

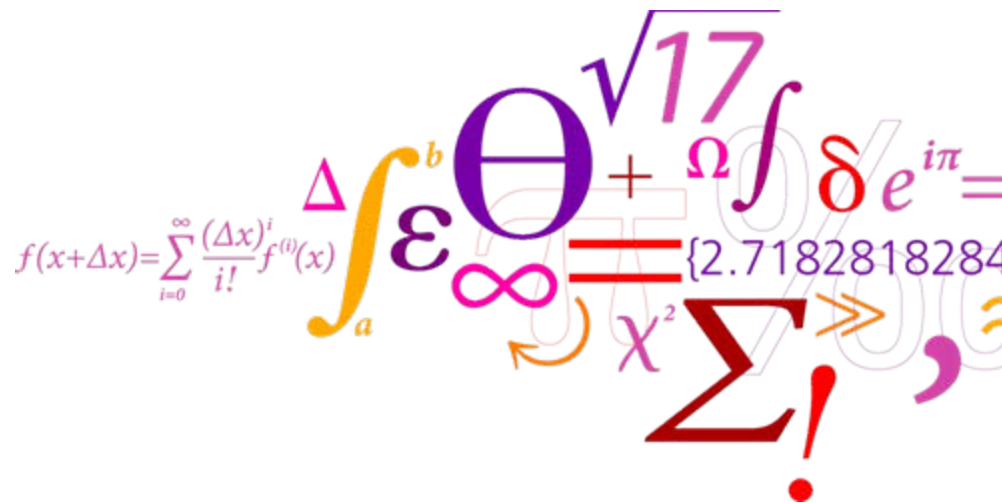
DANMAP

Danish Integrated Antimicrobial Resistance
Monitoring and Research Programme

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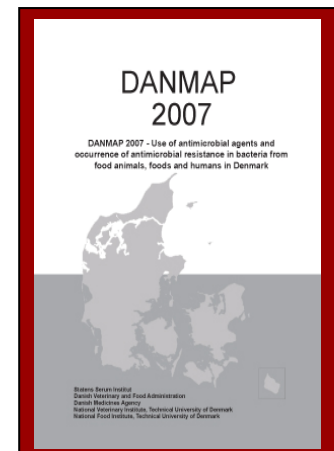
Introduction

- 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 Food Institute and National Veterinary Institute, DTU

- The results are published yearly



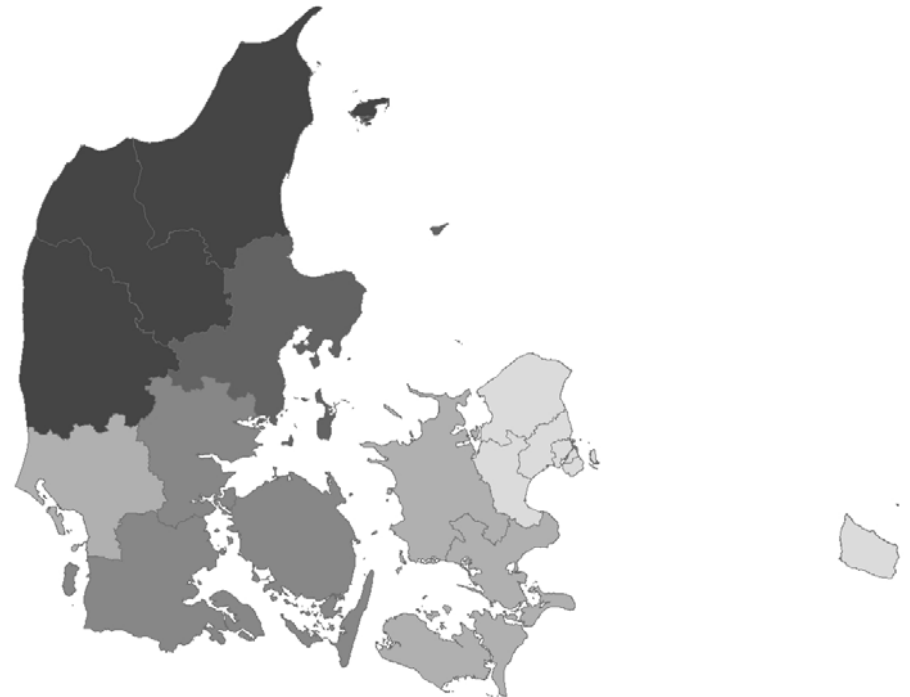
Considerations (1)

