

Options, cost and effect of salmonella control in pigs and pork

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CLITRAVI

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Union Européenne du Commerce du Bétail et de la Viande



European Livestock and Meat Trading Union

- Options
- Data
- Correlation between salmonella in primary production and on the slaughterhouse
- Cost and effect of interventions
- Relevant target
 - Primary production
 - Carcass

Options

- Primary production
 - Eradication
 - Reduction
- Slaughter house
 - Improved hygiene
 - Decontamination
 - Chemical
 - Physical (hot water, steam)
 - Other

Cost-effect calculations

- Target arbitrarily set at 3 % positive swab pools (=1 % positive carcasses)
- Cost to reach target under different slaughterhouse sizes and initial prevalences
- 15 years time-horizon to even out effect of high starting cost or high maintenance cost
- No discounting is done

Data

- Pooled swab samples
 - 5 carcasses pr pool
- Danish movement database
- Meat-juice results



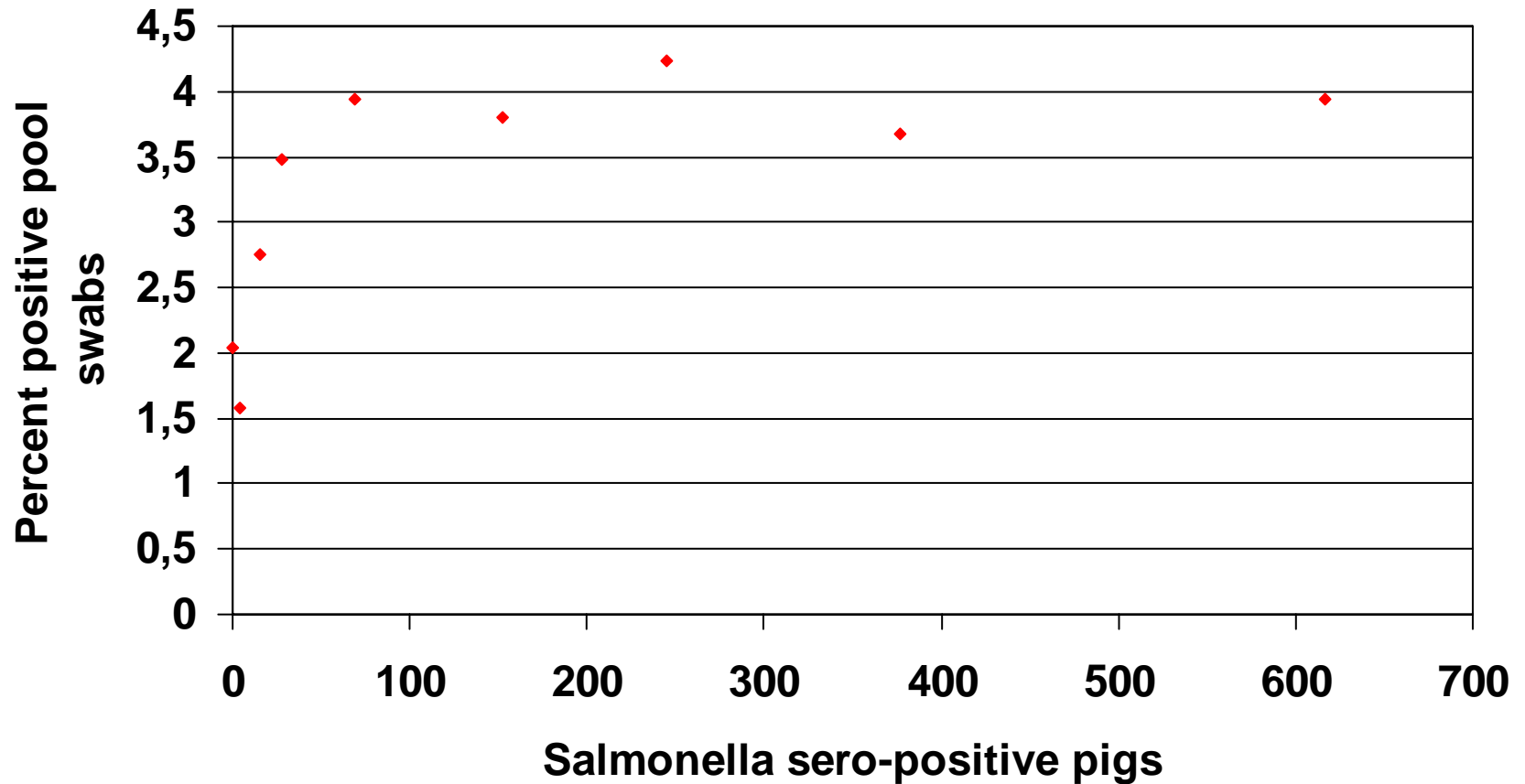
Data II

- Period
 - July 2002 – July 2008
- 38336 swaps
 - Full data on 17180 swab samples
 - Serological data on each of the 5 herds in pool
 - Serological data on pigs delivered same day, but not part of pool
- 22 slaughterhouses
- >9000 herds
- >100 million pigs
- >2 million serological tests
 - Cutoff for positive sample 30 OD% (not the cutoff used in surveillance)
- Herds classified using 1 years samples

Pool positivity depending on serological status of herds represented in the pool

Positive herds in the pool	Positive pools	Negative pools	Sum
5	88 (4.4 %)	1895	1983
4	135 (4.9 %)	2642	2777
3	166 (4.18 %)	3809	3975
2	122 (3.14 %)	3767	3889
1	85 (3.13 %)	2634	2719
0	38 (2.07%)	1799	1837
Sum	634 (3.69 %)	16546	17180

Association between number of seropositive pigs on the slaughterday and risk of pool positivity



