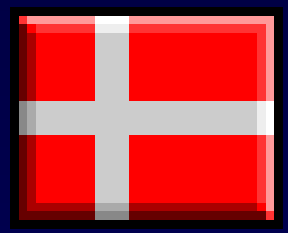
Prevalence of *Salmonella* and *Campylobacter spp.* following the discontinued use of antimicrobial growth promoters in broilers and swine in Denmark



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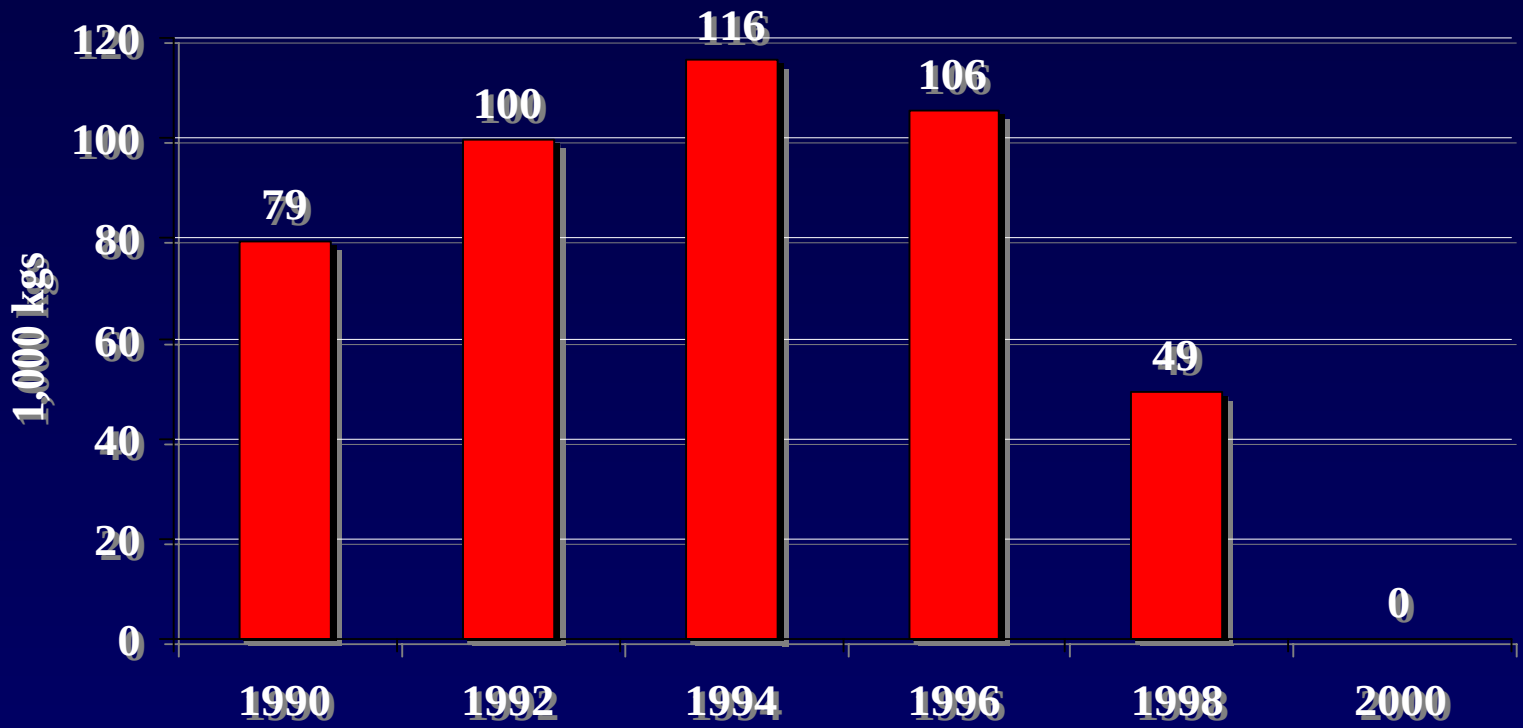
AGP usage in Denmark

- 1970’s: AGPs widely used in food production
- 1970’s: EU directive restricting use

- May 1995: Avoparcin banned in Denmark
- Jan 1998: Virginiamycin banned in Denmark

AGP usage in Denmark

- February 1998, Danish cattle and broiler industries voted to stop all use of AGP's
- Pig industry withdrew use of all AGP's in pigs >35 kg
- Remaining use of AGP's in pigs phased out during 1999



Producer Concerns

- Decreased productivity
- Increased morbidity and mortality
- Increased therapeutic consumption of antimicrobials
- Increase in *Salmonella* infected herds and contaminated meat
  - → Pathogen Load

Pathogen Load Studies

Broilers	Evangelisti et al. (1975)	*S.*Typhimurium	Oxytetracycline	<
	Holmberg et al. (1984)	*S.*Infantis	Avoparcin Monesin	< <
	Bolder et al. (1999)	*S.*Enteritidis	Flavophospholipol Salinomycin	< <
Swine	Girard et al. (1976)	*S.*Typhimurium	Oxytetracycline + Neomycin	<
	Williams et al. (1978)	*S.* Typhimurium (resistant/sensitive)	Chlortetracycline	< (sensitive)
	Ebner/Matthew (2000)	*S.*Typhimurium	Apramycin/ oxytetracycline	<

* Effect of the use of antimicrobials in food-producing animals on pathogen load: Systematic review of the published literature. October 2000. US Food and Drug Administration, Center for Veterinary Medicine.

