Regional level: regional optimal strategies according to mean impact



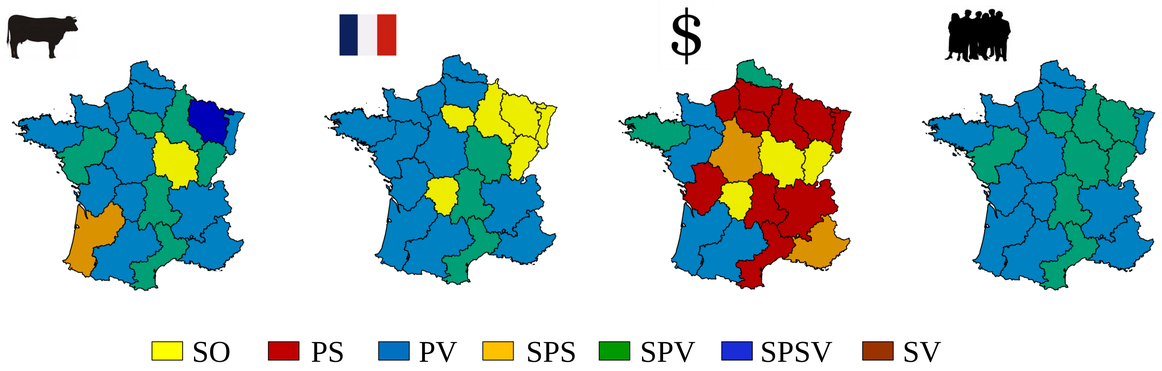
→ **no unique optimal mean strategy in France for the 4 output variables**
→ **the nature of best strategies differ between regions and output variables**

Question 2: strategy with lowest impact variability for risk-averse?

National level: in green, lowest variability ; in red, highest variability



Regional level: regional optimal strategies according to lowest impact variability



→ **preemptive slaughter strategies (SPS) = high impact variability**
→ **vaccinal strategies (PV, SPV) = low impact variability**
→ **optimal strategy fo variability is different between regions and output variables**

CONCLUSION

Question 1 risk-seeker: lowest mean

→ no unique optimal mean strategy at national and regional level regarding epidemiology, economy, and social opinion

Question 2 risk-averse: lowest variability

→ high variability of strategies with preemptive slaughter and low variability of vaccinal strategies (except for export losses)

Risk-perception of decision-makers should be taken into account. Stakeholders should be involved. Strategies should be adapted to local conditions
→ without a unique optimal strategy (risk-perception, stakeholders, local conditions), adaptive strategies are needed

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