64th Annual Meeting of the European Federation of Animal Science
Nantes, August 26th-30th, 2013

INRA SCIENCE & IMPACT

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An Economical Tool for the Assessment of *Salmonella* Control Strategies in the Pork Supply Chain

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Introduction

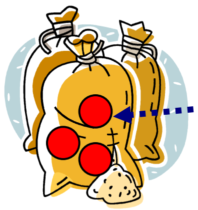
Main objective:

- The aim of this study is to develop a useful tool to support decision making regarding food pathogen control throughout the pork supply chain

2 steps:

- Building a generic model (→ cost-effectiveness analysis)
- Application to *Salmonella* control in the pork supply chain

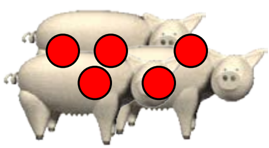
Context: *Salmonella* in pork supply chain

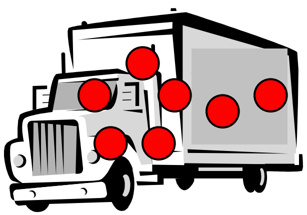


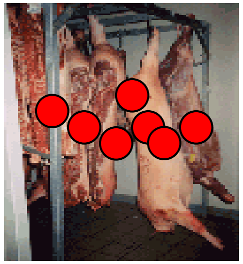
Salmonella

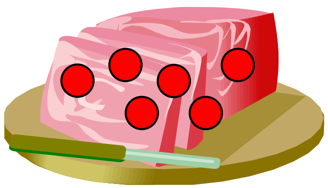
What is the pork supply chain?

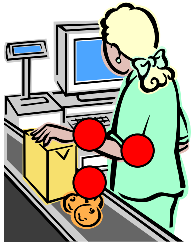
Production → Transportation → Slaughter → Process → Retail → Consumer

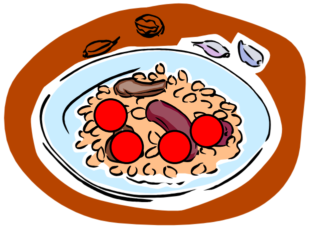












Pre-harvest | Harvest | Post-harvest

Control strategies

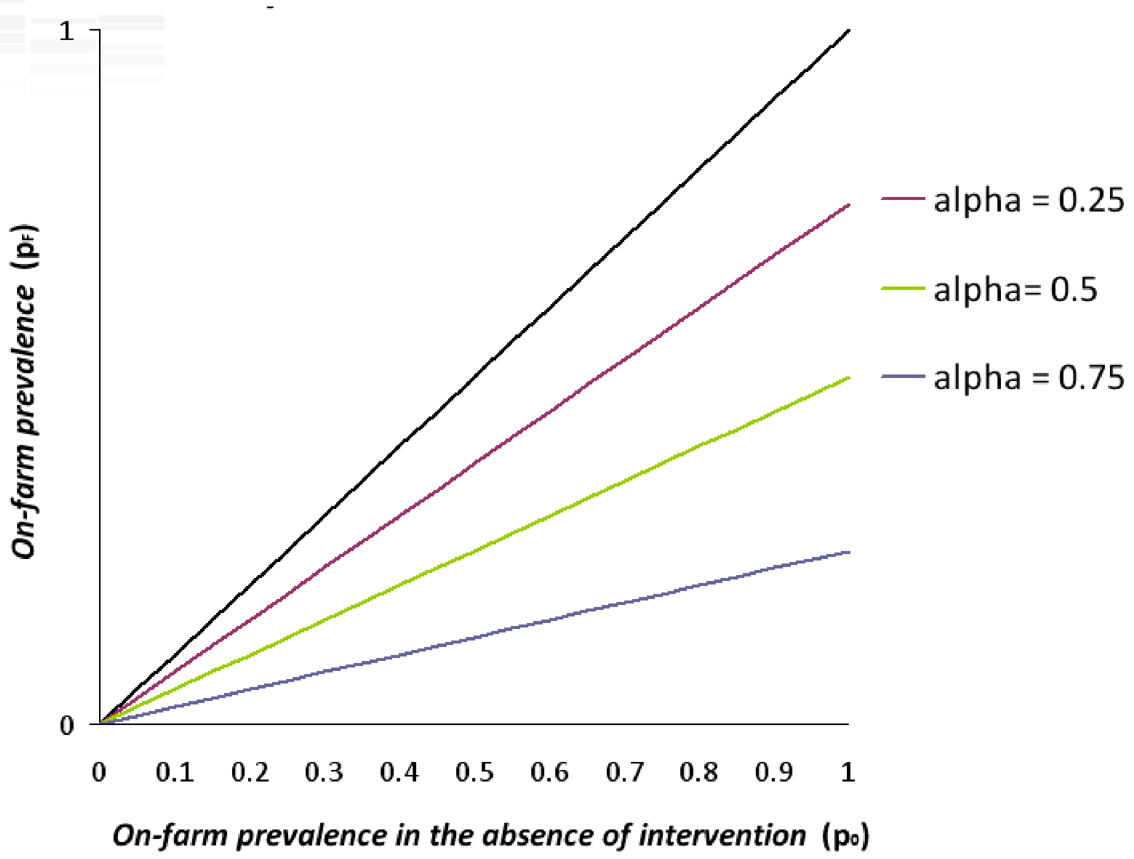
7 intervention strategies considered in the model:

- ‘Farm’
- ‘Transportation-Lairage’
- ‘Slaughterhouse’

- ‘Farm’ + ‘Slaughterhouse’
- ‘Farm’ + ‘Transportation-Lairage’
- ‘Transportation-Lairage’ + ‘Slaughterhouse’

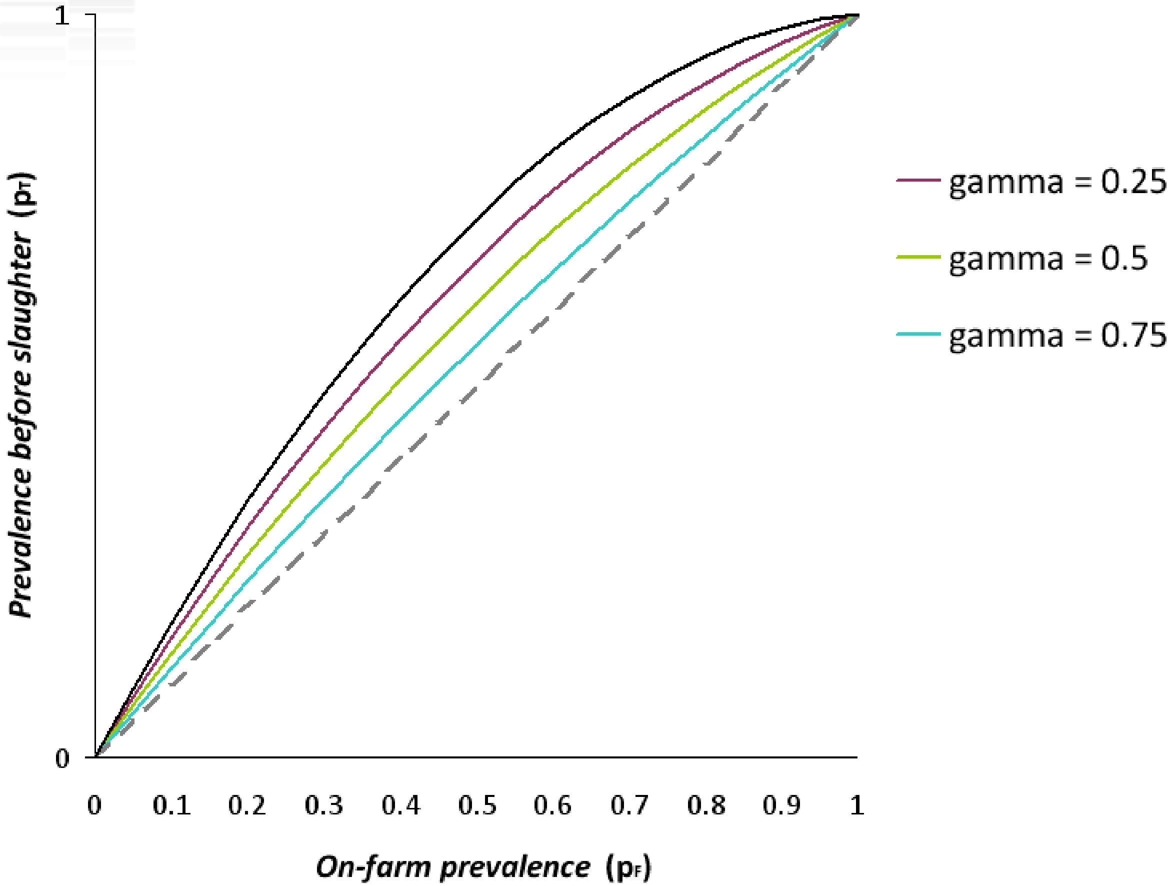
- ‘Farm’ + ‘Transportation-Lairage’ + ‘Slaughterhouse’