- 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

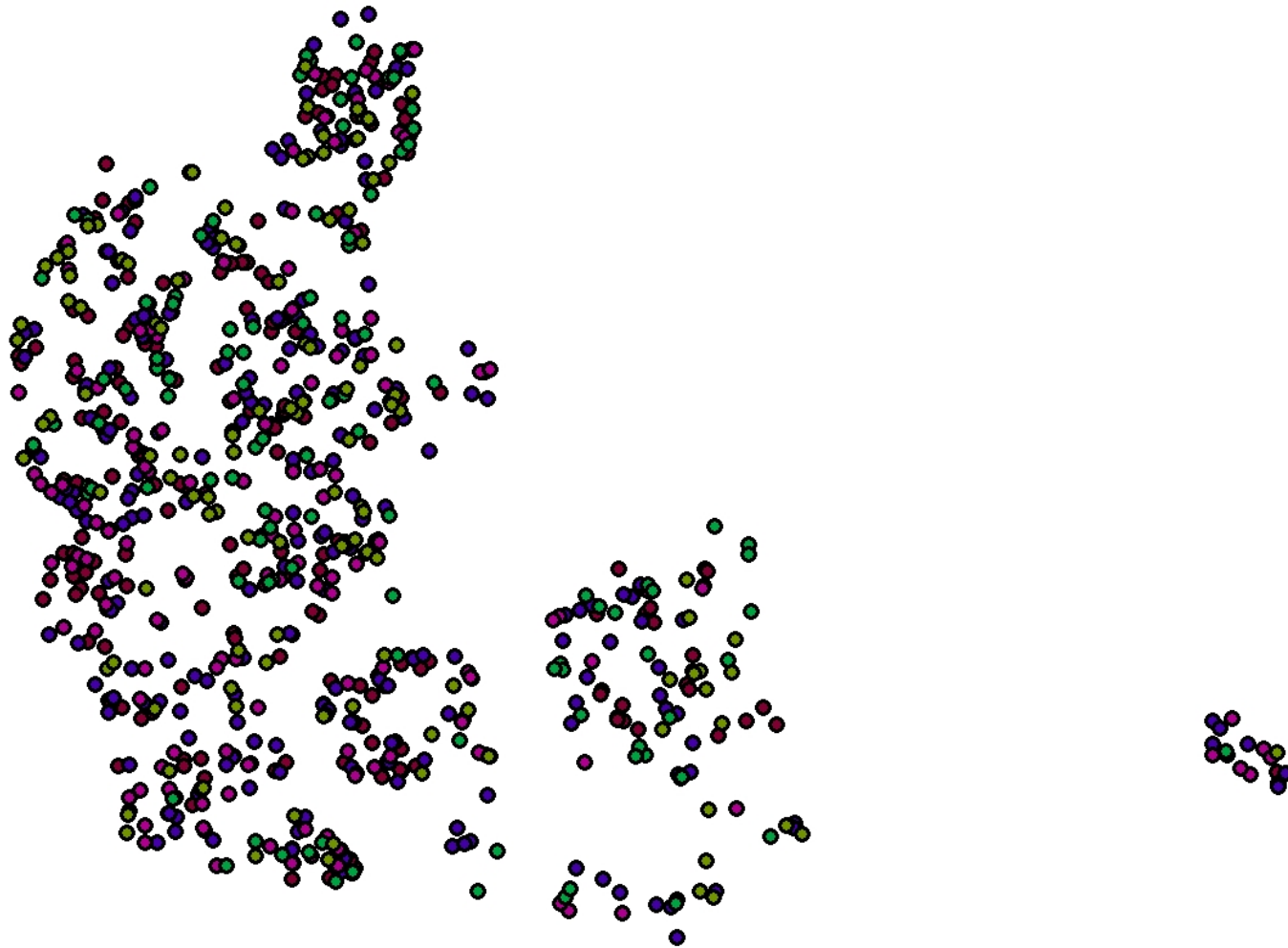
Considerations (2)

- 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

Herds 2002-2006



DANMAP Herds 2002-2006



Passive surveillance

- Passive:
 - Diagnostic submissions from veterinarians and human doctors
 - Isolates from the existing Salmonella surveillance programmes
- 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, we design the sampling strategy
 - 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	Pathogens	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 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)

No. of isolates per year

	Animals	Food	Humans
E. coli (pathogens)	<50	-	>10,000
Salmonella	600	90	700
Campylobacter	200	250	130
E. coli (indicator)	350	(700)	(50)
Enterococci	420	(1,100)	(60)
Streptococci			>1,000
Staphylococci	<50		2,000

