

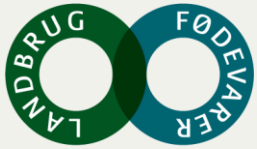
# Evaluation of risk-based residue surveillance in Danish pork



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## RESIDUE SURVEILLANCE IN DANISH PORK

1972

- Danish Veterinary & Food Administration began official residue surveillance programme in pigs

### FROM 2001 ONWARDS

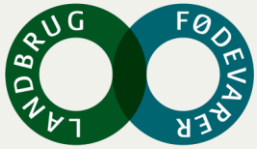
- Danish abattoirs randomly sample sows and slaughter pigs for antibacterial residues

20,000 samples/year

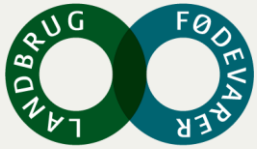


- 0.1% of total slaughter pig population and
- >1% of sows slaughtered in previous year

(exceeds 0.03% sampling level required by EU)



1. Evaluate human health risk of residues in Danish pork
  - Please see poster and proceeding elsewhere at this conference
2. **Evaluate current antibacterial residue surveillance system**
3. **Evaluate epidemiological impact of introducing a risk-based approach**

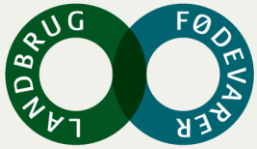


### **OFFICIAL RESIDUE SURVEILLANCE**

- Samples collected at:
  - farms
    - feed, drinking water, blood, urine or faeces
  - abattoirs
    - muscle, blood or organs
- Include 0.015% of finishers and 0.4% of sows

### **OWN CHECK RESIDUE SURVEILLANCE**

- Danish abattoirs sample 0.085% of finishers and 1% of sows at slaughter



## ANTIBACTERIAL RESIDUE SURVEILLANCE PROGRAMME IN DANISH PIG ABATTOIRS

### RANDOMLY SELECTED CARCASS

- one kidney sent for screening at an accredited lab
- carcass in detention pending outcome of testing

## SCREENING AND CONFIRMATORY METHODS

### BIOLOGICAL SCREENING METHOD

Detect presence of substance or classes of substances

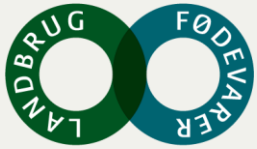
- 4-plate method

### CHEMICAL CONFIRMATORY METHODS

Identify and quantify specific substance

- HPLC
- LC-MS
- GC-MS
- UV





### POTENTIAL RESIDUES THAT MIGHT BE FOUND IN PORK

- **Contaminants** (mycotoxins, dyes, chemical elements, organophosphorus or organochlorine compounds)
  - **1 sample >MRL for Cadmium in pig liver in 1990**
- **Substances with anabolic effect** (steroids,  $\beta$ -agonists, stilbenes, antithyroid agents)
- **Antibacterials**
  - **Sows: 0.15%; Slaughter pigs: 0.01%**
- **Other products** (anthelmintics, anticoccidials, carbamates, pyrethroids, sedative, non-steroidal anti-inflammatory drugs)
- **Prohibited substances** (chloramphenicol, nitrofurans)

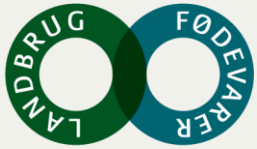
**!** PRELIMINARY FINDING: ANTIBACTERIAL RESIDUES  
■ MIGHT BE POTENTIAL HAZARD FOR HUMAN HEALTH

## PREVALENCE OF RESIDUES FOUND IN PORK - OWN CHECK SURVEILLANCE

Own check antibacterial residue surveillance results in sows and slaughter pigs, 2005-2009, Denmark

Age group	Year	Total number of samples	Number of samples positive at screening	Substances identified (N)	
				≤ MRLs	> MRLs
Sows	2005	4,278	10	Benzylpenicillin (5)	Benzylpenicillin (4) Amoxicillin (1)
	2006	3,995	6	Benzylpenicillin (2) Doxycycline (1)	Benzylpenicillin (3)
	2007	5,148	6	Benzylpenicillin (2) Tulathromycin (1)	Benzylpenicillin (3)
	2008	5,422	15 <sup>a</sup>	Benzylpenicillin (5)	Amoxicillin (2) Benzylpenicillin (6) Oxytetracycline (1)
	2009	4,445	9	Benzylpenicillin (5)	Benzylpenicillin (4)
Slaughter pigs	2005	18,910	4	The substances could not be identified	
	2006	17,956	2	Amoxicillin (1)	Benzylpenicillin (1)
	2007	17,612	2	Tilmicosin (1)	Benzylpenicillin (1)
	2008	22,806	3	Benzylpenicillin (1)	Doxycycline (1) Benzylpenicillin (1)
	2009	21,686	3 <sup>a</sup>	Doxycycline (1)	Doxycycline (1)

<sup>a</sup>One sample could not be further tested.