Effectiveness: ‘Farm’ intervention



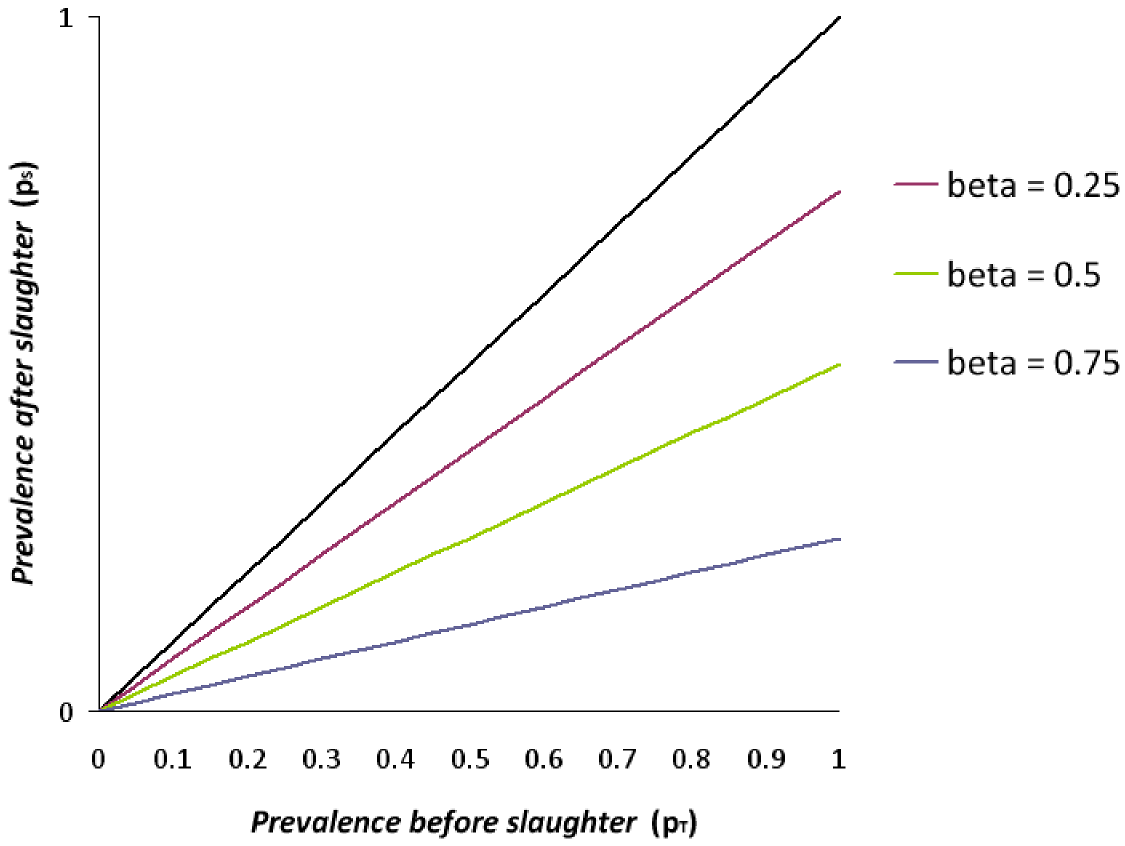
$$p_F = (1-\alpha)\cdot p_0 \quad \text{where} \quad 0 \le \alpha \le 1$$