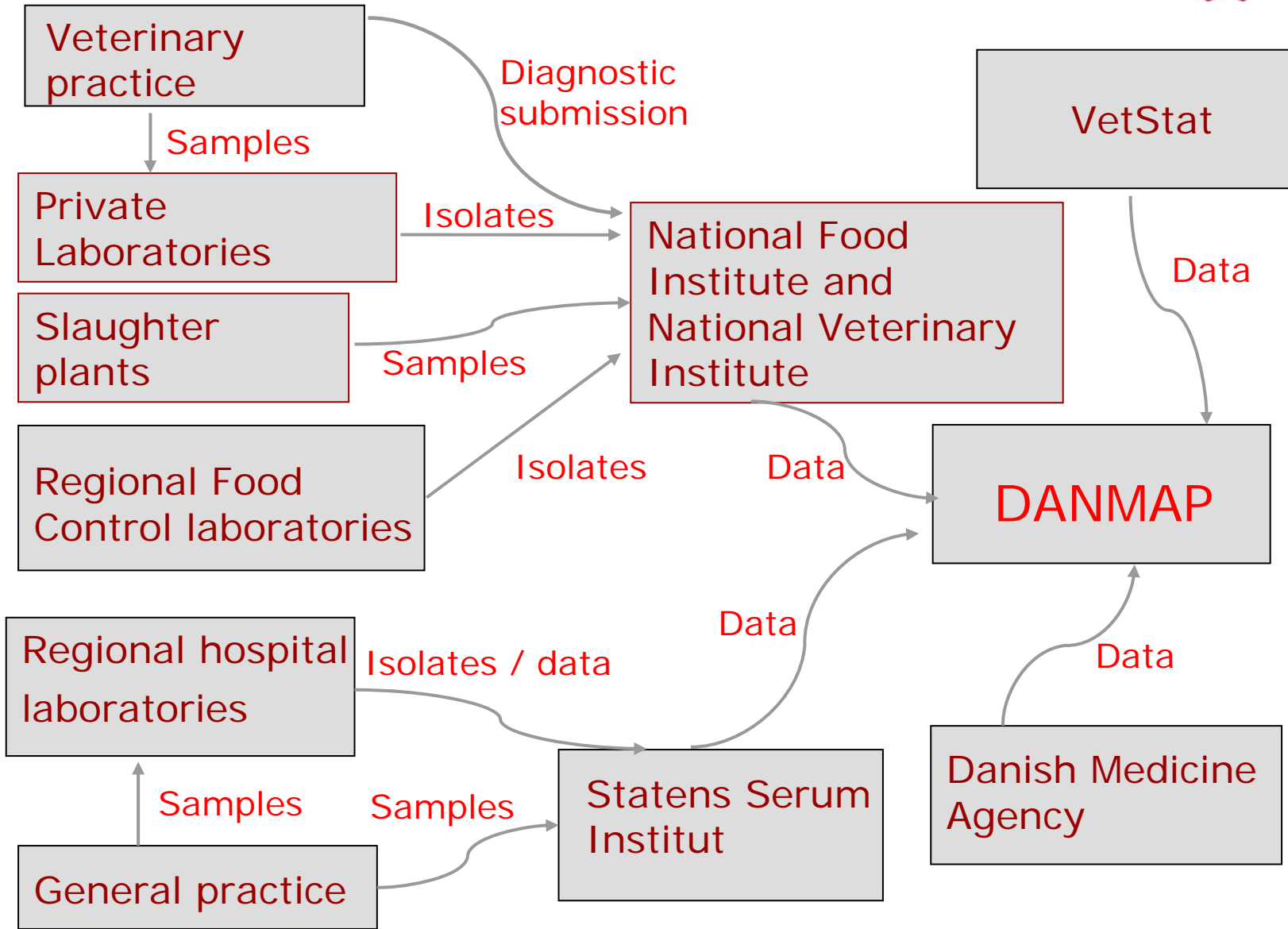
Information available for each isolate

- 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

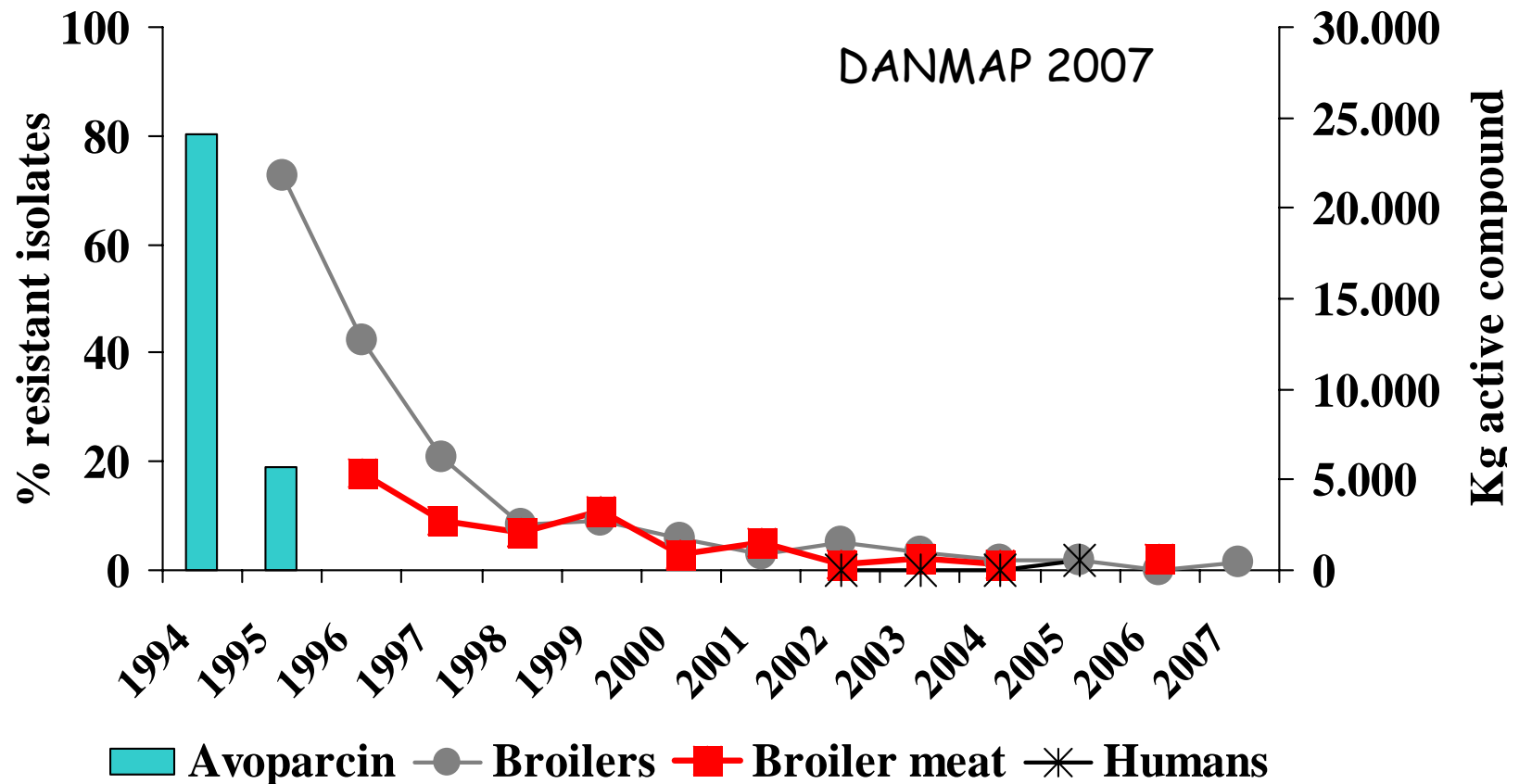
Susceptibility testing

- Bacteria from animals and humans: MIC-determination using Sensititre[®] or agar dilution MIC
- Some bacteria from humans tested in hospitals: disk diffusion
- In DANMAP 2007, cut-off values were used to report the results off the susceptibility testing for all zoonotic and indicator bacteria from animals, food and humans