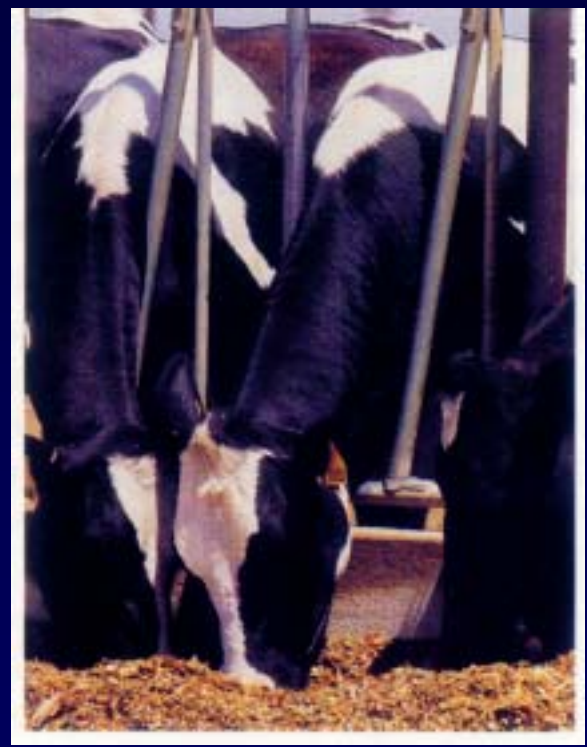
Objective

- To examine the effect of discontinued use of antimicrobial growth promoters on pathogen load in Danish food production animals
  - *Salmonella* in broilers and swine
  - *Campylobacter* in broilers

Surveillance and control programs in Denmark

Total No. of control samples > 3 million / year

- Feed compounds
  - *Salmonella* in feeding stuff
- Primary production
  - *Salmonella* and *Campylobacter* in broilers
  - *Salmonella* in layers
  - *Salmonella* in slaughter pigs
  - BSE in cattle
- Slaughterhouses
  - *Salmonella* in pork and beef
  - *Salmonella* in broilers
- Retail level
  - *Salmonella*, *Campylobacter*, *Yersinia enterocolitica*, and *E. coli* O157 in food



Sample collection

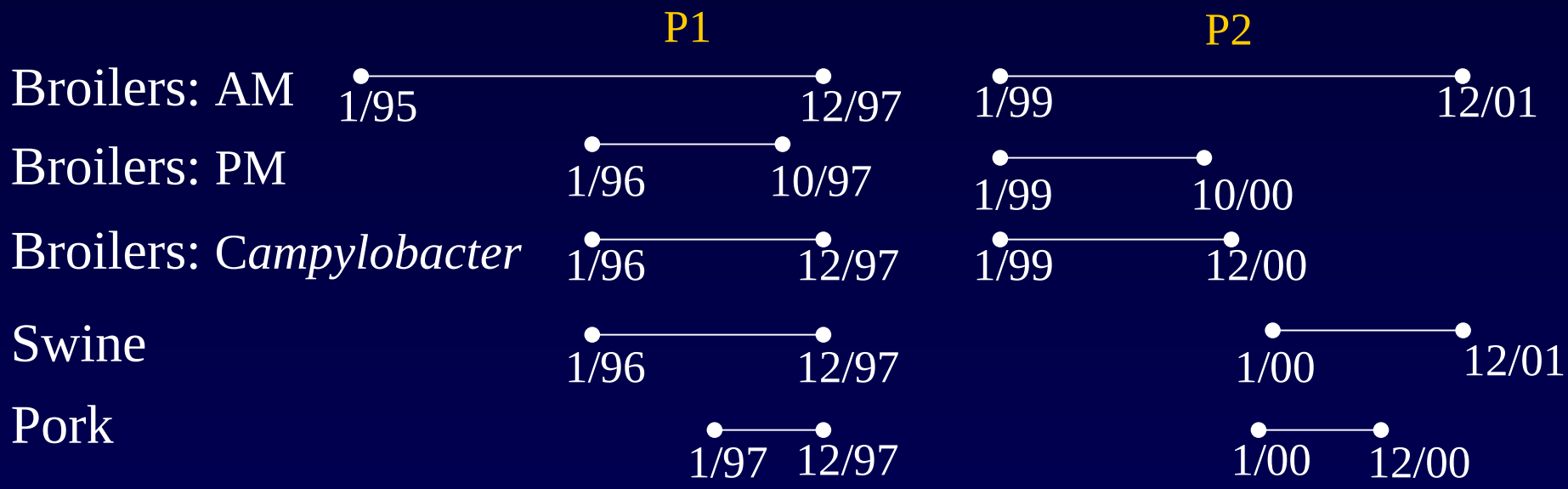
Broiler flocks

- *Salmonella:*
  - AM- sock samples 3 weeks before slaughter
  - PM- neck skin samples at slaughter
- *Campylobacter*:
  - Cloacal swab samples of 10 birds per flock at slaughter

