National Food Institute

Technical University of Denmark

DANMAP
Monitor the occurrence of antimicrobial resistance

Hanne-Dorthe Emborg
Department of Microbiology and Risk Assessment
National Food Institute, DTU

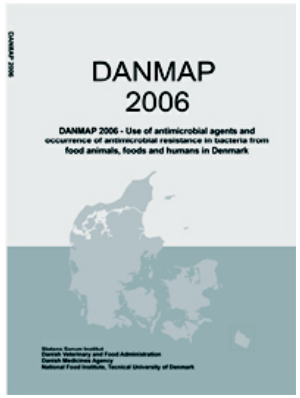
Introduction

- The DANMAP programme was initiated in 1995
- Objectives are:
  - Monitor consumption of antimicrobials for food animals and humans
  - Monitor the occurrence of antimicrobial resistance among bacteria from food animals, food of animal origin and humans
  - Study associations between antimicrobial consumption and antimicrobial resistance
  - To identify routes of transmission and areas for further research

The DANMAP participants

- Statens Serum Institute
- The Danish Veterinary and Food Administration
- The Danish Medicines Agency
- National Veterinary Institute, DTU
- National Food Institute, DTU

- The results are published yearly



Considerations (1)

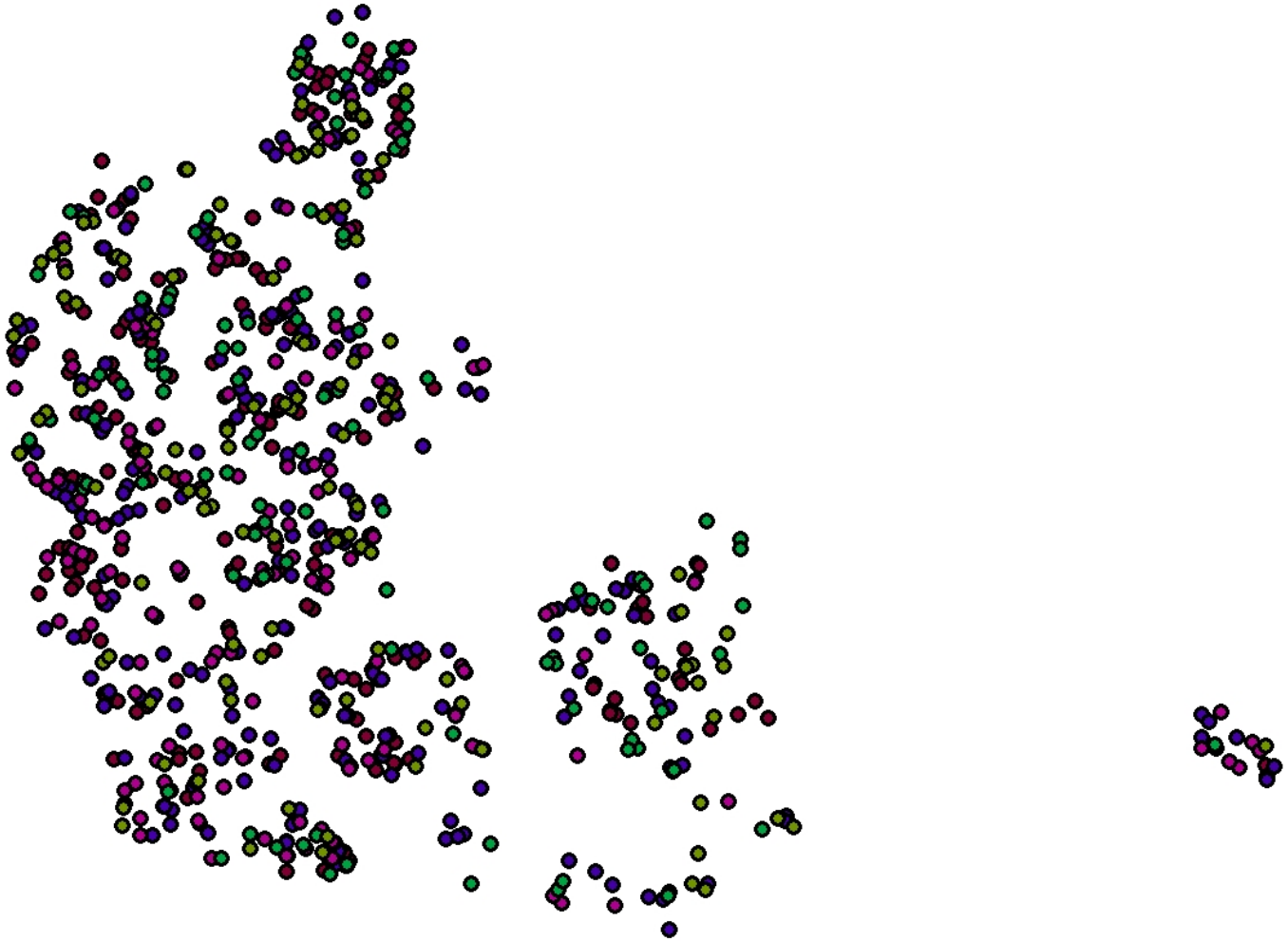
- Purpose of the surveillance programme
  - Trend
  - Early warning
  - Estimate associations between consumption and resistance
  - Effect of interventions
  - Guide to antimicrobial use policies
- Methods
  - identical methods
  - MIC-values
- Active / passive surveillance

Considerations (2)

- Sampling scheme
  - The sampling frame should cover all epidemiological unit of the national production
  - A representative sample collected randomly
    - The epidemiological unit for broilers and turkeys is the flock
    - For pigs and cattle the epidemiological unit is the holding
  - Sampling procedure remains constant
- Comparable samples between populations and countries

Pig farms in Denmark 2002-2006

Pig farms included in DANMAP 2002-2006



Passive surveillance

- Passive:
  - Diagnostic submissions from veterinarians and human doctors
  - Isolates from the existing Salmonella surveillance programmes in animals
- Advantage and disadvantage:
  - Low cost, large number of isolates
  - Representing worst cases, often not a representative sample