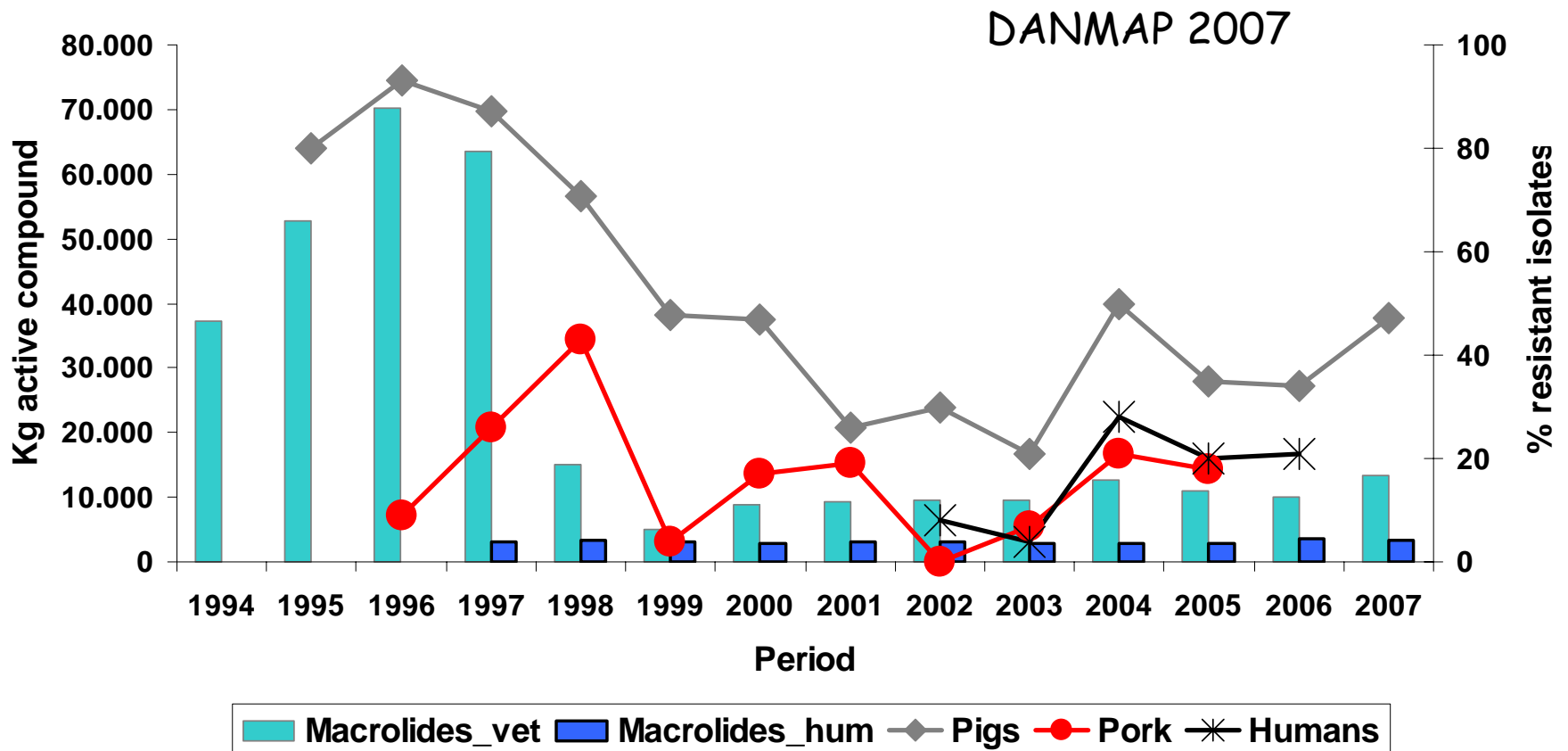
Humans Foods Food animals



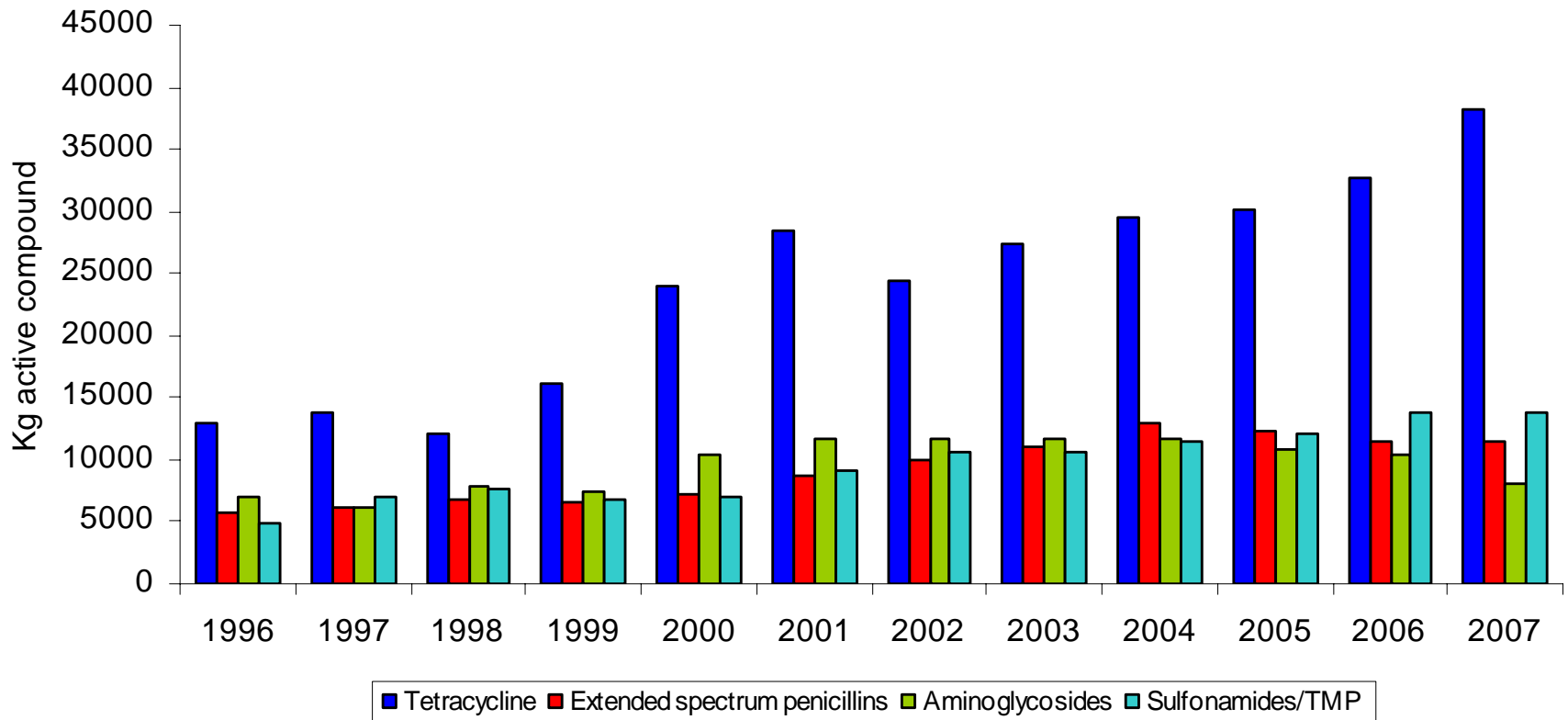
Avoparcin consumption and resistance to avoparcin among *E. faecium*