Results of statistical analyses

Carcass positivity is function of:

Serological herd status of carcasses in pool

Serological status of pigs other pigs (cross contamination)

Increasing risk up to 40 seropositive pigs pr day

No increase after 40

Slaughterhouse

Probably a reflection of hygiene

(and in rare events a "house-infection", not found here).

Primary production-scenarios



- Eradication – increasing number of negative herds
- Reduction-reducing prevalence in positive herds

Primary production

- Scenario 1, eradication at herd level
 - Eradication will include genetic-, sow- and finisher herds
 - Reduction in number of seropositive herds
 - No reduction of number of positive pigs in positive herds (7.5%)
 - 4 slaughter-house sizes
 - 4 starting herd prevalences
 - Deterministic model
 - Target set at 3 % positive pools

Proportion of herds in eradication program to reach target



Slaughterhouse size	Initial herd prevalence			
	10%	20%	40%	60%
200	0	0	0	0
1000	0	0	0	20%
5000	0	8%	28%	48%
10000	0,00%	10%	30%	50%

Cost pr pig slaughtered

- Cost based on accurate Danish figures from the DT104 program
 - 79 Euro pr depop – repop pig year 1
 - 3 Euro pr depop-repop pig following years

Cost pr pig slaughtered year 1 /following year/average over 15 years to achieve target



Slaughterhouse size	Initial herd prevalence			
	10%	20%	40%	60%
200	0/0/0	0/0/0	0/0/0	0/0/0
1000	0/0/0	0/0/0	0/0/0	16/1/2
5000	0/0/0	6/0.3/0.7	22/1/2	38/2/4
10000	0/0/0	8/0.3/1	24/1/2	39/2/4

Problems



- Who decides which herds are to undergo depop-repop
- Who pays

Scenario 2, reduction at herd level

- Number of positive herds unchanged
- Reduction in sero-prevalence in positive herds
- 4 slaughterhouse sizes
- Initial herd prevalence 50 %
- Initial average within-herd prevalence in positive herds 7.5%