## EFFICIENCY OF SURVEILLANCE PROGRAM

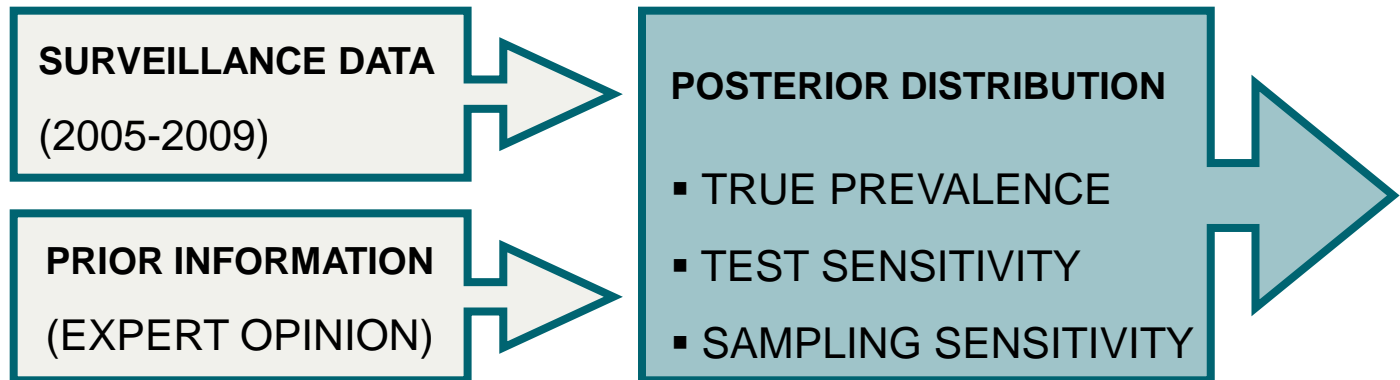
Here defined as ability to detect at least 1 sample with residues  $>$ MRL

- Reflects current number of confirmed samples
  - Easier to explain to trading partners

Bayesian modelling techniques were used to:

- Estimate **true prevalence** of antibacterial residues at confirmation in sows and slaughter pigs
- Estimate **relative risk** between sows and slaughter pigs

## BAYESIAN MODEL



**Sensitivity** assumed to be primarily influenced by 4-plate screening test (modal value: 0.90; 5th percentile: 0.80)

**Specificity** assumed to be perfect

## True prevalence of antibacterial residues in Danish pork - posterior mean estimates

Age group	Year	True antibacterial residue prevalence (%)
Sows	2005	0.16 (0.08-0.28)
	2006	0.15 (0.07-0.28)
	2007	0.13 (0.06-0.23)
	2008	0.26 (0.15-0.40)
	2009	0.23 (0.12-0.36)
Slaughter pigs	2005	0.01 (0.00-0.03)
	2006	0.01 (0.00-0.04)
	2007	0.02 (0.00-0.04)
	2008	0.02 (0.00-0.04)
	2009	0.01 (0.00-0.03)

**Relative risk:**

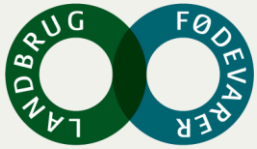
**10-25 times higher  
in sows than  
finisher pigs**

**Test Se: 86.3 (95%  
C.I.: 74.3-95.0)**

## EFFICIENCY DEFINED AS ABILITY (%) TO DETECT AT LEAST 1 SAMPLE > MRL

Prevalence in finisher pigs tested	Sample size	Efficiency (%)
<b>Current</b> <b>0.008%</b>	<b>20,000</b>	<b>72</b>
	<b>10,000</b>	<b>52</b>
	<b>5,000</b>	<b>33</b>
<b>Risk-based</b> <b>X 10 =</b> <b>0.08%</b>	<b>20,000</b>	<b>99</b>
	<b>10,000</b>	<b>97</b>
	<b>5,000</b>	<b>90</b>

If samples are taken in high-risk population, the sample size might be lowered



### TRUE ANTIBACTERIAL RESIDUE PREVALENCE IN DANISH PORK VERY LOW:

- PREVALENCE IN SOWS RELATIVELY HIGHER

#### Most common causes of positive findings

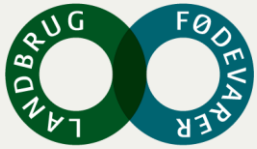
- poor keeping of treatment records
- inadequate identification of treated animals

#### ”Mistakes” more likely to occur in sows

- individual management & time of slaughter unknown

#### To further reduce low prevalence of residues in Danish sows:

- own-check farm programs
- education of farmers and farm workers
- awareness regarding impact on industry reputation and exports



## RISK-BASED APPROACH SEEMS COST-EFFECTIVE

- NEED TO FURTHER INVESTIGATE RISK FACTORS

Sampling of high-risk pigs increases sampling sensitivity  
=> sample size might be significantly reduced

High-risk herds might be identified based on:

- antibacterial use data (e.g. higher/ lower use)
- post-mortem meat inspection data (e.g. herds systematically presenting pigs with pulmonary lesions)

- **THANK YOU FOR YOUR ATTENTION**

Full report can be found at:

<http://www.lf.dk/Aktuelt/Publikationer/~media/lf/Aktuelt/Publikationer/Svinekod/UTF8Qreststoffer20overvUTF8QC3A5gning20RBR20Filipa.ashx>