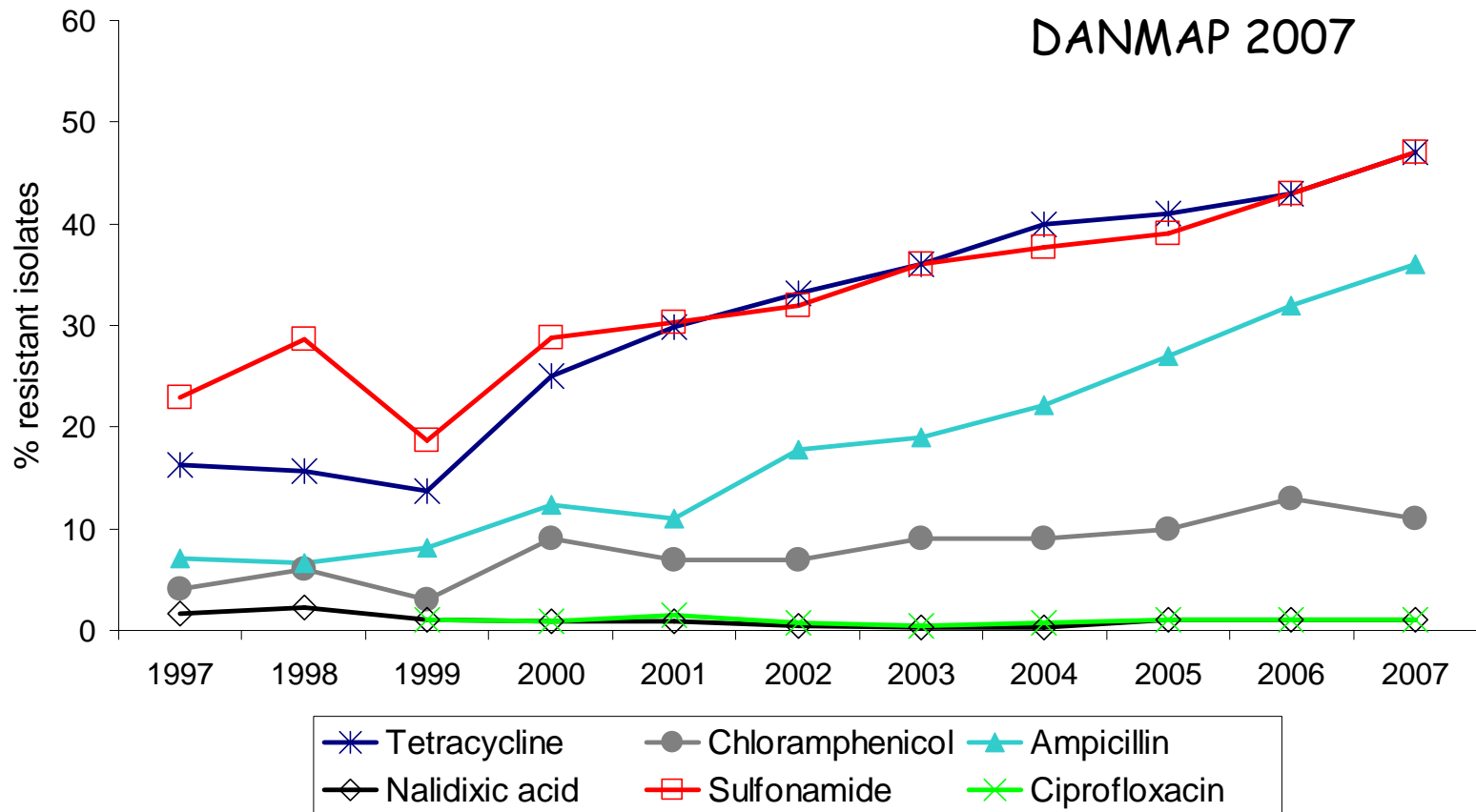
Trends in erythromycin resistance among *E. faecium*



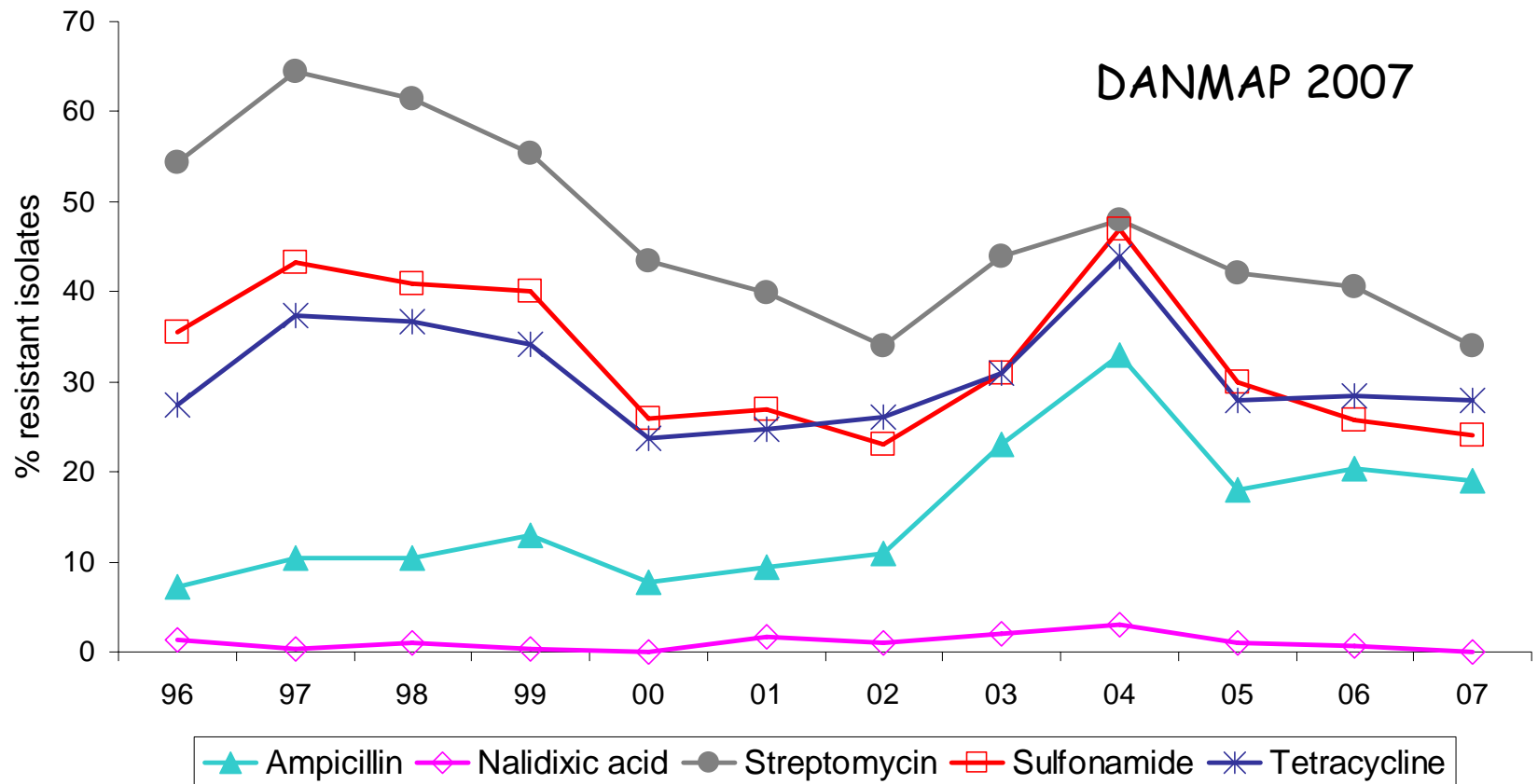
Consumption of antimicrobials commonly used to treat infections caused by Gram negative bacteria in animals