Swineherds

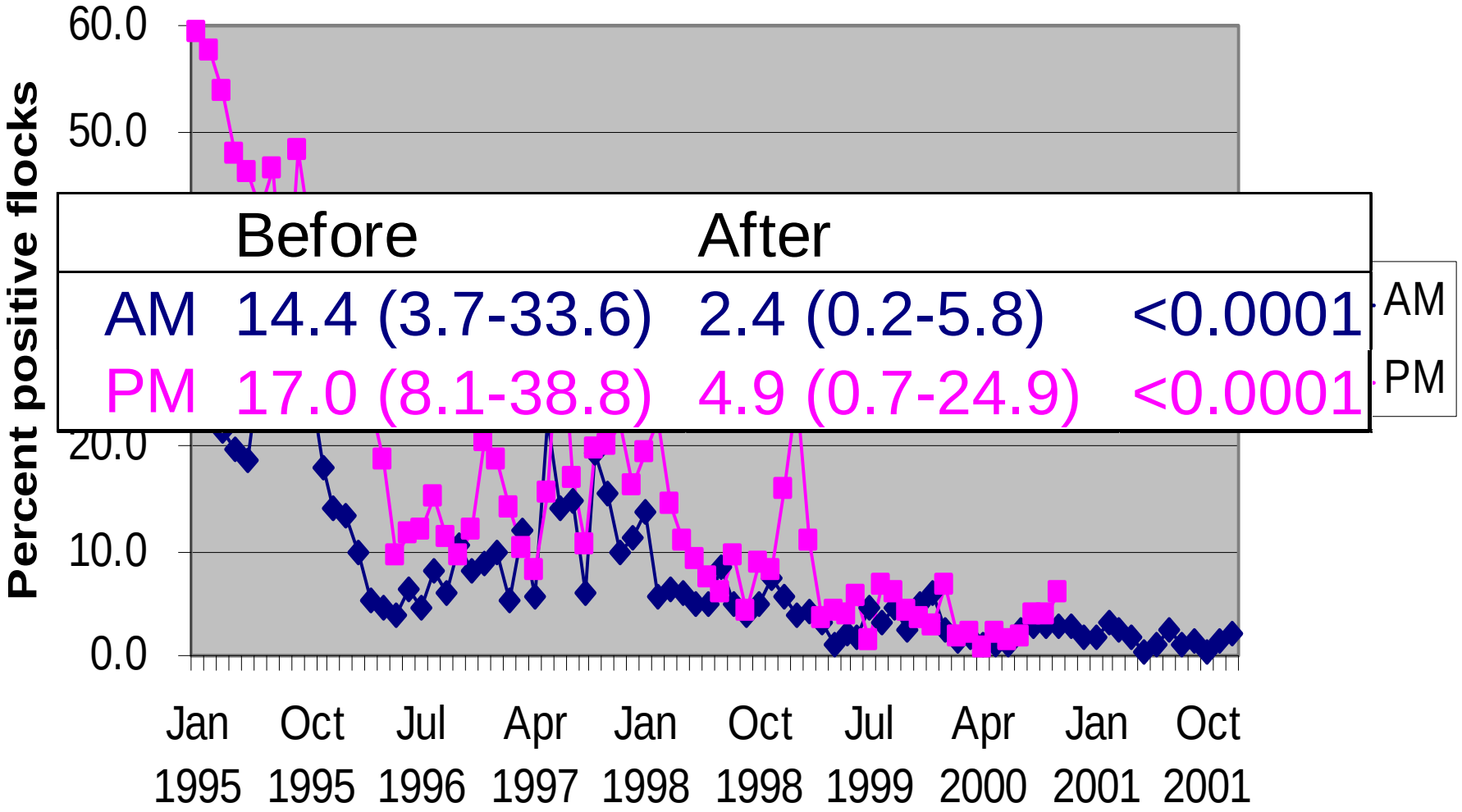
- *Salmonella*:
  - Serological test of meat juice samples
  - Monthly slaughterhouse samples