Effectiveness : 'Transportation-Lairage' intervention



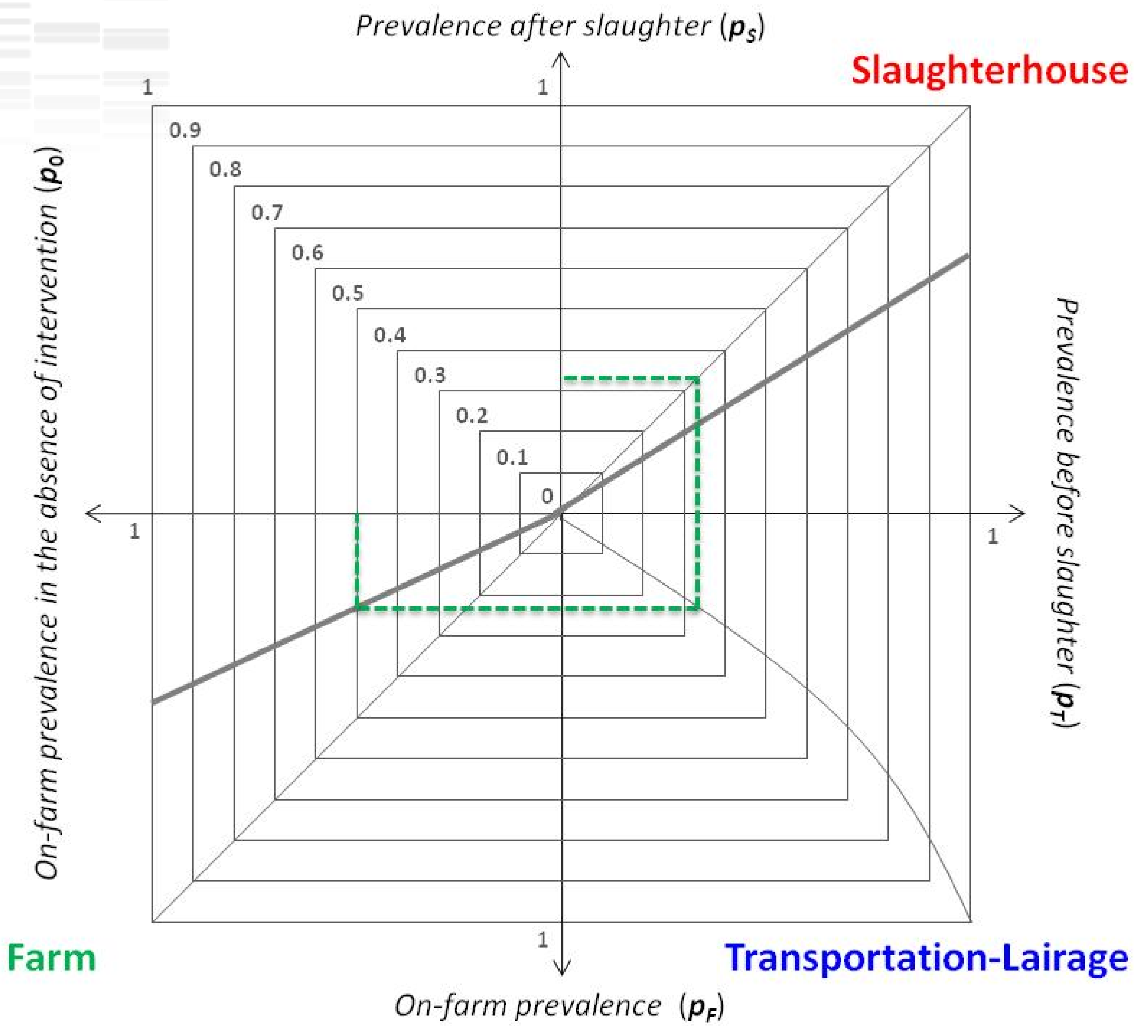
$$p_T = p_F + (1-\gamma)\cdot tx \cdot (1-p_F)\cdot p_F \quad \text{where} \quad 0 \le \gamma \le 1$$