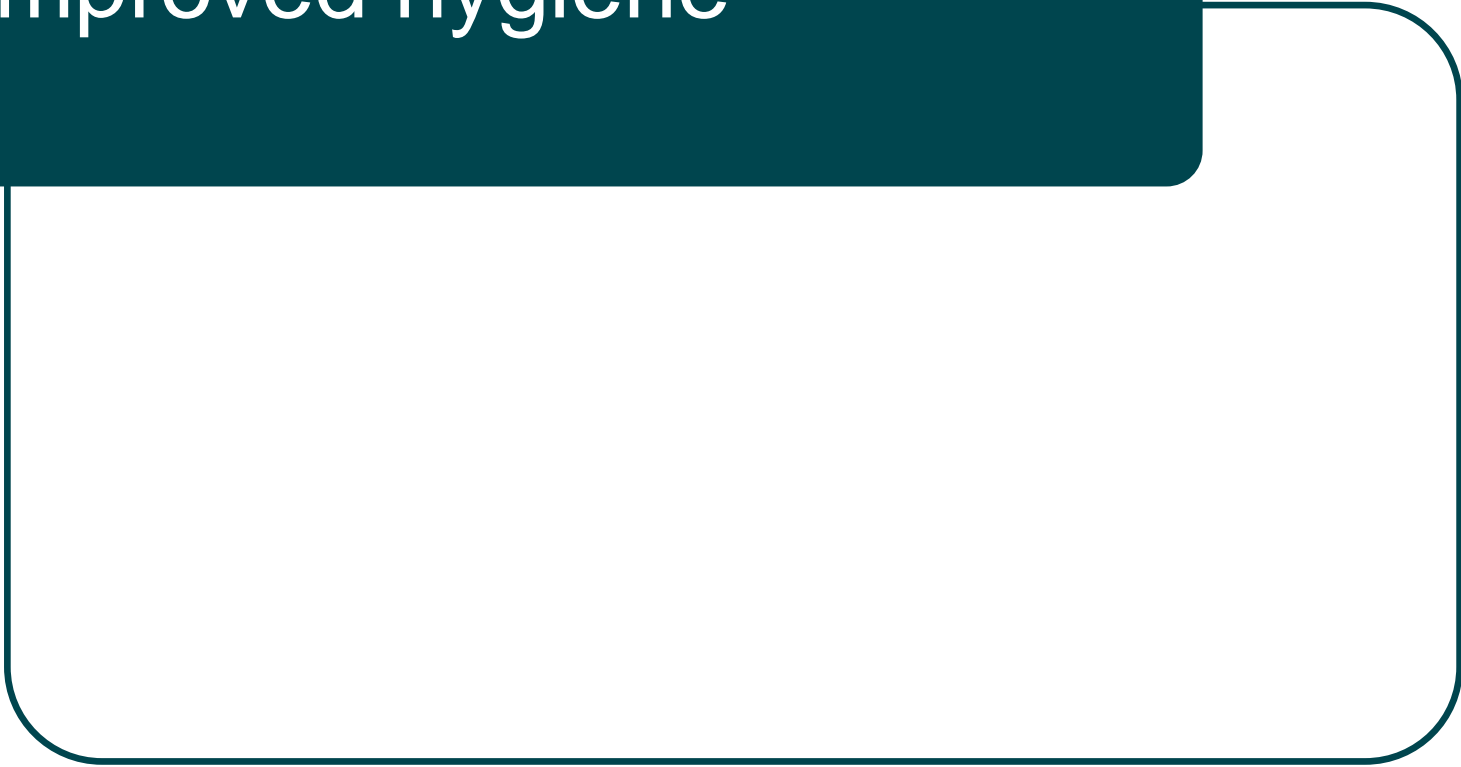
Cost to reach target

Slaughterhouse size	Proportion of pigs in reduction program to achieve target	Cost pr produced pig pr year
200	0%	-
1000	4%	0.08
5000	30%	0.60
10000	40%	0.80