Analysis



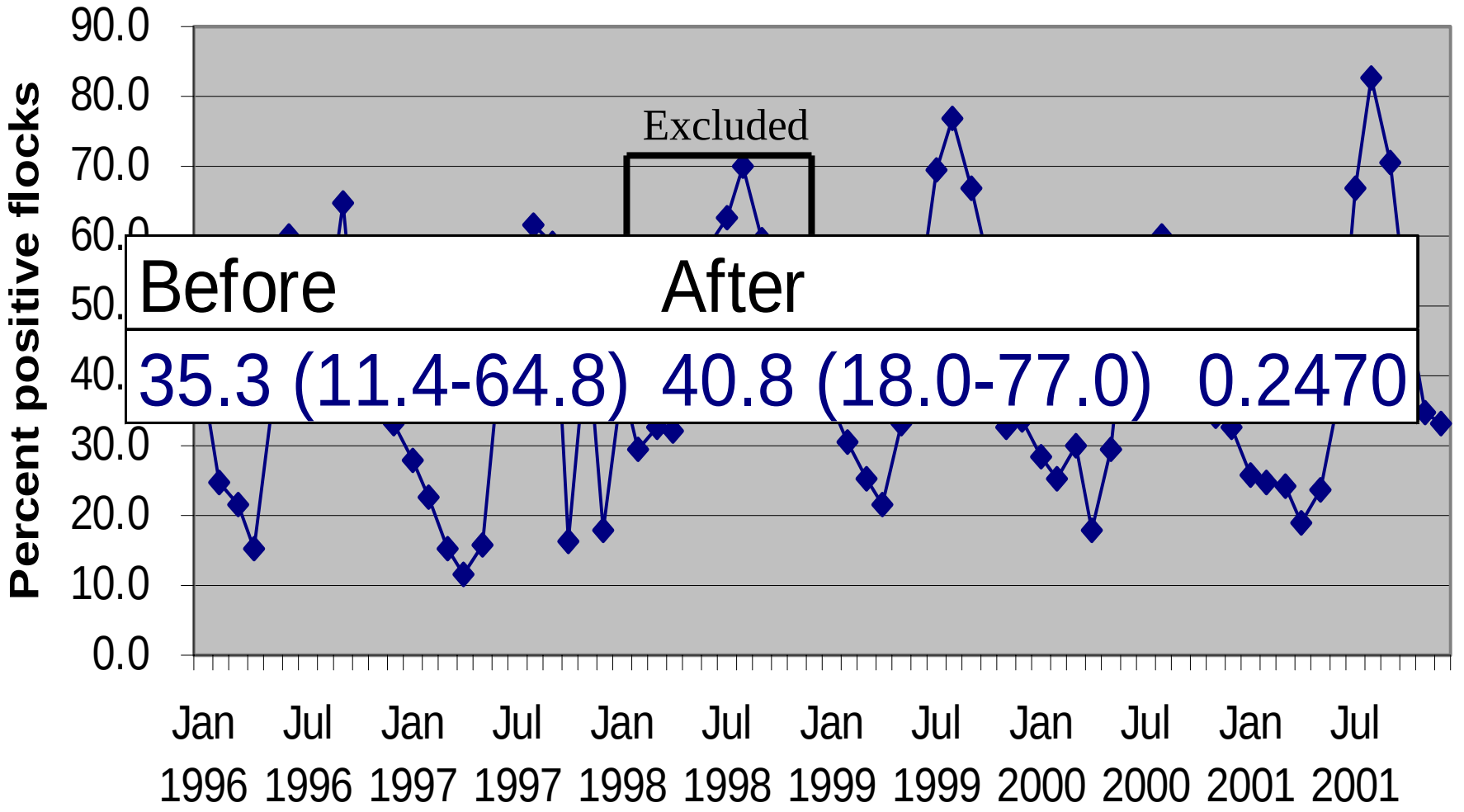
- Excluded: 1998 (broilers); 1998 and 1999 (swine)
- A t-test for comparisons of means

