



Resistance in farm animals: implications for animal and public health

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Some current issues in farm animal veterinary medicine

- Resistance in animal pathogens
- ESBL resistance in bacteria particularly from poultry
- MRSA particularly in pigs

Resistance in farm animal pathogens

- For most bacterial infections, current therapeutic options are usually adequate
- Exception is swine dysentery
- Salmonella- concerns about spread of multi-resistant *Salmonella* spp (multi-resistant *Salmonella* Newport, monophasic *Salmonella*)

Swine Dysentery

- Caused by *Brachyspira hyodysenteriae*
- Limited treatment options
- Multi-resistant strains
- Resistance develops by mutation
- 70 GB isolates 2006-2009 - both tiamulin resistant isolates also resistant to all other antimicrobials tested and high MIC values to valnemulin



ESBL resistance in poultry isolates

- Screening of diagnostic isolates carried out at VLA
- Few reports of disease due to ESBL-producing bacteria in farmed animals from Europe.
- In mainland Europe, highest prevalence of cephalosporin resistance in indicator *E. coli* is in chickens

Cefotaxime resistance in indicator *E. coli* from chickens in 2008

Country	% resistant
Denmark	0
Finland	1
Austria	3
France	6
The Netherlands	15
Spain	30

Is ESBL production in commensal *E. coli* important

- Potential source of ESBL genes to animal pathogens
- Potential source of ESBL genes to *Salmonella spp.*

ESBL producing *Salmonella*

- In mainland Europe since 2001, ESBL-producing *Salmonella* mainly isolated from poultry
- *Salmonella* Java (The Netherlands) 0% (1999)→29% (2007) cefotaxime resistance, mainly due to increase in CTX-M-1
- *Salmonella* Virchow (Belgium) 0% (1999)→18% (2003) cephalosporin resistance
- Some ESBL-producers have caused disease in people (*Salmonella* Virchow, *Salmonella* Infantis)

Bertrand et al 2006 J Clin Micro 44 2897-2903; Cloeckeaert et al 2007 Antimicrob Agents Chemother 51 1872-1875; MARAN 2007

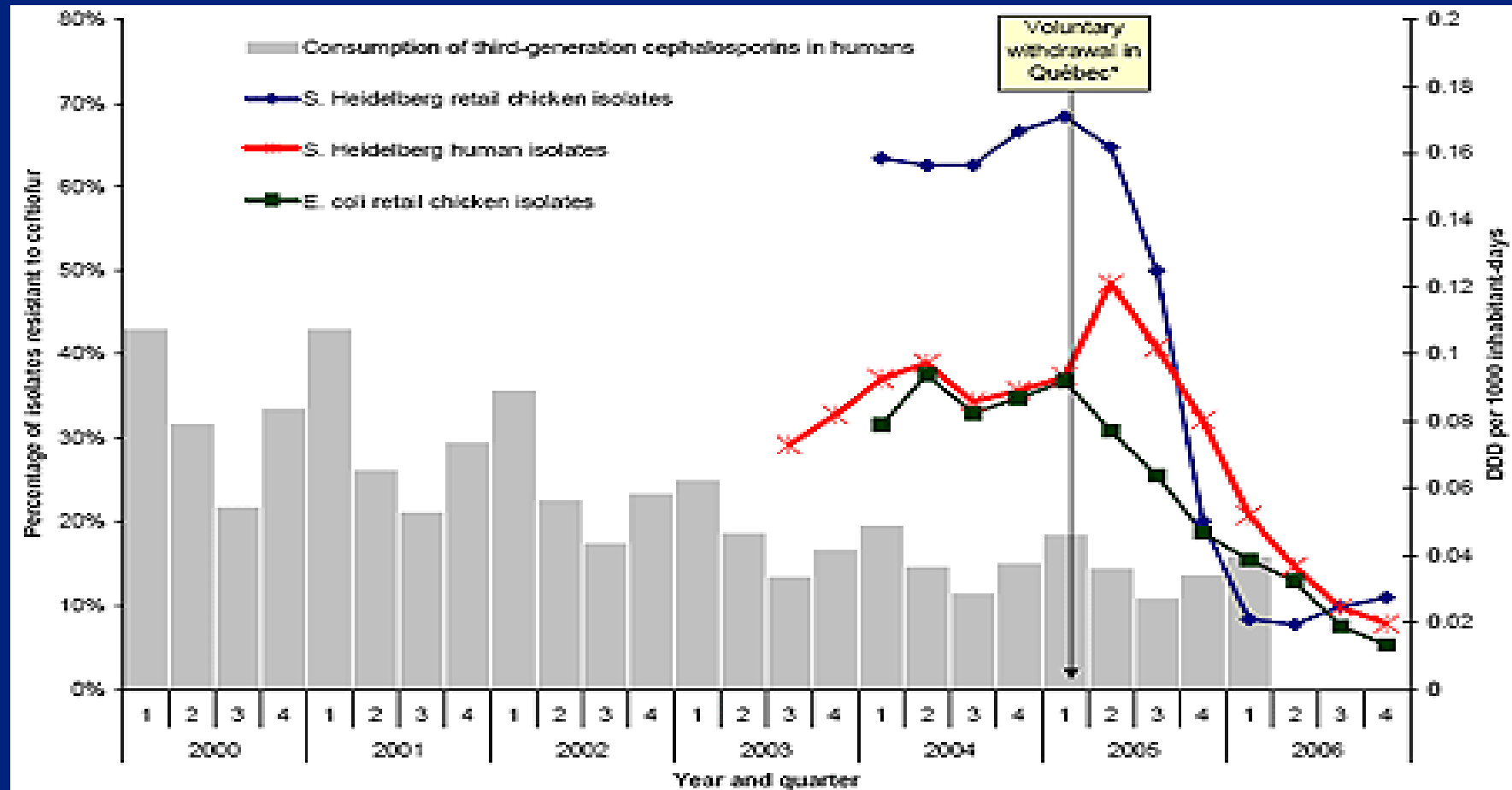
Resistance to cefotaxime in *Salmonella* from chickens in 2008