Active surveillance

- Active:
  - Extra samples that are collected on our request
  - The samples are from healthy animals, humans and from foods (slaughterhouses, retail outlet e.g. supermarkets)
- Advantage and disadvantage:
  - Knowledge about the level of resistance in the normal population and in food, we have influence on the sampling scheme
  - Each sample has a price, often not a large number of isolates

Bacteria included in the programme

Genus	Indicator	Pathogen	Zoonotic
E. coli	+	+	
Enterococci	+		
Staphylococci		+	
Streptococci		+	
Salmonella			+
Campylobacter			+

Isolates from food animals

- Random sampling of herds at slaughter
  - Broilers - 95% of population
  - Pigs - 95% of population
  - Cattle - 90% of population

- Diseased population
  - Almost 100% national coverage of poultry, pigs and cattle

Isolates from food

- Nationwide collection of samples at wholesale and retail outlets
- Samples are collected from pre-determined categories

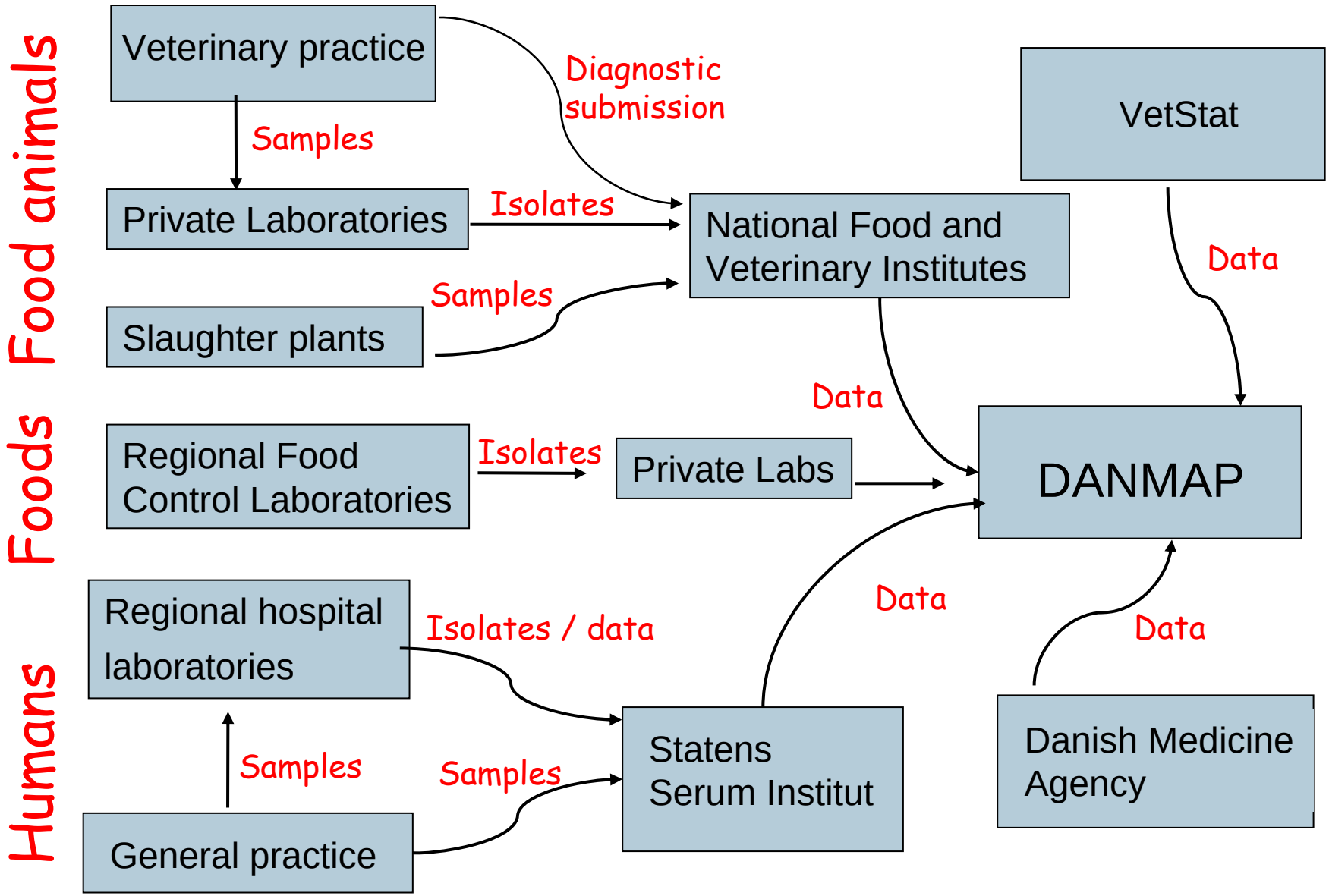
- Imported foods are sampled for Salmonella at point of entry