Effectiveness: ‘Slaughterhouse’ intervention

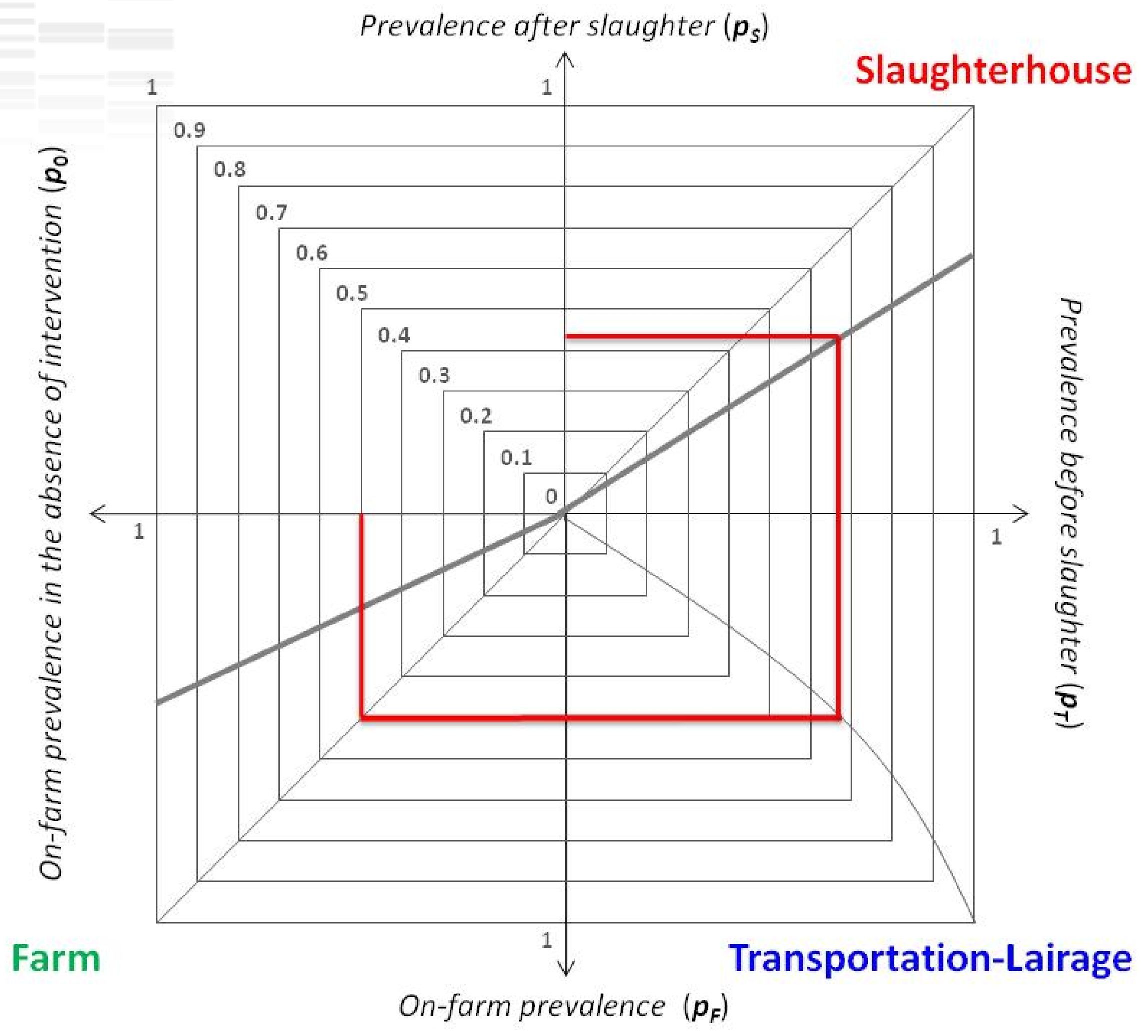


$$p_S = (1-\beta)\cdot p_T \quad \text{where} \quad 0 \le \beta \le 1$$

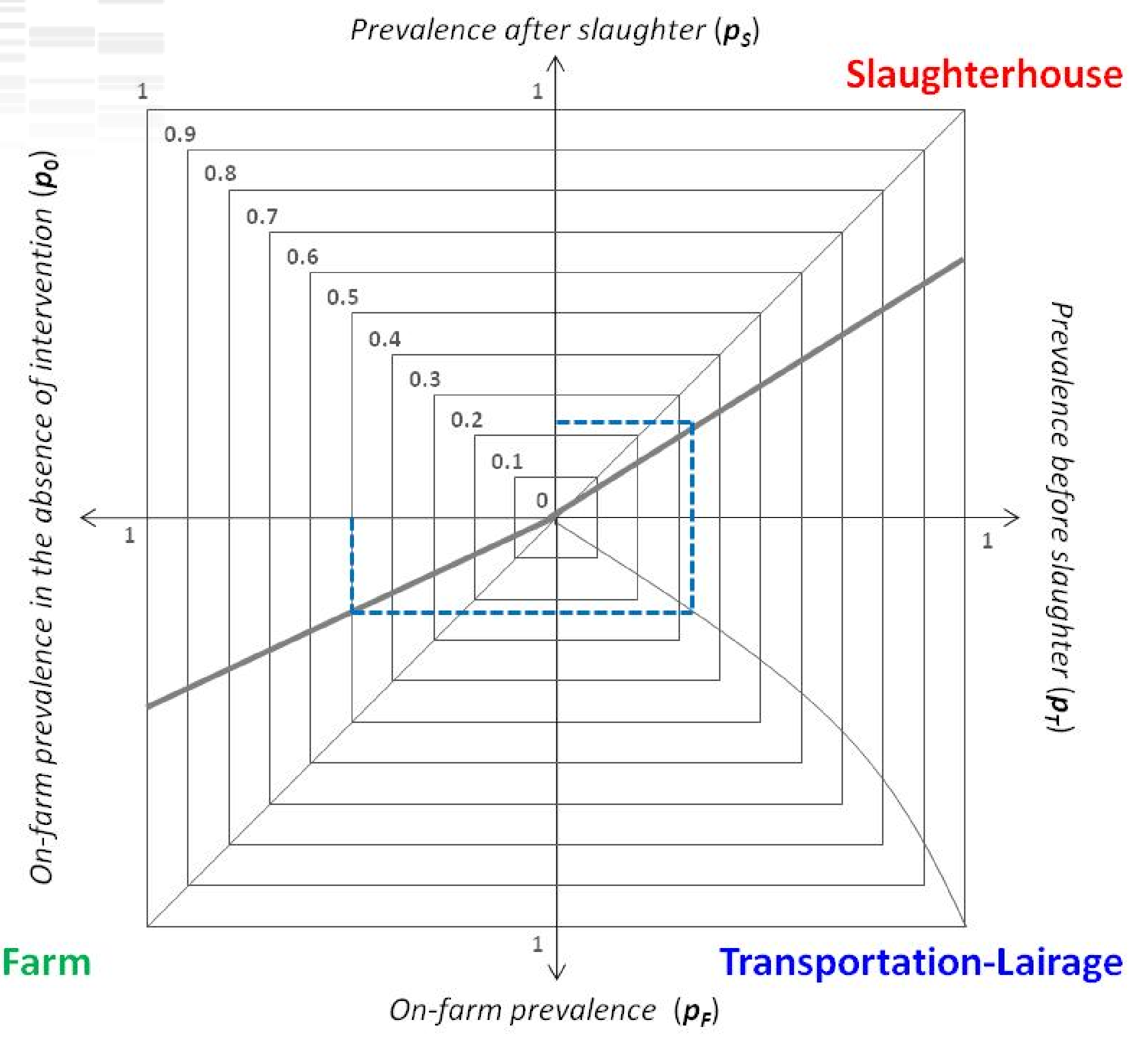
Effectiveness: <u>'Farm'</u> intervention only