Salmonella in Broilers

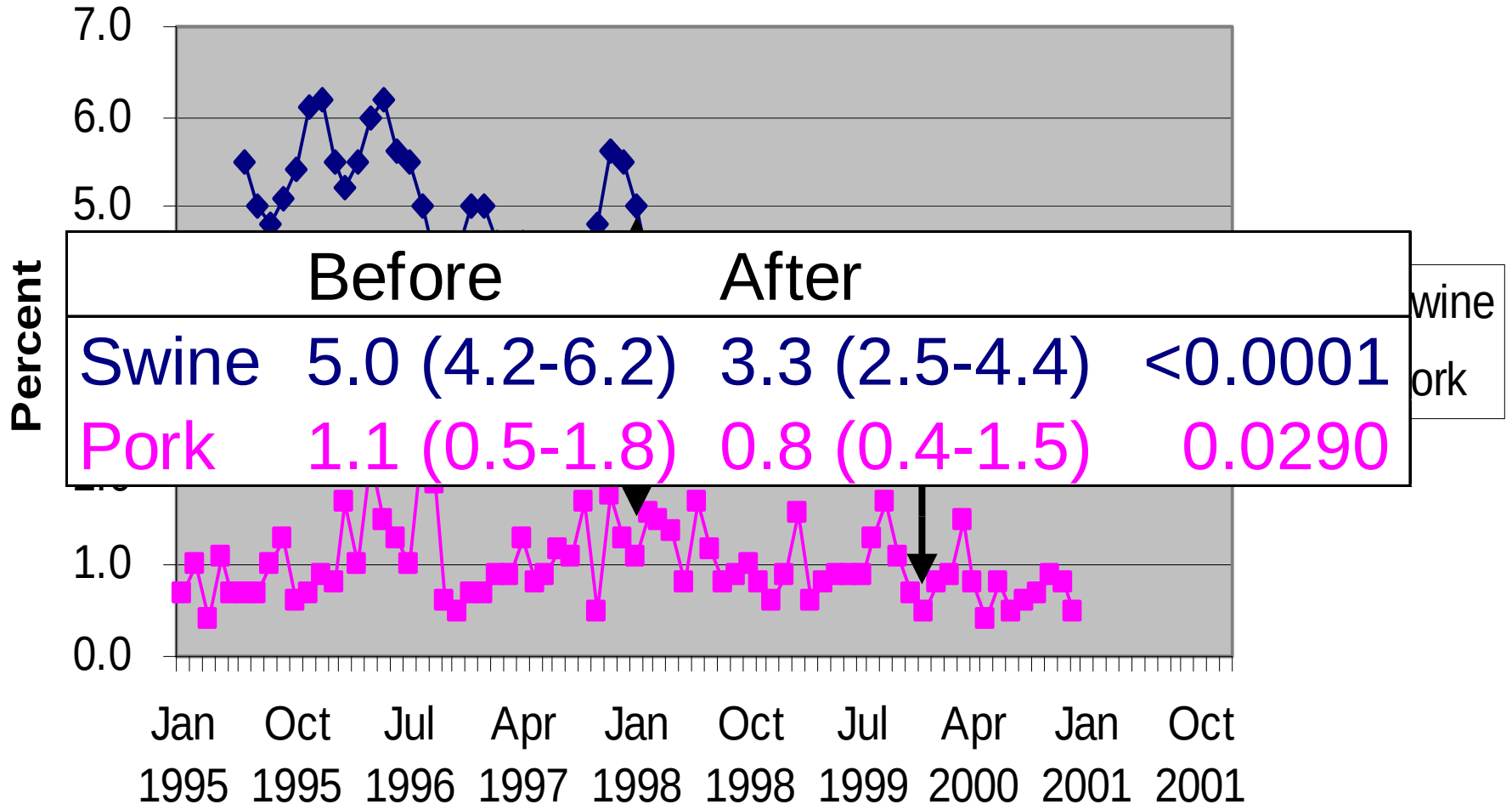


	Before	After	
AM	14.4 (3.7-33.6)	2.4 (0.2-5.8)	<0.0001
PM	17.0 (8.1-38.8)	4.9 (0.7-24.9)	<0.0001