Trends in resistance among *S. Typhimurium* from pigs



Trends in resistance among indicator *E. coli* from pigs



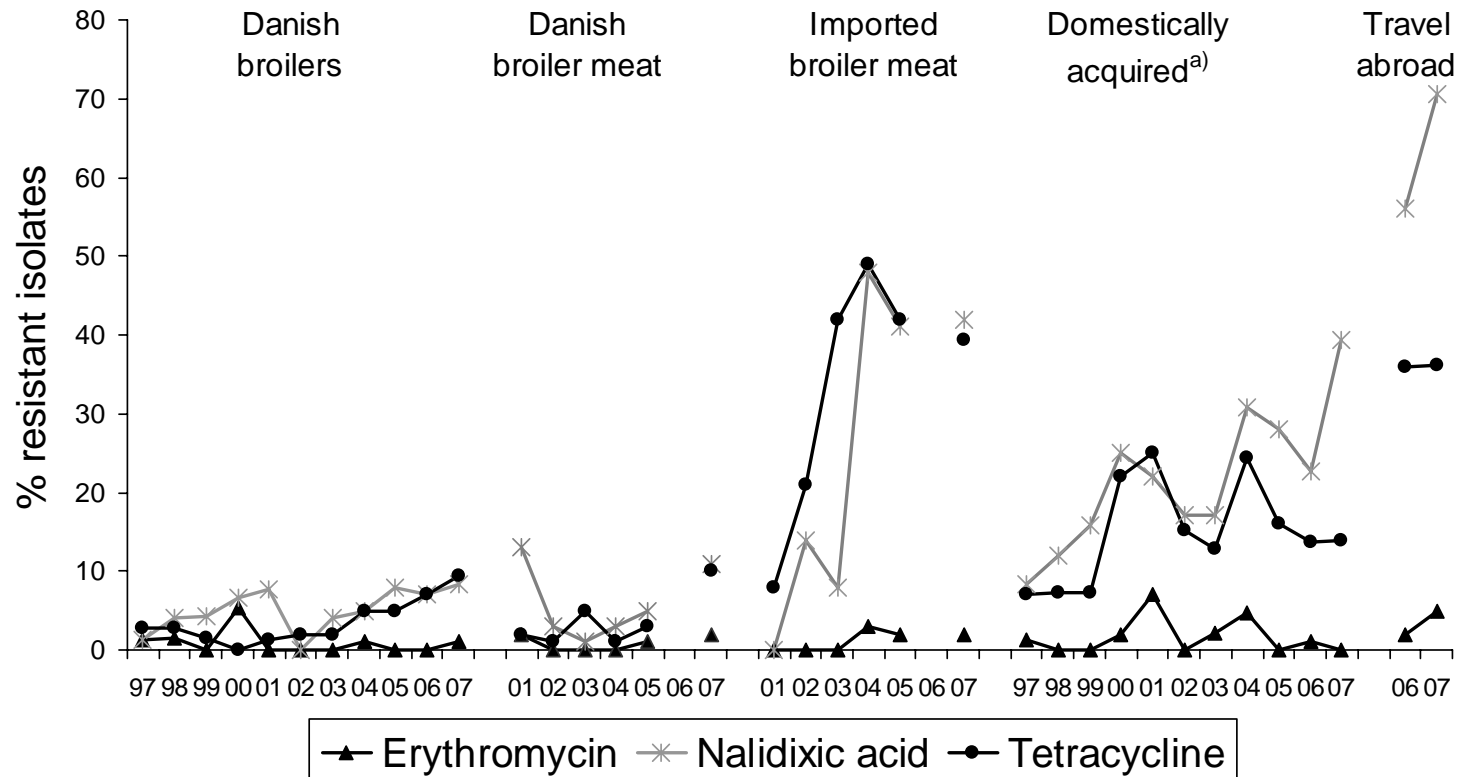
Comparison of resistance in *Campylobacter jejuni*

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

Trends in *C. jejuni* resistance

DANMAP 2007



VetStat

Surveillance of the consumption of antimicrobials in animals

VetStat (1)