Isolates from humans

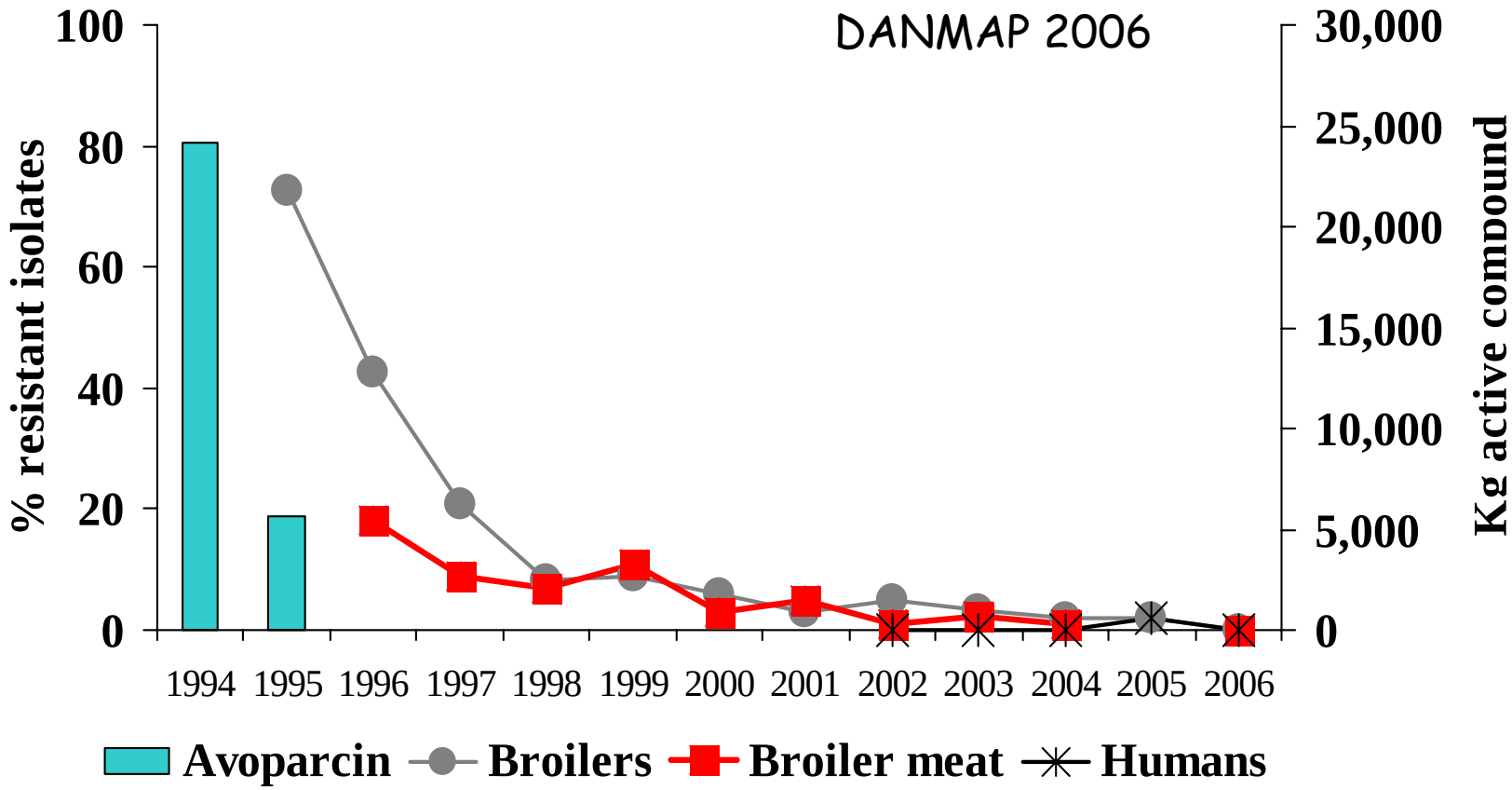
- Results of routine susceptibility testing of various pathogens in fourteen major hospitals
- Data from testing of *Campylobacter* and *Salmonella* submitted to the central public health laboratory
- Enterococci and *E. coli* isolated from stools from approx. 200 healthy humans (random sample)

Information available for each isolate

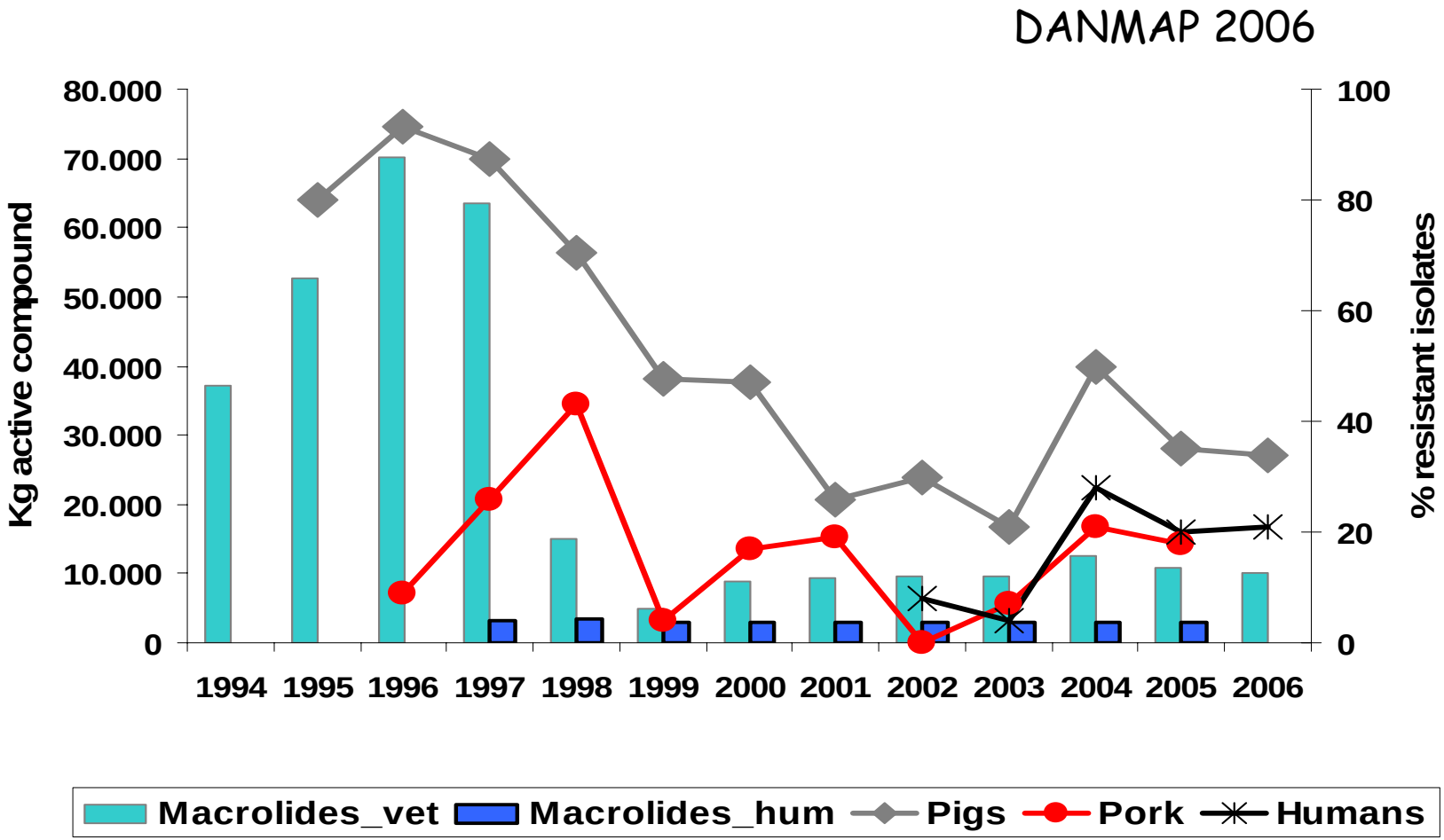
- Isolates of animal origin
  - Farm of origin (Central Husbandry Register number), animal species, bacterial species, sampling date, results of the susceptibility testing
- Isolates from food
  - Food product, country of origin of food product, bacterial species, sampling date, results of the susceptibility testing
- Isolates from humans
  - Hospital or county of origin, bacterial species and results of the susceptibility testing