Country	% resistant
Belgium	1
France	1
Italy	12
The Netherlands	13
Spain	1

Nine other countries reported 0% cefotaxime resistance in *Salmonella* species. Differences may be due to differences in serotypes and phage types between countries and years

Why the increase in cephalosporin resistance in *E. coli* and *Salmonella*?

- In EU, 3rd and 4th generation cephalosporins licensed for use in pigs and cattle only.
- Ceftiofur may be used off label in chicks in hatcheries
- suggested high prevalence in The Netherlands due to off label use in hatcheries
- Similar problems in Quebec with AmpC producing *E. coli* and *Salmonella*



Is ESBL production in commensal *E. coli* important?

- Potential source of ESBL genes to animal pathogens
- Potential source of ESBL genes to *Salmonella* spp.
- Potential role of food as a contributor to the overall burden of ESBL *E. coli* in people is ill-defined and may vary between countries

ESBL *E. coli* in meat

- Countries with high prevalence of ESBL *E. coli* in broiler chickens tend to have a high prevalence in chicken meat (and vice-versa).
- Possible link between isolates in poultry and people (CTX-M-1; The Netherlands) (TEM-52; Belgium).
- Low prevalence of quinolone-resistant ESBL-producing *E. coli* in UK-produced chicken meat
- CTX-M Group 2, 8 and 9 were predominant in *E. coli* from imported broiler meat

GB studies- ESBL *E. coli* in poultry 2006-2009

- 2 representative surveys
- 3.6% of broiler caecal samples positive- CTX-M-1 (78%), also CTX-M-3 and -15 (11%). TEM-52 also detected
- 0.6% of *E. coli* from non-selective plates from broiler chickens resistant to cefotaxime
- 5.2% of turkey fattening farms and 6.9% of turkey breeding farms positive, mainly CTX-M-1, CTX-M-14 also CTX-M-15 (13.8%) and -55

Randall et al 2011 JAC 66 86-95

Conclusions of GB poultry ESBL study

- Chickens and turkeys in GB carry *E.coli* with CTX-M and TEM-52 ESBLs
- CTX-M isolates are not those currently circulating in people (on basis of MLST data)
- There are some common plasmid and CTX-M types
- The human pandemic clone CTX-M-15 025 ST-131 was not detected

MRSA in animals

- First reported from cows 1972 (Belgium)
- Companion animals (human genotypes)
- 2005 - Pigs and pig farmers in The Netherlands (primarily ST398)

MRSA ST398 (Livestock Associated MRSA)