Campylobacter in Broilers



Salmonella in Swine and Pork



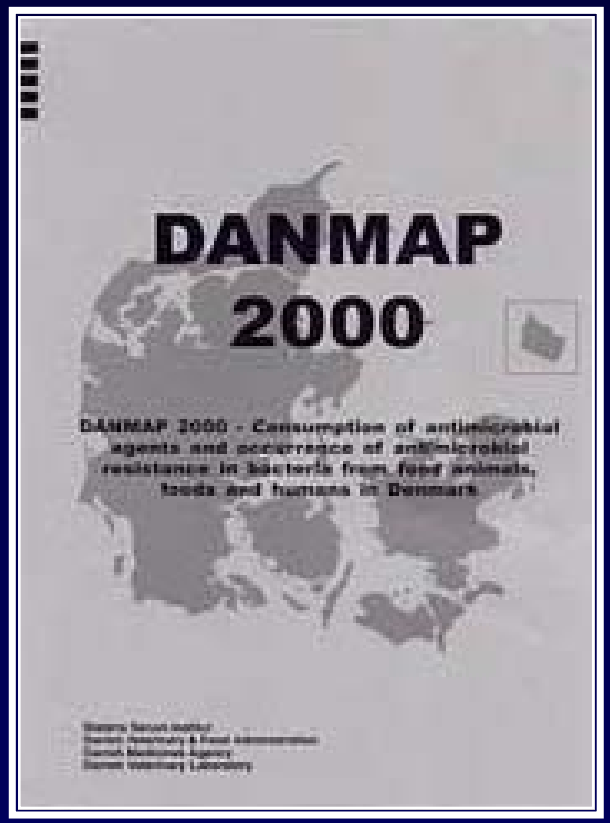
Limitations

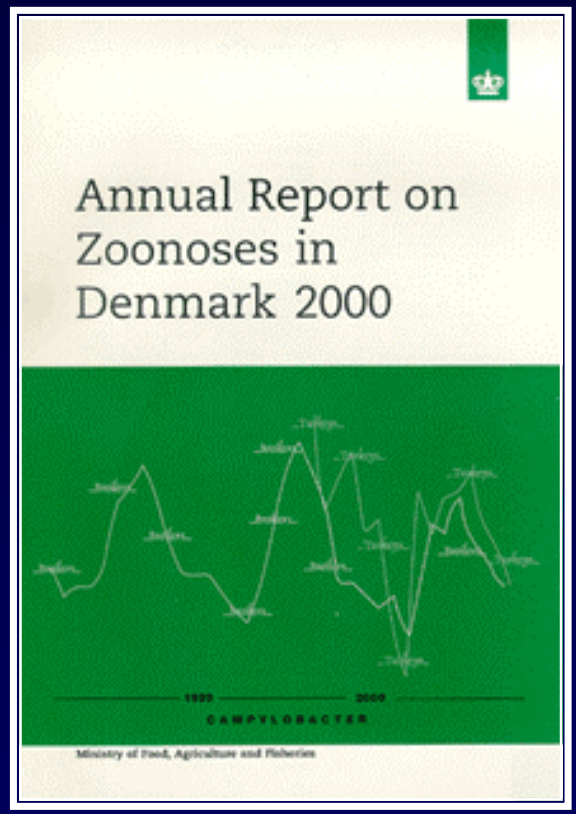
- Short time periods=small sample size
- Focuses primarily on *Salmonella spp.*
- Looks at combined effect of all antibiotics
- Does not account for other factors that might explain decreasing trend

Conclusion

- Increase in pathogen load? **NO!**
  - Decreased levels *Salmonella* in broilers and swine
  - No change in levels *Campylobacter* in broilers
- Can decreases be explained by withdrawal of AGPs? **???**
  - Likely due to control programs, but role of growth promoters cannot be discounted
- Is additional research needed? **Maybe**

More Information





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Thank you

Salmonella surveillance 1999

	No. of samples	Authority	Laboratory
Feed stuffs	7,000	PD	Private / DVL
Herds			
- Poultry			
central rearing	160,000	VFA	DVL
parent stock	480,000	VFA	DVL
hatcheries	10,000	VFA	DVL
layers	250,000	VFA	DVL
broilers	250,000	VFA	DVL
- Pigs			
breeders	36,000	Private	DVL
slaughter	800,000	VFA	DVL

Salmonella surveillance 1999

	No. of samples	Authority	Laboratory
Slaughter			
- Broilers	200,000	VFA	Private / DVL
- Pork	30,000	VFA	Private / DVL
- Beef	3,000	VFA	Private / DVL
Manufacturing and retail	20,000	VFA	MFCU / DVL
Humans	120,000	Min. Health	SSI / CML
Total	**2,375,000**		

Salmonella sampling program for poultry, 2000

	Age/time	Samples
Central rearing	Day old	10 crates + 20 chicks[1]
(broiler and table-egg)	1st week	40 chicks
	2nd week	2 pairs sock samples
	4th week	60 faecal samples[1]
	8th week	2 pairs sock samples
	2 weeks before movement	60 faecal samples + 60 blood samples[1]
Breeders (hatching-egg production)	Every 2nd week	50 chickens or meconium from 250 chickens[1]
	Every week	2 pairs sock samples
Hatchery	After each hatching	Wet dust

[1] Requirements of the EU Zoonosis Directive (92/117/EEC)

Salmonella sampling program for poultry, 2000

	Age / time	Samples
Rearing flocks	Day old	10 crates + 20 chicks[1]
(table-egg)	3rd week	10 sock samples or 300 faecal samples
	12th week	10 sock samples or 300 faecal + 60 blood
Table egg production	Every 9th week for egg packing center	2 pairs sock samples or faecal + egg samples
	Every 6 mos. for sale at barnyard	2 pairs sock samples or faecal + egg samples
Broilers	3 weeks prior to slaughter	5 pairs sock-samples
	At slaughter	5 pooled samples of 10 neck skin samples per flock

Salmonella control in broilers and table-egg producers

- Flocks testing positive for *Salmonella* under routine exam placed on suspicion of infection and re-tested
- If second set of samples positive, infected breeder and rearing flocks slaughtered and eggs to heat treatment
- More frequent (4 week) testing of non-infected layer flocks
- Cleaning/disinfection of houses prior to introduction of new flocks