Food animals
Foods
Humans
Veterinary practice
Diagnostic submission
Samples
Private Laboratories
Isolates
National Food and Veterinary Institutes
VetStat
Data
Samples
Slaughter plants
Data
Regional Food Control Laboratories
Isolates
Private Labs
DANMAP
Regional hospital laboratories
Isolates / data
Data
Data
Samples
Samples
Statens Serum Institut
Danish Medicine Agency
General practice

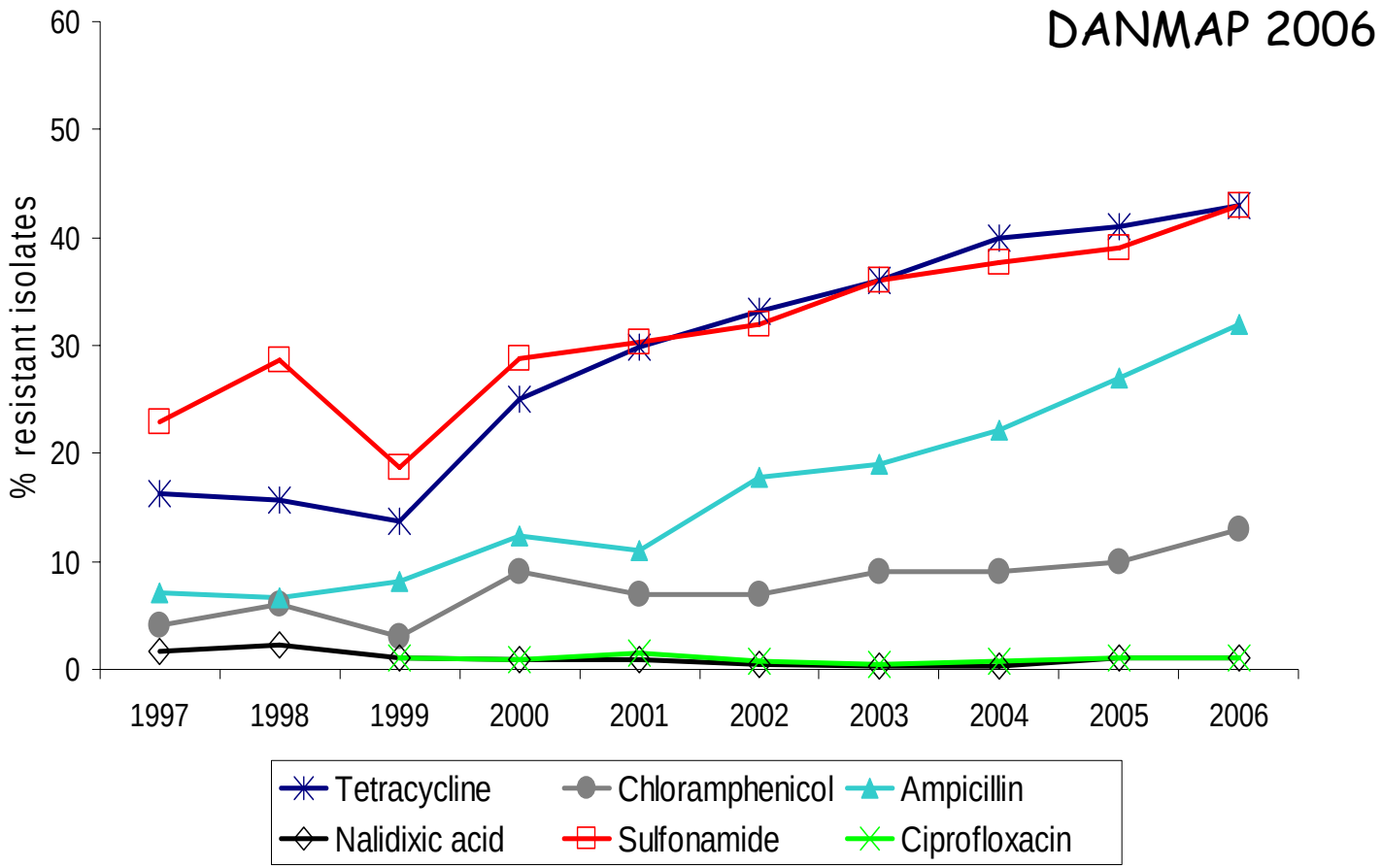
Avoparcin consumption and resistance to avoparcin among *E. faecium*