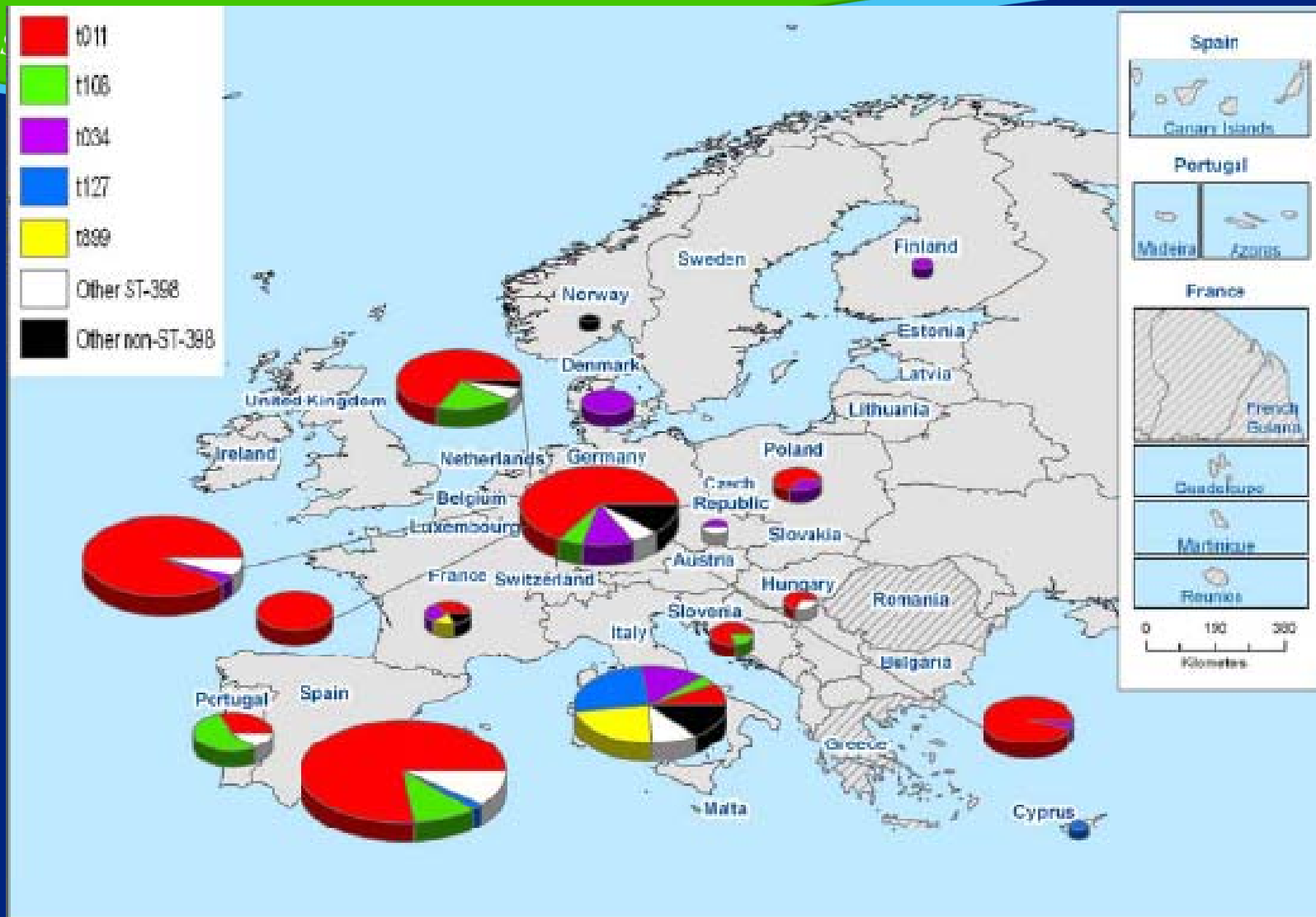
- Predominant strain in pigs (Europe, North America)
- Panton-Valentine Leukocidin (PVL) absent
- Disease in people and pigs rare
- Can be an occupational risk for people exposed to colonised animals

European baseline MRSA study- breeding pigs

- 24 EU Member States, Norway, Switzerland
- 5 environmental dust samples per farm pooled and tested
- Enrichment broth, then selective broth, then MRSA selective media

Results

- 7 EU Member States (including UK) did not detect MRSA in pigs
- Overall EU holding prevalence 22.8% (95% CI 21.0-24.7%)
- Higher prevalence in production than breeding holdings



Distribution of spa types of MRSA in environmental dust samples collected from production holdings with breeding pigs in EU, Norway and Switzerland 2008

Conclusions

- Risk of being infected with MRSA increased with herd size, varied with country
- Spa type varied with country
- Strong association between prevalence of MRSA on holdings with breeding pigs and volume of imported breeding pigs
- PVL toxin genes not detected in non-ST398 MRSA isolates

Implications for human health

- No evidence of increased risk of MRSA infection from consumption or handling of meat
- LA-MRSA may add to MRSA in healthcare setting
- Non-ST398 MRSA from pigs may pose an occupational risk

Summary

- MRSA in pigs and ESBLs in poultry- situation in UK production currently appears relatively favourable
- Potential for change (usage, spread of resistant organisms and genes)
- Risk factors not fully understood
- New resistance mechanisms

Acknowledgements

- Colleagues in Bacteriology, VLA Weybridge and VLA Regional Laboratories

- Defra