Salmonella control of Danish slaughter pig herds

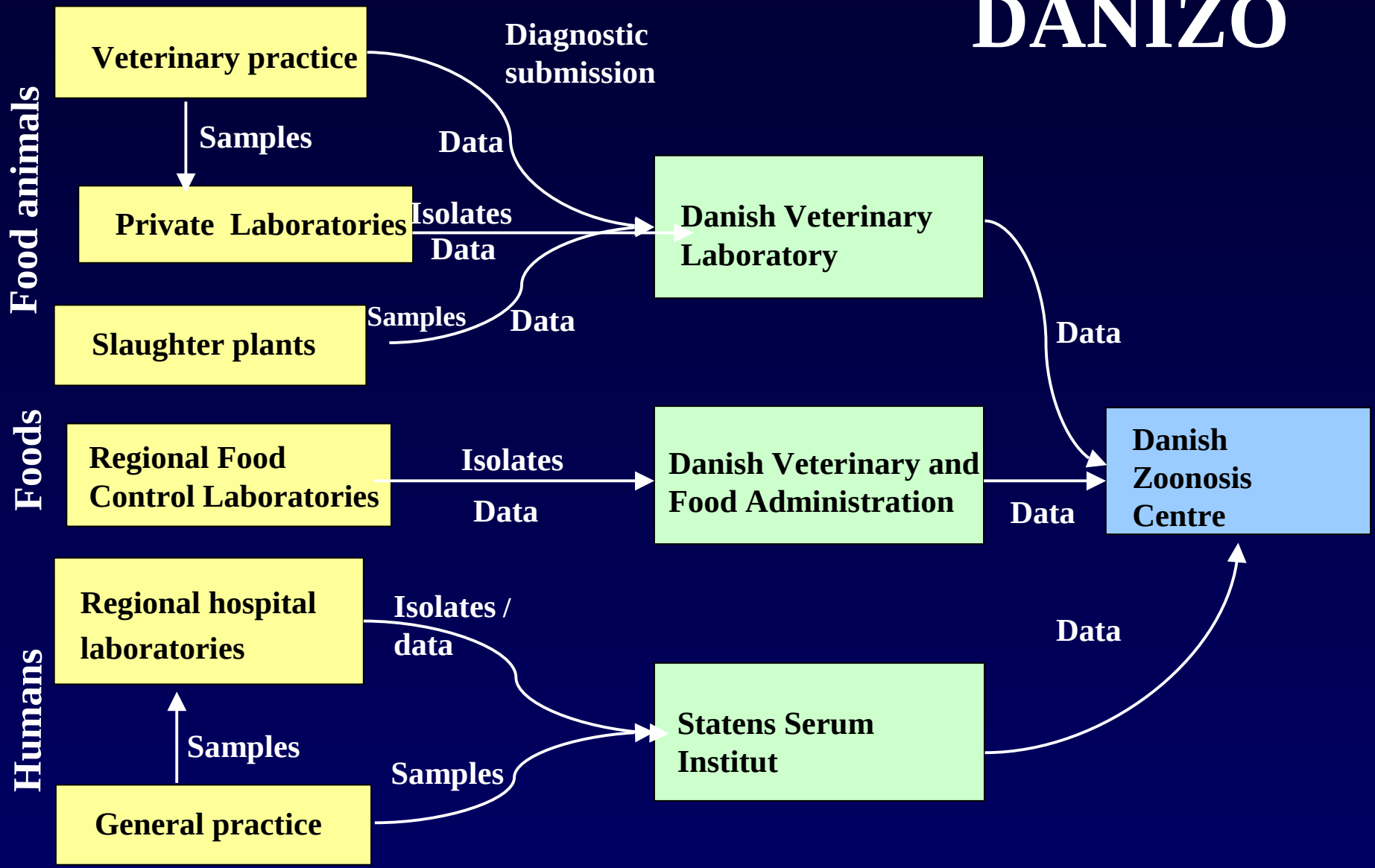
- Continuous testing of all herds producing >100 finishers per year
- Serological exam of 8-60 samples of meat juice per herd quarterly
- Diagnostic method: mix-ELISA technique, based on LPS-antigen factors (O:1,4,5,6,7,12)
- Based on the proportion of sero-reactors each herd is assigned to one of three status levels
  - Level 1: No or few sero-reacters, no intervention required
  - Level 2: Higher proportion of sero-reacters, owner seek advice
  - Level 3: High proportion sero-reacter, owner seek advice and slaughter under special hygenic precautions