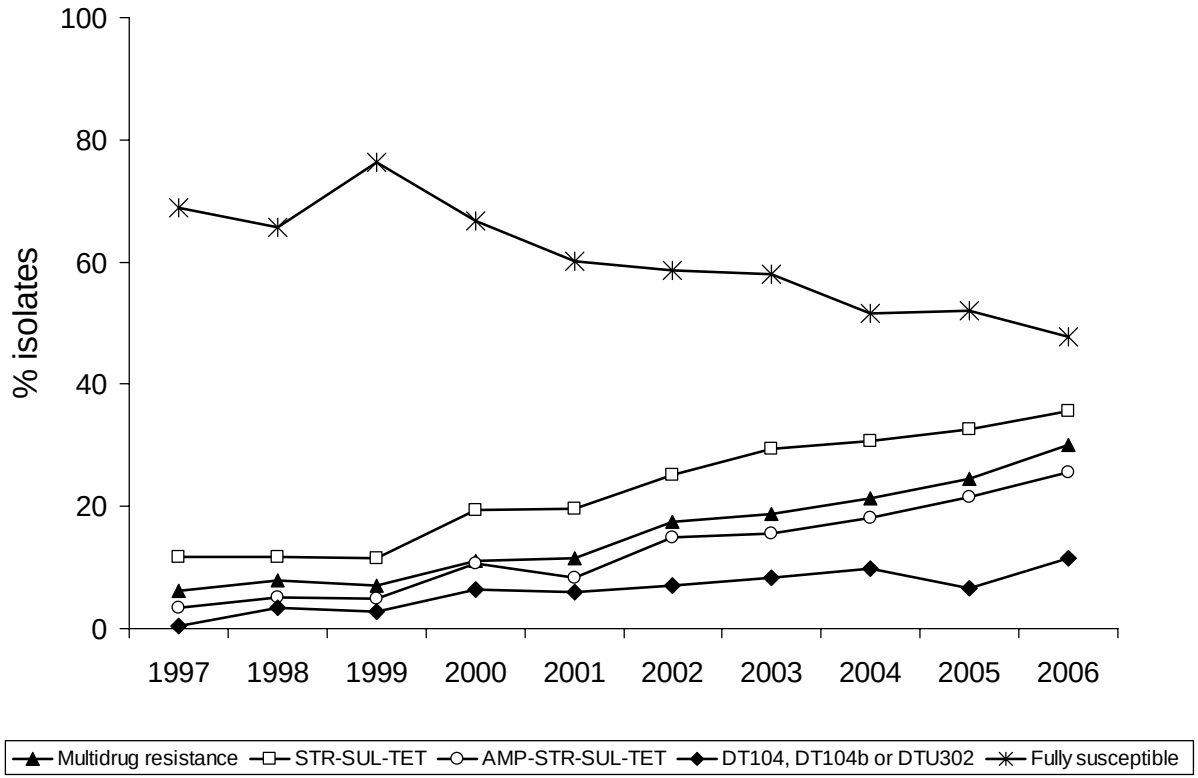
Trends in erytromycin resistance among *E. faecium*



Trends in resistance among *S.* Typhimurium from pigs



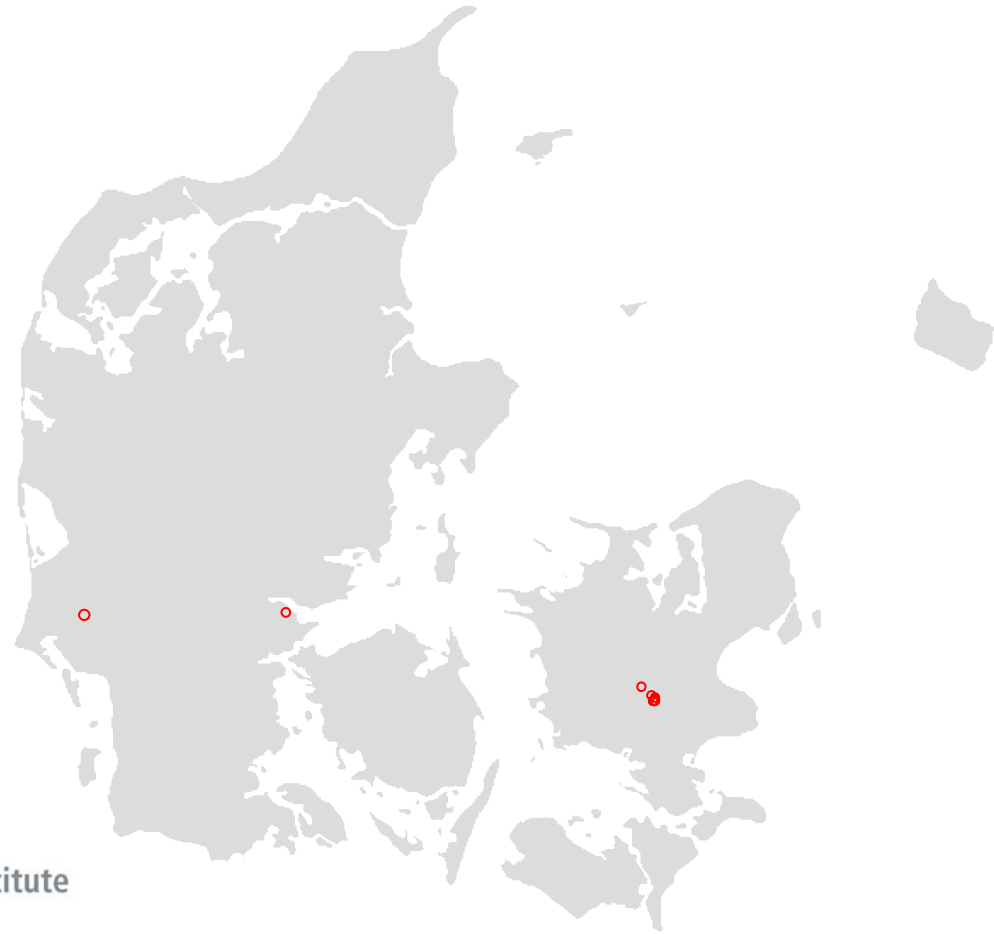
Trends in multidrugresistance and selected resistance patterns among *S*. Typhimurium from pigs



Occurrence of resistance (%) among *Salmonella* Enteritidis (1999)

	Poultry	Humans
Ampicillin	0	2
Chloramphen.	3	<1
Ciprofloxacin	0	-
Nalidixic acid	20	5
Gentamicin	3	<1
Streptomycin	3	<1
Sulfonamide	3	2
Tetracycline	5	2
No. of isolates	40	489