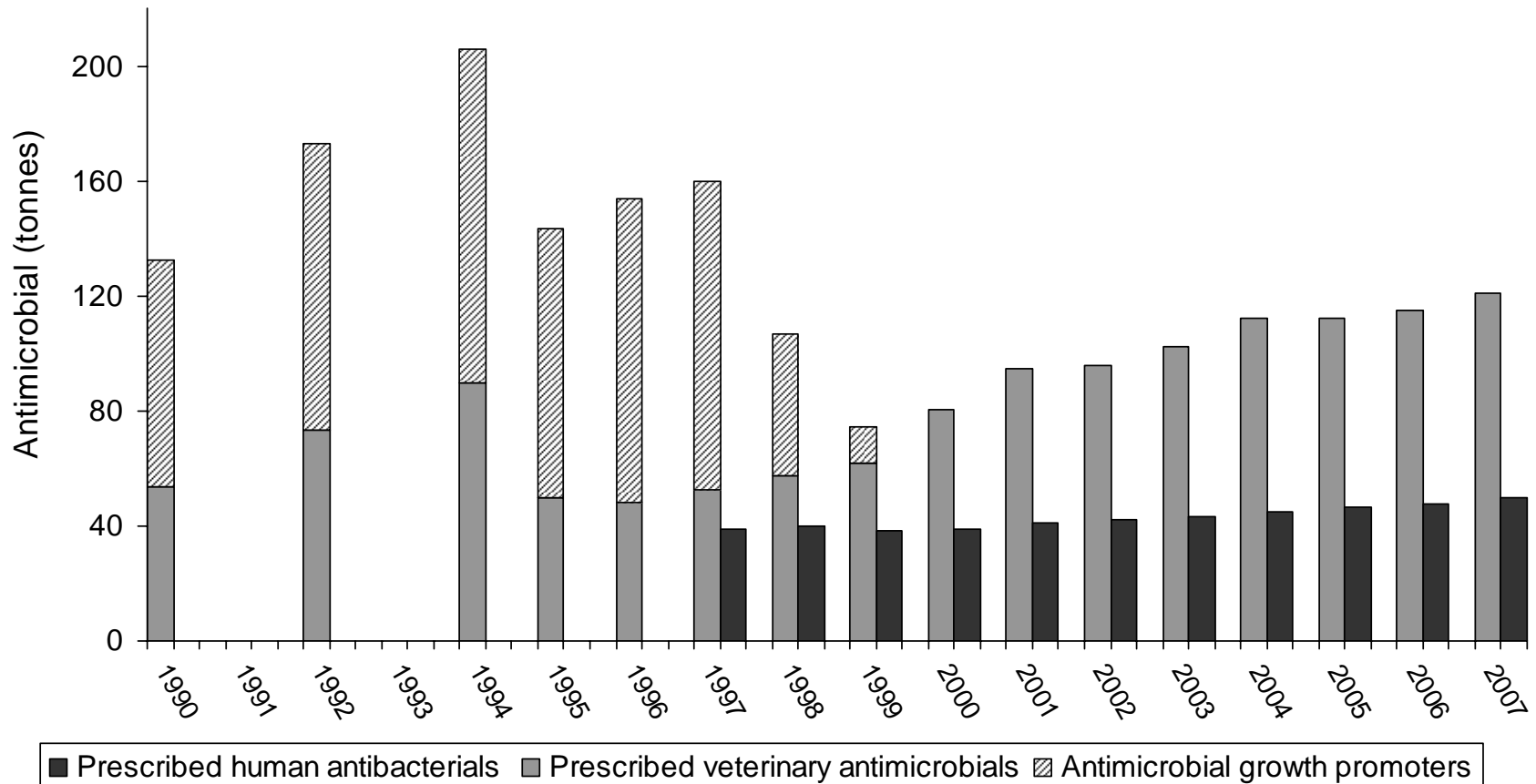
- Monitors the use of all prescription medicines in animals in Denmark
 - In production animals: the therapeutic use of medicine, sera and vaccines and coccidiostats are registered at farm level
 - The prescription includes information about: farm identity, animal species, age group, diagnosis, name 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)

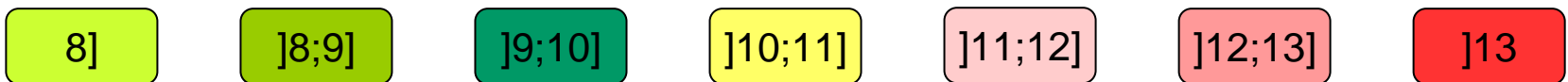
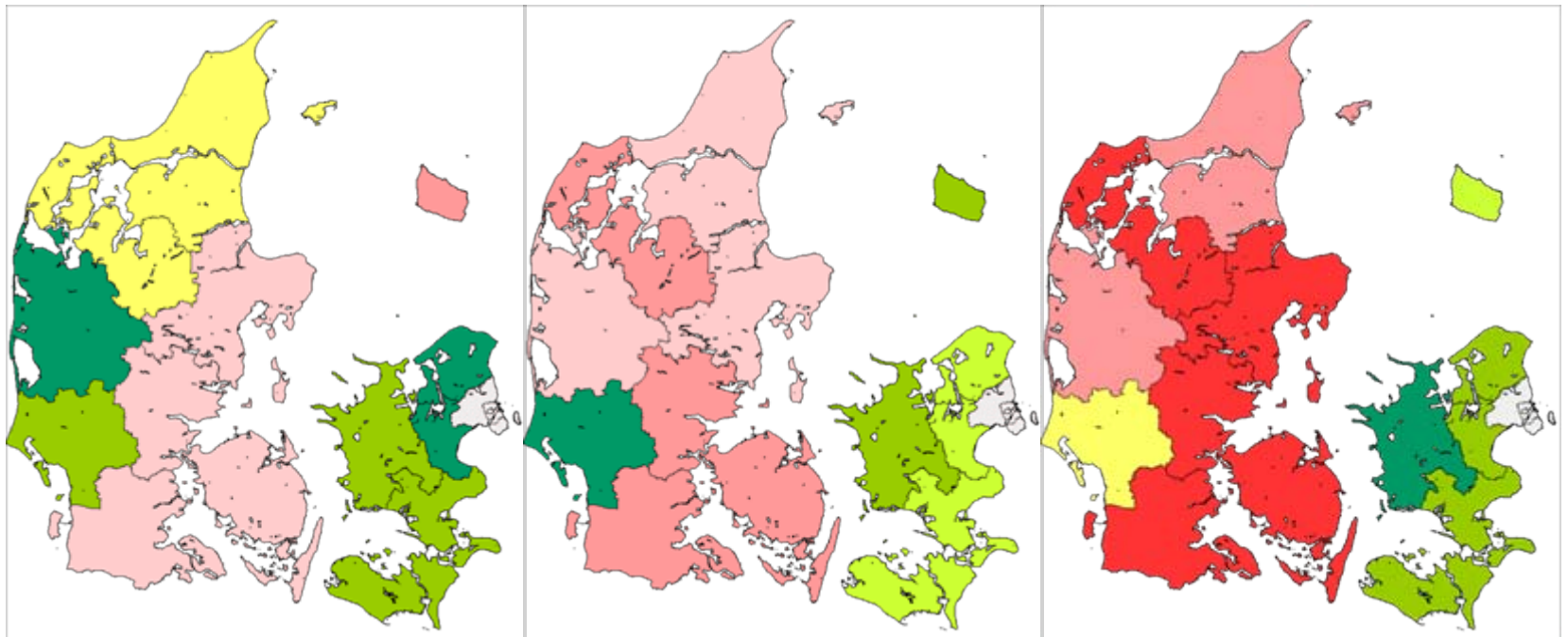
- Objectives
 - Provide a basis for research on the association between the use of antimicrobial agents and resistance
 - Provide a basis for the elimination of unnecessary and improper use of antimicrobials
 - Analysis of prescription habits
 - Tools for the veterinarians