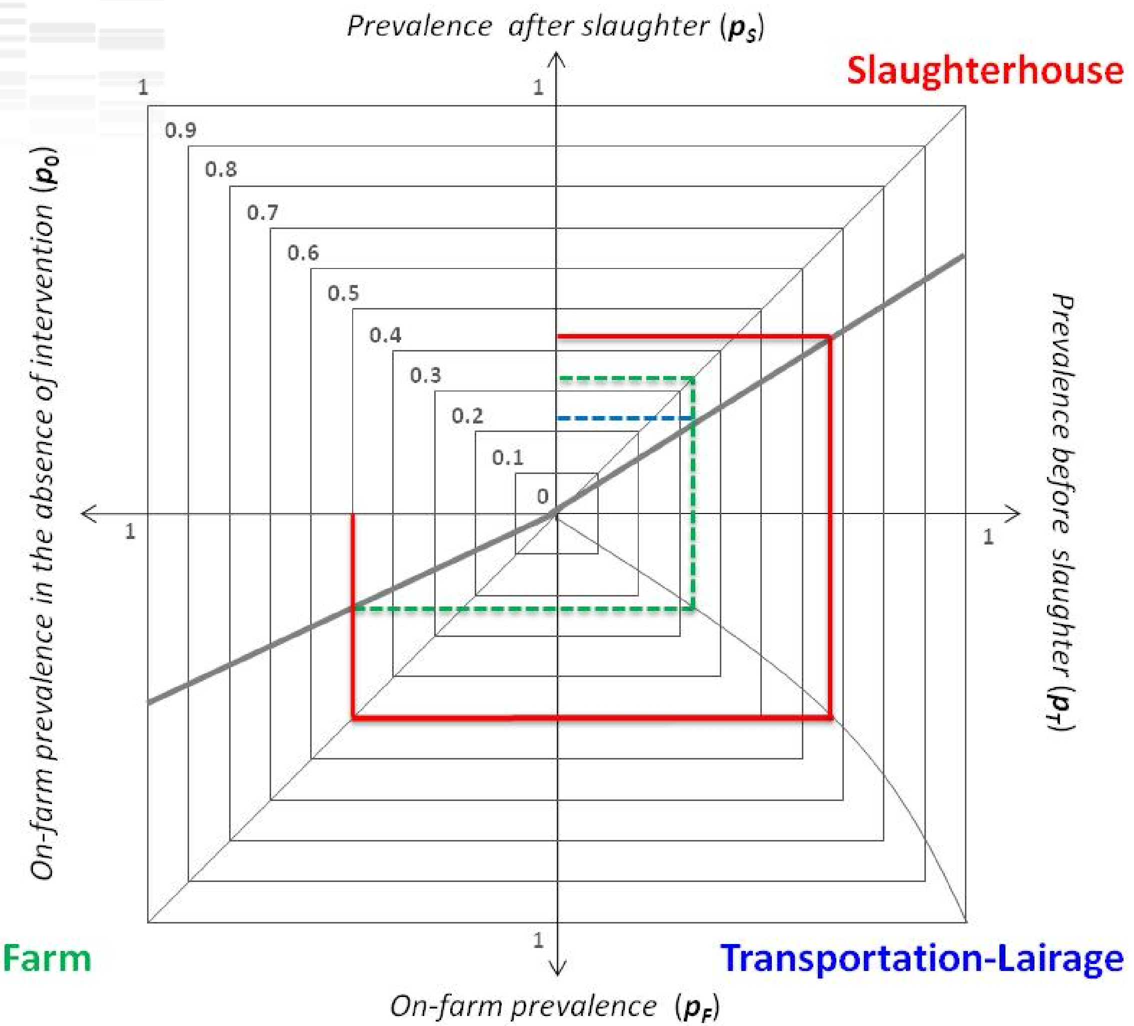
Effectiveness: **'Slaughterhouse'** intervention only



Effectiveness: 'Farm' + 'Slaughterhouse'



Effectiveness: intervention strategies ranking



Cost-effectiveness analysis

The most cost-effective intervention strategy is the one for which the following ration is maximal:

$$\frac{p^* - p_i}{C_i}$$

where	i	=	F, S, T, FS, FT, ST, FST
	p_i	=	prevalence after slaughter associated to intervention i
	p^*	=	prévalence target
	C_i	=	cost associated to intervention i