Nalidixic acid resistant *S.* Enteritidis from poultry (1999)



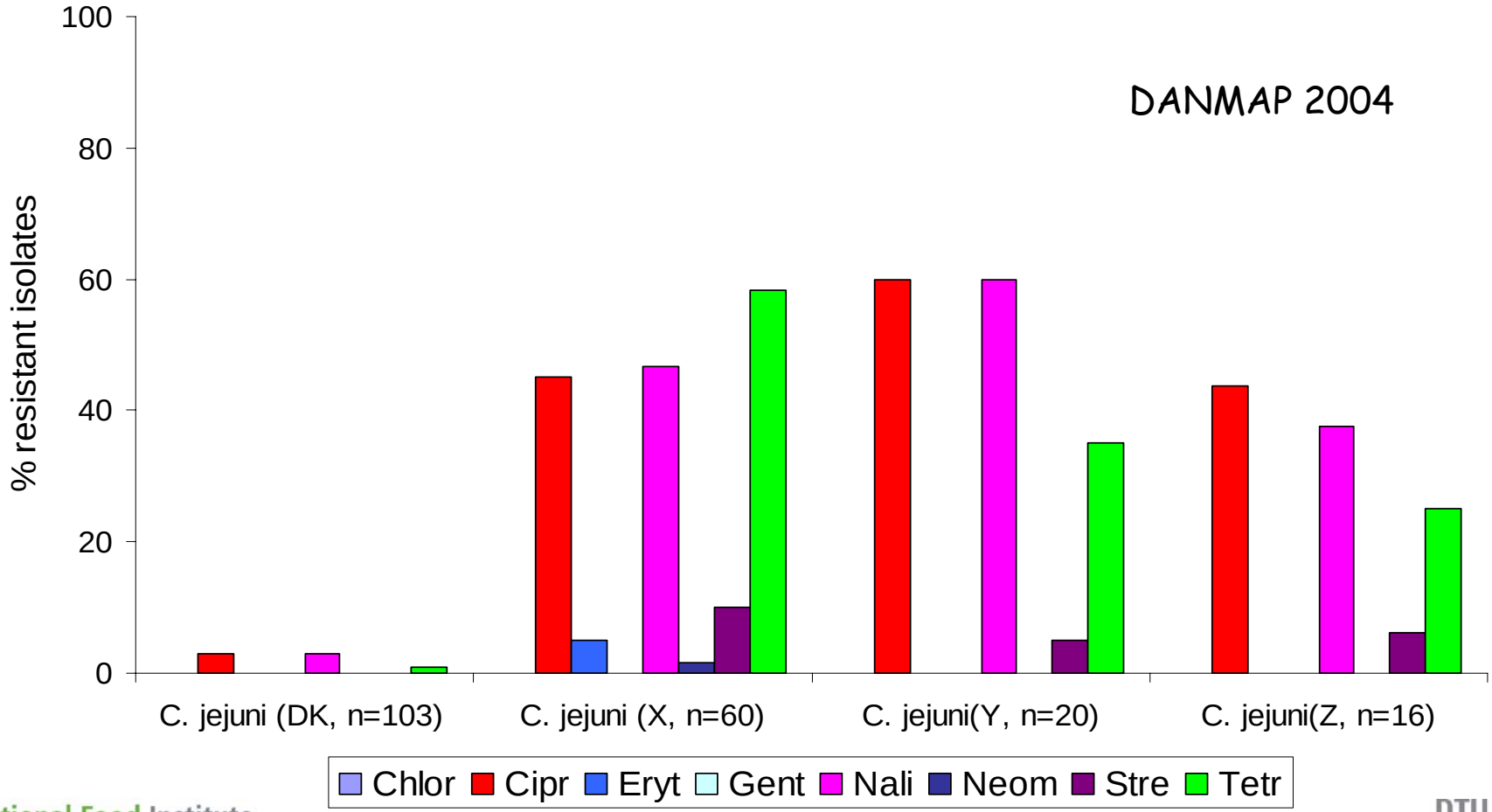
Farms

Comparison of resistance in *Campylobacter jejuni*

DANMAP 2004

Compound	Cattle	Broilers	Broiler meat		Humans	
	Danish	Danish	Danish	Imported	Domestically acquired a)	Travel abroad
	%	%	%	%	%	%
Tetracycline	0	5	1	49	24	42
Erythromycin	0	1	0	3	5	8
Ciprofloxacin	2	5	3	48	29	58
Nalidixic acid	2	5	3	48	31	50
Number of isolates	42	77	103	101	107	12