Consumption of antimicrobials 1990-2007

DANMAP 2007



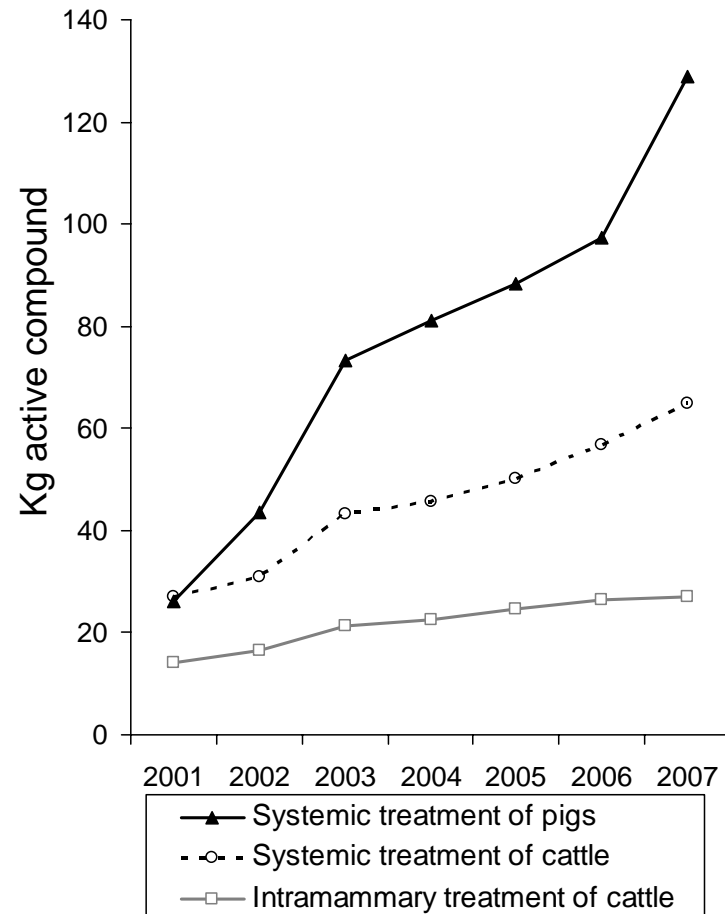
Antimicrobial consumption by county 2002-2004



DTU Fødevareinstituttet ADDkg / kg live pig / county

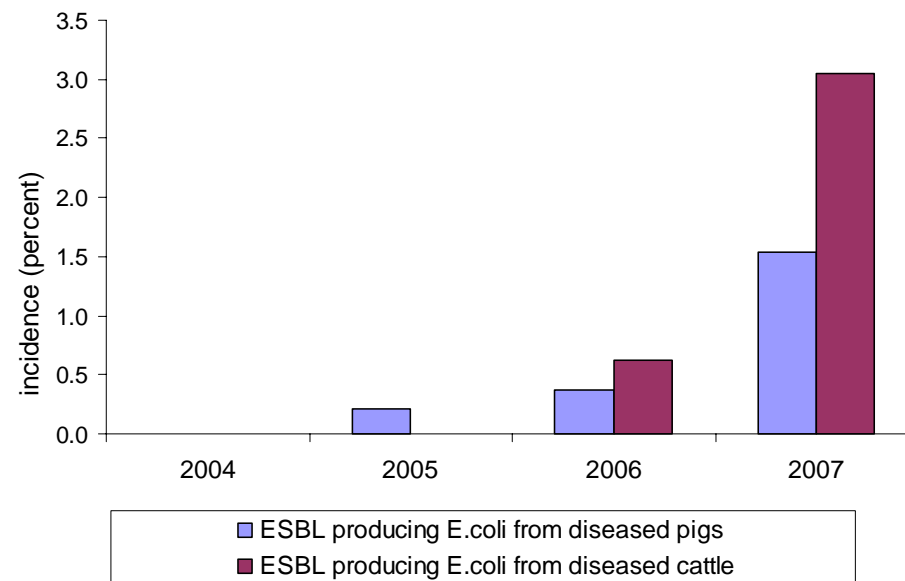
Consumption of cephalosporins in animals

- In cattle: 41 kg i 2001 and 92 kg i 2007
- In pigs: 24 kg i 2001 and 129 kg i 2007
- In pigs, 83 % is used for sows and piglets



ESBL producing bacteria from animals

- Until August 2003 ESBL producing *E. coli* and *Salmonella* from animals and food was not detected in Denmark
- The first cases of ESBL producing bacteria was found in imported food and animals
- In 2005, the first ESBL producing *E. coli* was detected in Danish animals
- In 2006, ESBL producing *E. coli* was detected in 7 cases and in 2007 it was 23 cases



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