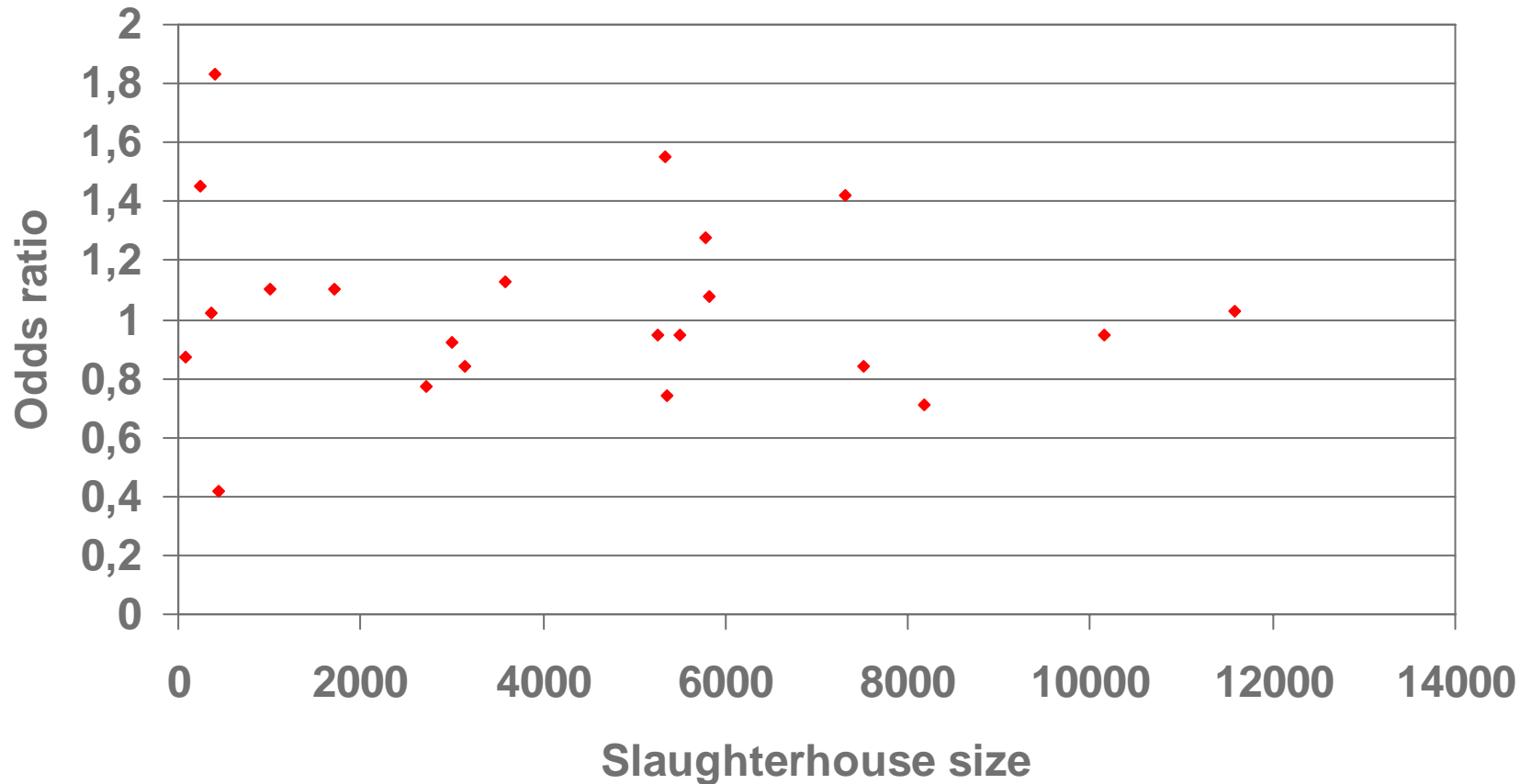
Can this be achieved?

- Danish experience and Danish research have shown, that it is extremely difficult to reach a near zero prevalence in positive herds.
- A herd reduction scenario will not reach the target for large slaughterhouses