Comparison of resistance in *C. jejuni* from Danish and imported broiler meat



VetStat

Surveillance of the consumption of antimicrobials in animals

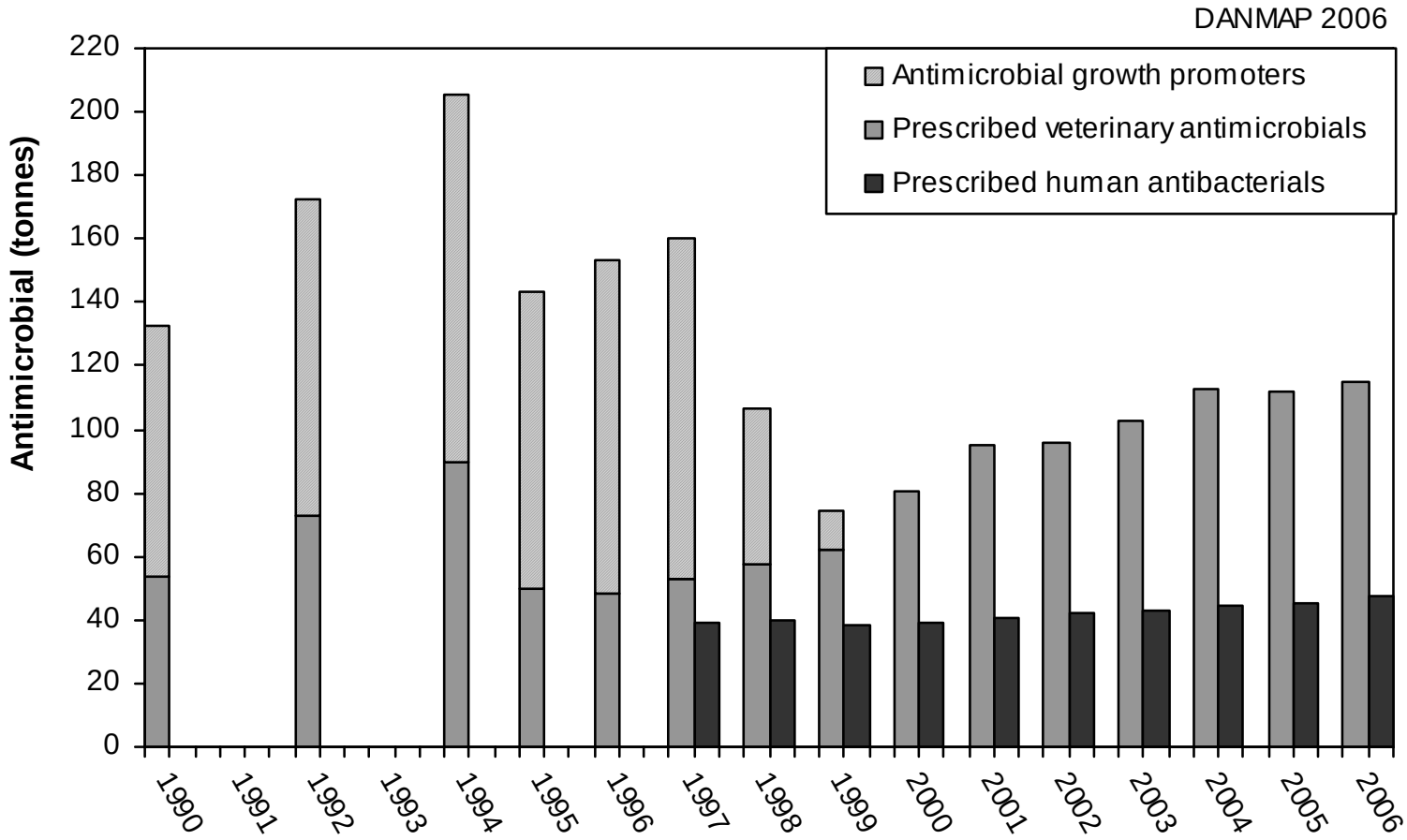
VetStat (1)

- Monitors the use of all prescription medicines in animals in Denmark
  - In production animals: the therapeutic use of medicine, sera and vaccines and coccidiostats are registered at farm level
  - The prescription includes information about: farm identity, animal species, age group, diagnosis, name and quantity of the drug and the identity of the veterinarian
  - Medicines used and sold by veterinarians themselves is reported at a similar level of detail
  - Medicines used for companion animals are monitored but at a less detailed level
  - Feed mills report all sales of medicated animal feed and feed containing coccidiostats

VetStat (2)

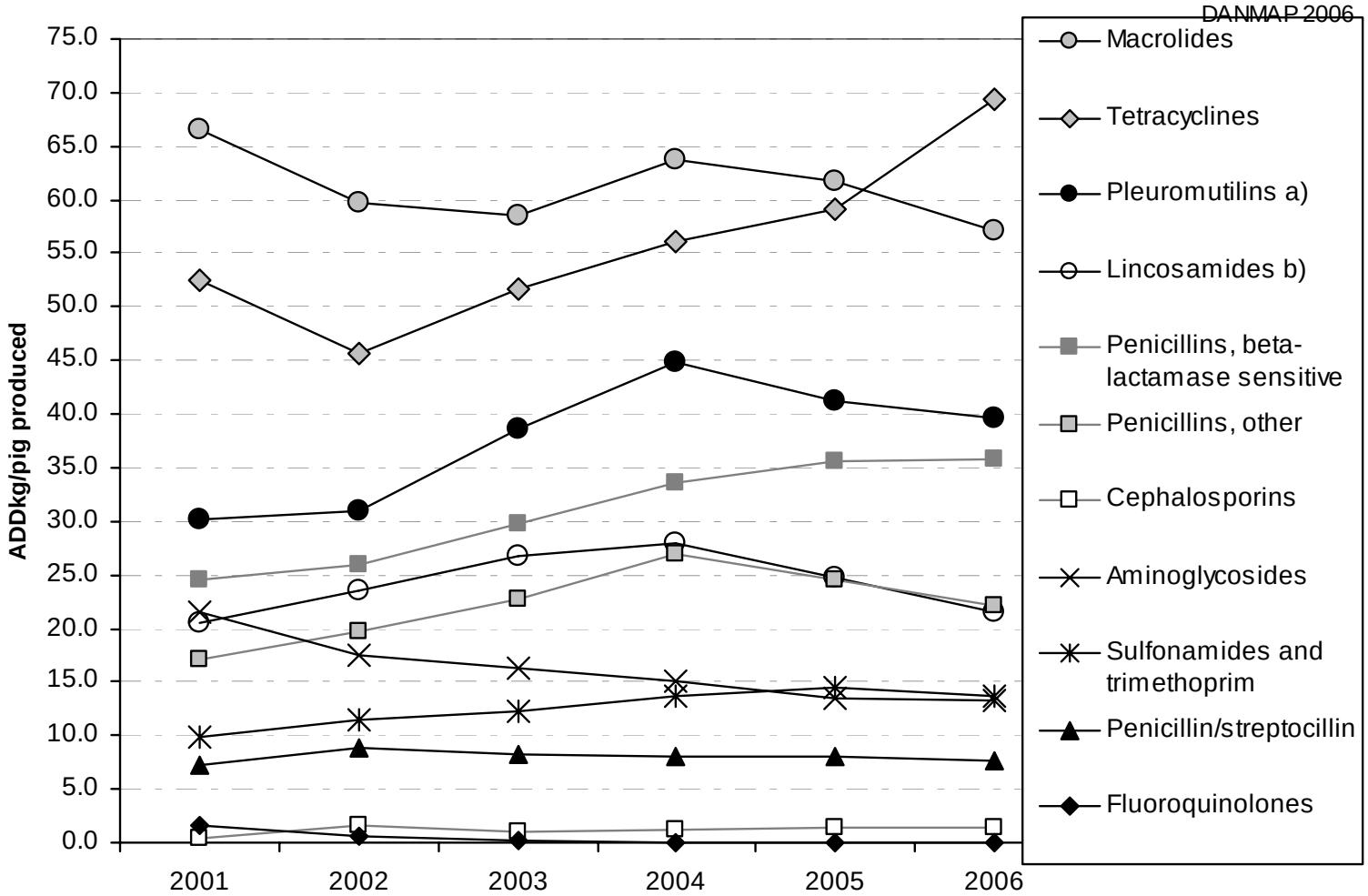
- Objectives
  - Provide a basis for research on the association between the use of antimicrobial agents and resistance
  - Provide a basis for the elimination of unnecessary and improper use of antimicrobials
  - Analysis of prescription habits
  - Tools for the veterinarians