Campylobacter control in poultry

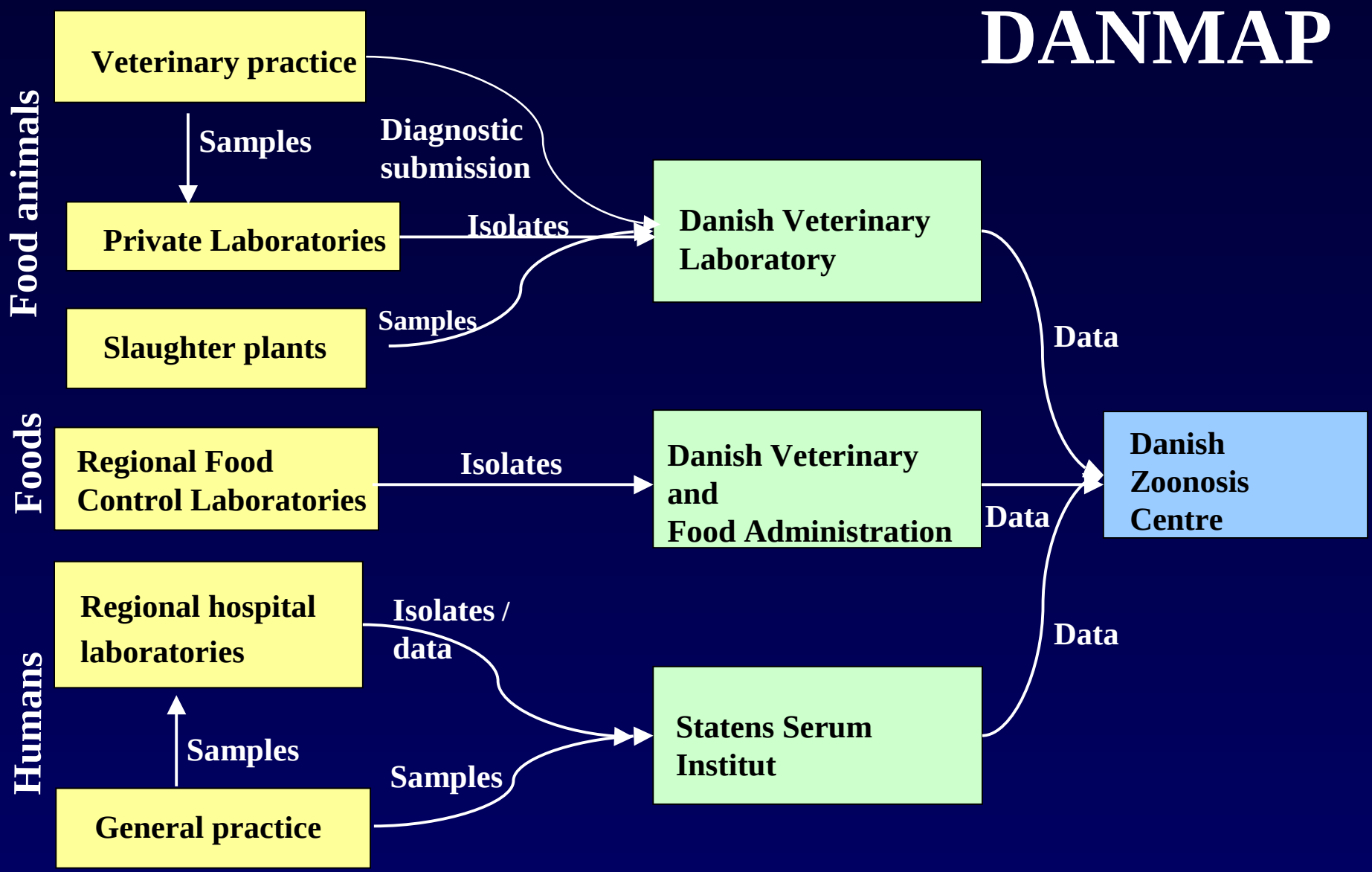
- Initiated in 1998 (broilers, hens, ducks) and 1999 (turkeys)
- Ten birds from each flock examined by cloacal swabs at slaughter

- 1998-99: special study *Campylobacter* prevalence in broilers from different production categories

Surveillance of foodborne zoonoses in Denmark



Surveillance of antimicrobial resistance Denmark



Pathogen Load Studies-Broilers*

Evangelisti et al. (1975)	*S.*Typhimurium	Oxytetracycline	<
Gustafson et al. (1981)	*S.*Typhimurium	Avoparcin Virginiamycin w/ monesin	No effect No effect
Abou Youssef et al. (1982)	*S.*Typhimurium	Virginiamycin	No effect
Holmberg et al. (1984)	*S.*Infantis	Avoparcin Monesin Avoparcin + Monesin	< < >
Hinton et al. (1986)	*Salmonella*	Monesin sodium Furazolidone Penicillin	No effect No effect >
Barrow et al. (1989)	*S.*Typhimurium Other *Salmonella*	Avoparcin	>
Bolder et al. (1999)	*S.*Enteritidis *C.jejuni*	Flavophospholipol Salinomycin	< No effect

* Effect of the use of antimicrobials in food-producing animals on pathogen load: Systematic review of the published literature. October 2000. US Food and Drug Administration, Center for Veterinary Medicine.

Pathogen Load Studies- Swine*

Bridges et al. (1952)	Total bacteria, enterobacteriacae	Penicillin Streptomycin	> No effect
Evangelisti et al. (1975)	S.Typhimurium	Oxytetracycline	No effect
DeGeeter et al. (1976)	S.Typhimurium	Lincomycin	No effect
Girard et al. (1976)	S.Typhimurium	Oxytetracycline+Neomycin	<
Williams et al. (1978)	S.Typhimuirum (resistant/sensitive)	Chlortetracycline	> resistant < sensitive
Jacks et al. (1988)	S.Typhimurium	Efrotomycin	No effect
Ebner/Matthew (2000)	S.Typhimurium	Ceftiofur sodium/oxytetracycline Apramycin/oxytetracycline Carbadox/oxytetracycline	No effect < No effect

* Effect of the use of antimicrobials in food-producing animals on pathogen load: Systematic review of the published literature. October 2000. US Food and Drug Administration, Center for Veterinary Medicine.