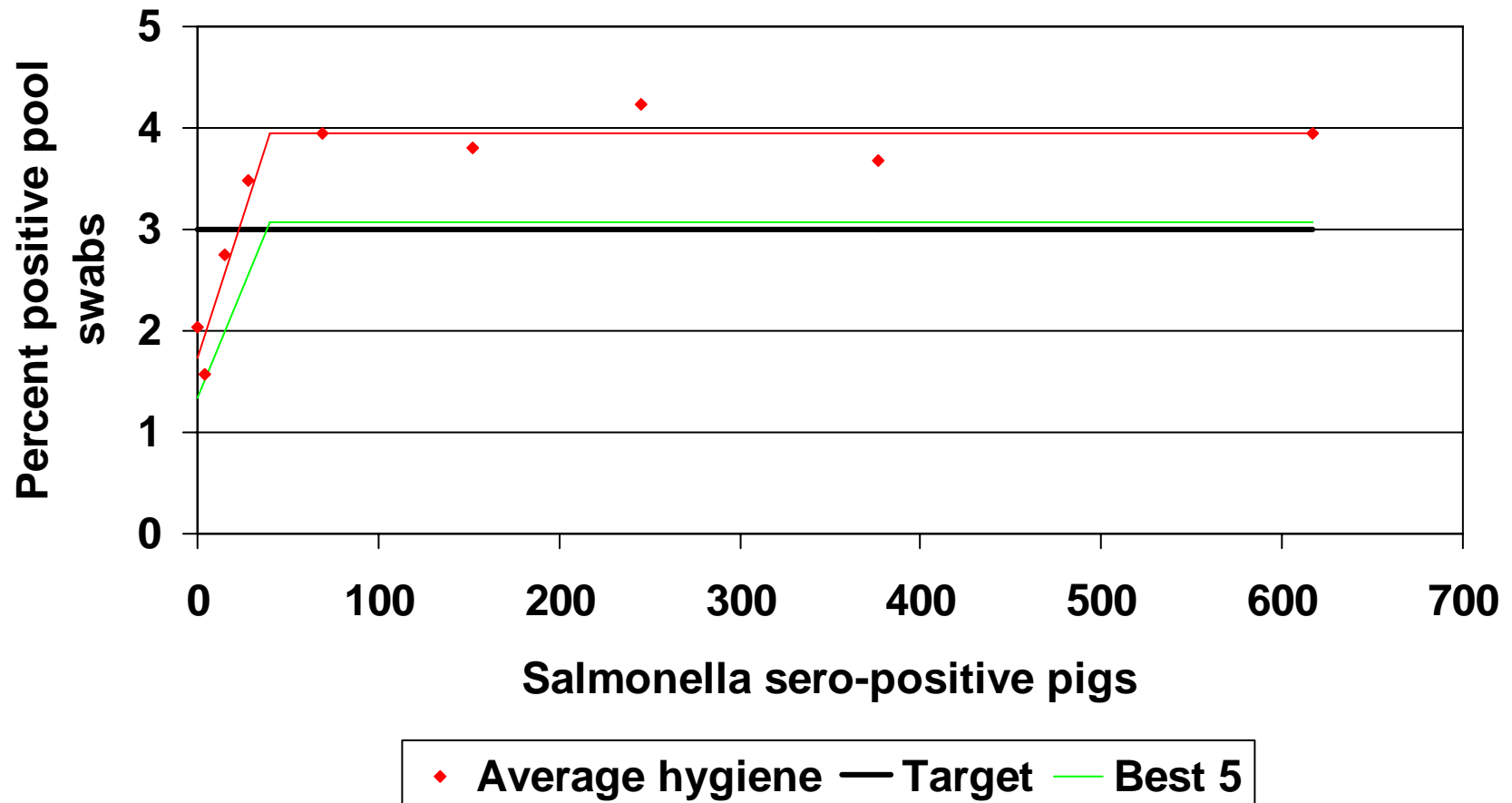
Improved hygiene



Slaughterhouse effect corrected for salmonella input – effect of hygiene



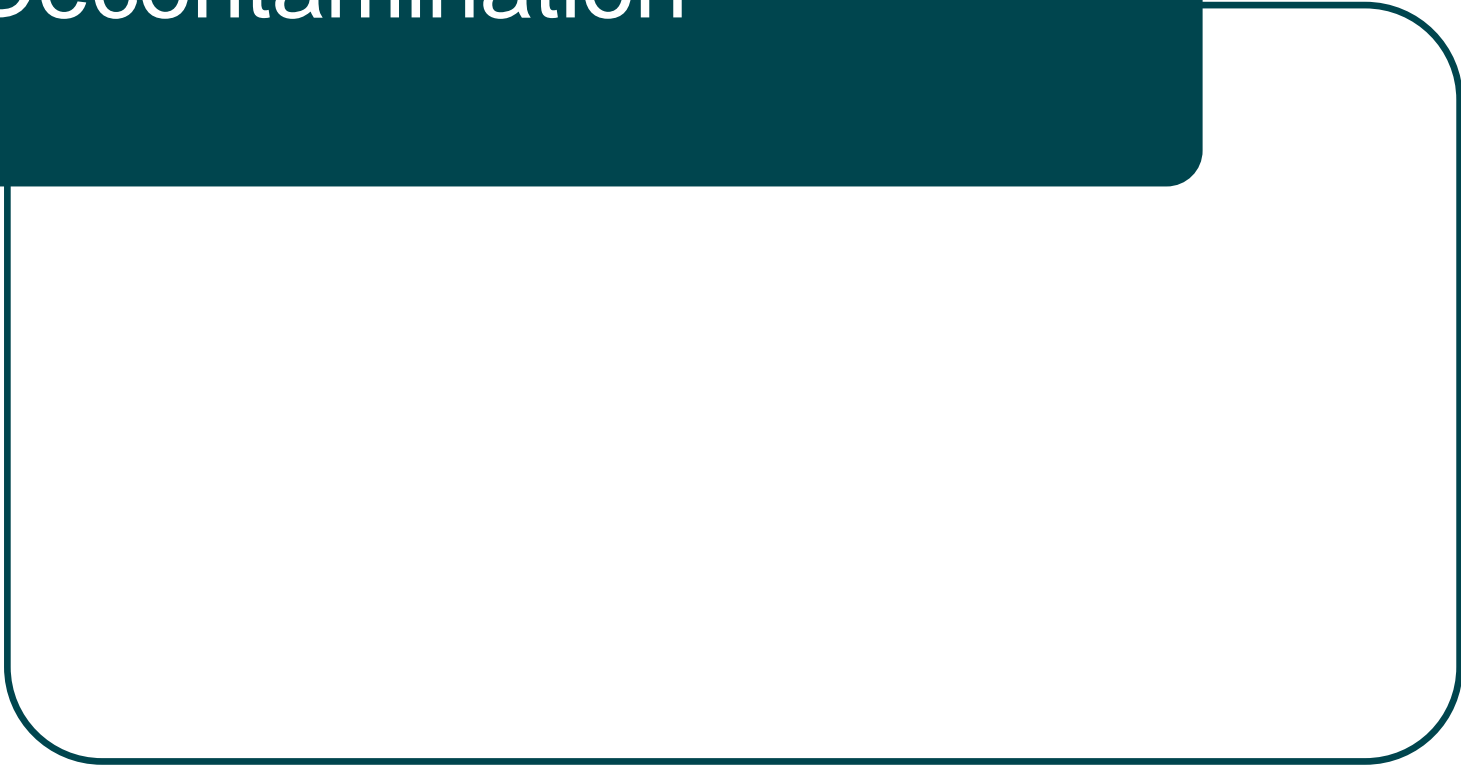
Effect of improving the hygiene to level of the 5 slaughterhouses with the best result



Improved slaughter hygiene

- Target can be reached, if all slaughterhouses can achieve results similar to the results from the best 5 slaughterhouses (excluding the smallest one)
- Costs will be very different from slaughter house to slaughter house