Consumption of antimicrobials 1990-2006

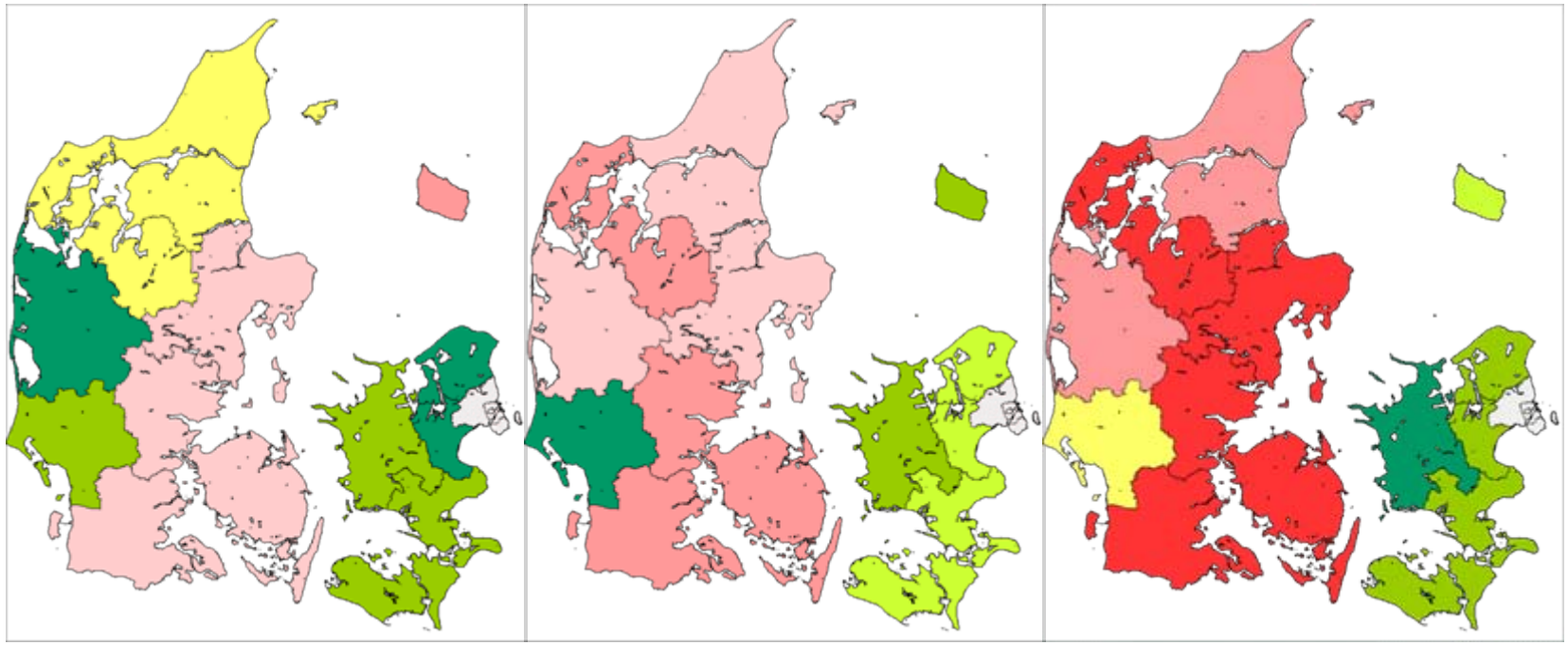


Trends in antimicrobial consumption in pigs

DANMAP 2006



Antimicrobial consumption by county 2002-2004

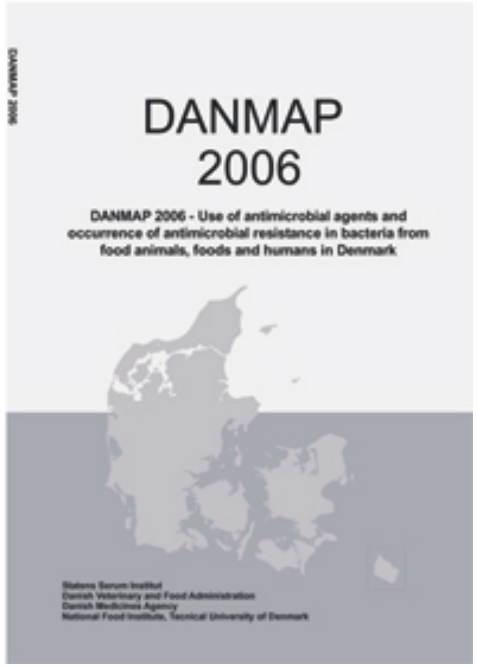


8]]8;9]]9;10]]10;11]]11;12]]12;13]]13

ADDkg / kg live pig / county

Conclusions

- DANMAP provide a resistance baseline
- DANMAP records trends in antimicrobial resistance
- Overall, levels of resistance reflect consumption of antimicrobials.
- With VetStat the possibility to demonstrate association between the use of antimicrobial agents and resistance is improved
- A tool to follow national interventions



The report is available from **www.danmap.org**

E-mail: **dzc@dzc.dk**