Application to *Salmonella* control

To parameterize the model, several data are required:

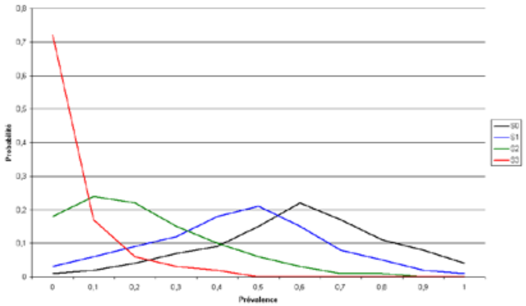
- On-farm prevalence in the absence of intervention
- Post-farm infection risks
- Effectiveness of control strategies implemented at each stage of the pork supply chain
- Costs of these control strategies

Application to *Salmonella* control

Model parameterization based on :

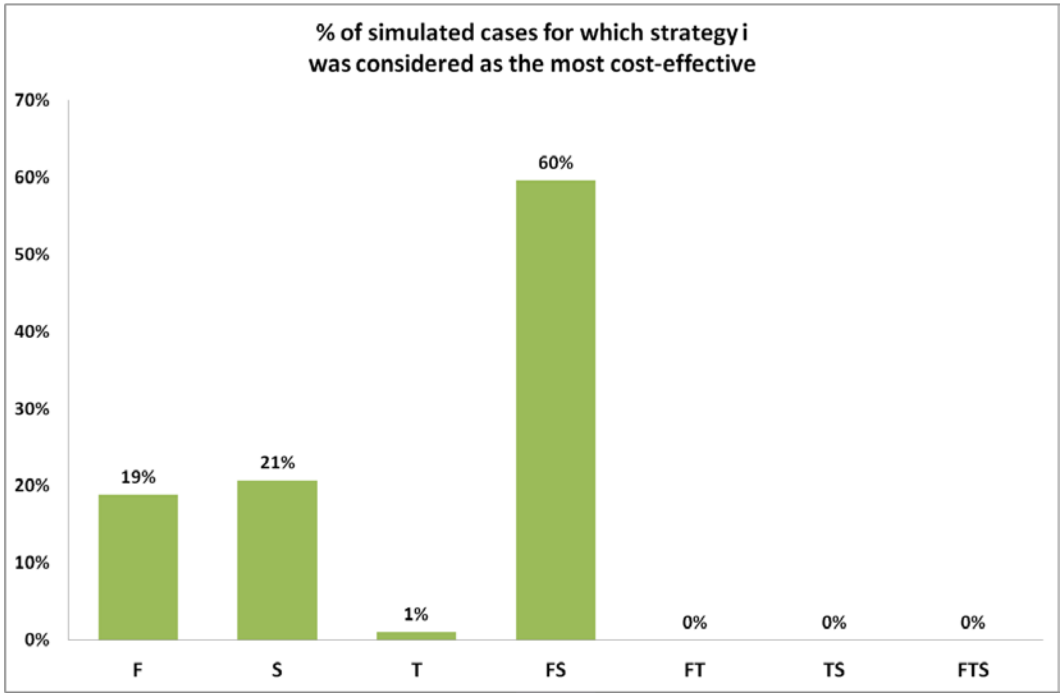
- Outcomes of epidemiological models
- Data available in the literature
- Expert knowledge

Parameterization can be based on average values, but also on distributions to take into account the variability of *Salmonella* prevalence between batches



Numerical illustration: Monte Carlo simulation results

Simulation results show the incidence of the heterogeneity of *Salmonella* prevalence between batches on the choice of an intervention strategy



For each intervention strategy, the probability of not reaching the prevalence target can also be assessed

Conclusion

The framework developed in this study is a flexible tool that can be easily extended to take into account a large variety of control measures at each stage of the pork supply chain

Our model is a useful tool for decision support, taking explicitly into account public health goals (prevalence target) and the large variability of *Salmonella* prevalence between pig batches

Thank you for your attention!

Acknowledgements

This work was supported by the French Research Agency, program Investments for the future, project ANR-10-BINF-07 (MIHMES)