Decontamination

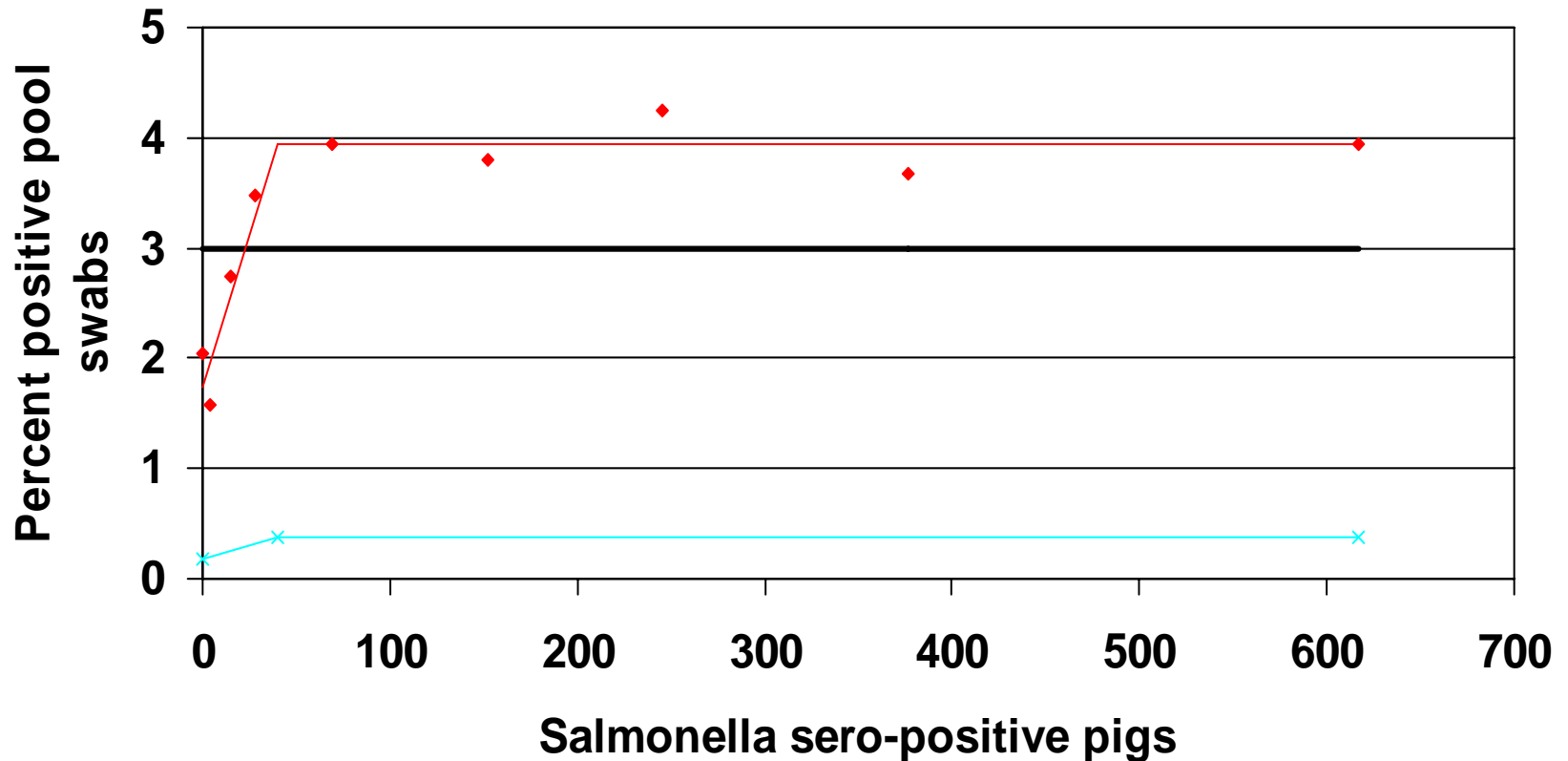


Decontamination

- Only physical decontamination relevant at the moment
- One facility based on hot water has been in operation for several years
- Steam and steam combined with ultrasound under investigation
- These calculations are based on results from the hot water wash

Hot water wash

More than 90 % reduction of positive carcasses



◆ Before decontamination — Target × After decontamination

Cost of decontamination (Euro) (max capacity for 1 device=750.000 pigs pr year)



Slaughterhouse size	Annual kill	Initial cost	Running cost pr pig	Cost year 1 pr pig	Average expence 15 years
200	48,000	333,333	0.60	8	1.07
1000	240,000	333,333	0.32	2	0.42
5000	1,200,000	666,667	0.15	1	0.18
10000	2,400,000	1,000,000	0.15	1	0.17

Conclusion 1

- Cost-effective salmonella control dependant on
 - Herd prevalence
 - Sector structure
 - Slaughterhouse size
- Small slaughterhouses, low prevalence
 - Herd interventions cost effective
- Large slaughterhouses, high prevalence
 - Slaughterhouse interventions cost effective

Conclusion 2



- Targets should be set on carcass level, not on herd level
 - Targets on breeding pigs and slaughter pigs is poorly correlated with carcass level and human health

Conclusion 3

- Cost-benefit analyses have to be done, or to incorporate country/region differences
 - Herd prevalence
 - Herd and slaughterhouse structure

Conclusion 4

- Experience from Denmark
 - Herd reduction can only reduce the level from high to medium
 - Almost impossible to measure an effect on the slaughterhouse/human cases
- Research is needed to get new tools for reduction
 - At herd level
 - At slaughterhouse level

Conclusion 5

- Cost-benefit-analyses are only meaningful on a chain level
 - "Good economic models cannot compensate for bad biological models"