

What we know on the relation between use of antimicrobials and resistance

Christina Greko, Strama VL
Department of Animal health and antimicrobial strategies



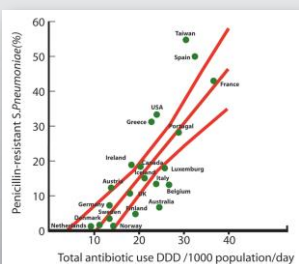
Is there a relation?

YES

But it is complex...



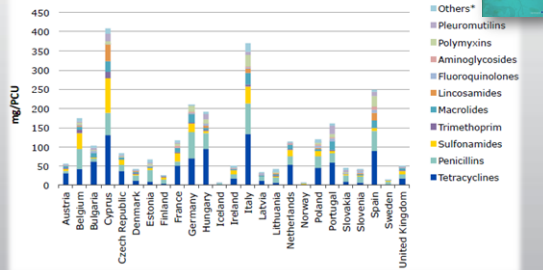
Correlations – use of antimicrobials and penicillin-resistance in pneumococci (humans)



Riedel et al Eur J Clin Microbiol Infect Dis, 26:485-



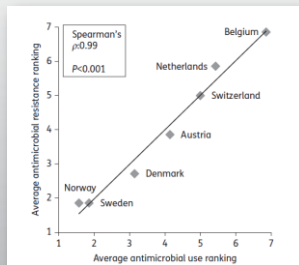
Sales of antimicrobials for production animals in mg/PCU (estimated live bodyweight)



ESVAC 3rd report, 2013. Data for 2011
www.ema.europa.eu



Ranking – overall use and overall resistance



Correlation between veterinary antimicrobial use and antimicrobial resistance in food-producing animals: a report on seven countries

Bios Chantziaras¹, Filip Boyer¹, Bénédicte Callens¹ and Jeroen Dewulf²

Chantziaras et al 2014 J Antimicrob Chemother 2014 69: 827-834



Causality?

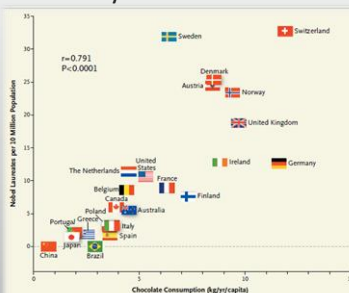


Figure 1. Correlation between Countries' Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population.

Messerli F, 2012, New England J Med 367:16-

Correlation

- Chocolate consumption
- No of Nobel prizes per 10 M pop.



Experimental evidence

- Mice given enterococci resistant to vancomycin and streptomycin
- One group treated with **vancomycin**
- Difference day 14 and 21

Day	Positive/Total number	
	Untreated	Treated
0	0/10	9/9
7	10/10	9/9
14	0/10	9/9
21	3/10	9/9

Whitman et al, 1996, Antimicrob Agents Chemother 40:1526-



Experimental evidence – co-selection

- Mice given enterococci resistant to vancomycin and streptomycin
- One group treated with **streptomycin**
- Difference day 14 and 21

Day	Positive/Total number	
	Untreated	Treated
0	0/10	9/9
7	10/10	9/9
14	0/10	9/9
21	3/10	9/9

Whitman et al, 1996, Antimicrob Agents Chemother 40:1526-



Observational evidence – vancomycin resistant enterococci

- Broiler flocks with or without avoparcin in feed
- Difference btw groups (p= 0.0006)

	Pos	Neg	Total
Avoparcin	11	1	12
No avoparcin	2	12	13

Bager et al 1997, Prev vet med 31: 95-



Observational evidence - co-selection (?)

County wide reduction of use of trimethoprim, human beings, SE

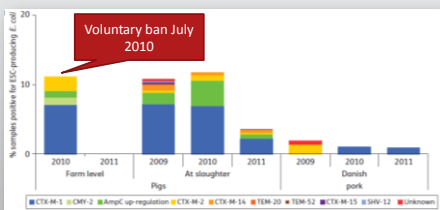
- 2 years
- 88% reduction of trim. consumption
- But - no overall reduction
- E coli*: no change in trim-R
- ...but modelling predicted halted increase
- Trim-R isolates also R to other antimicrobials

Sundqvist et al, 2010, J Antimicrob Chemother 65:350-



Before – after

E coli producing ESBL or pAmpC (resistance to cephalosporins) in pigs, DK



Voluntary ban on cephalosporin use in Danish pig production has effectively reduced extended-spectrum cephalosporinase-producing *Escherichia coli* in slaughter pigs

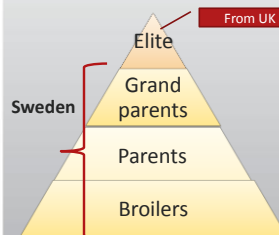
Yvonne Agerholm and Frank M. Aarestrup

Agerholm & Aarestrup 2013, J Antimicrob Chemother 68:569-



But in the absence of use....

Swedish broiler production: very low use of antimicrobials 1 broiler flock/2853 treated in 2012



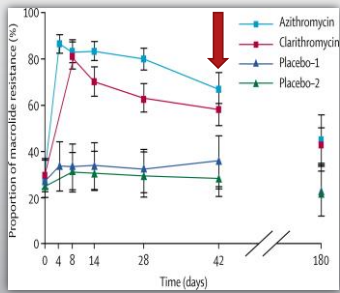
2010: 34% broilers ESBL & pAmpC-positive

Day old GP-chicks positive

SWEDRES-SVARM 2012 www.sva.se



Type of drug – long acting vs not

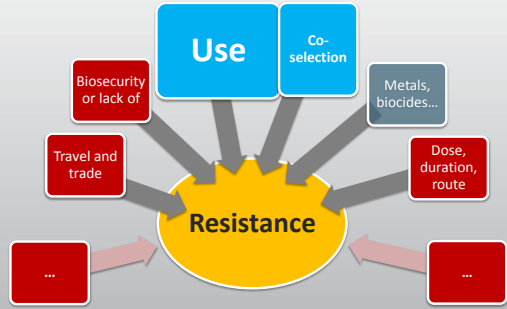


Resistance to macrolides in oral streptococci of humans

Malhotra-Kumar et al, 2007, Lancet 369:482-



"Confounders"



What we know

- There is a relation
- But it is complex
- Use & spread



Photos: SVA and C Greko

