



Antimicrobial Resistance In *Salmonella enterica* In Portugal: An Overview On Long-term Surveillance (2009-2017)

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SALMONELLA NATIONAL CONTROL PLANS

CD 652/2013

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Overview of the results obtained in Portugal during the period 2009-2017

- The most common *Salmonella enterica* serotypes and phenotypic characterization of the strains isolated from poultry, swine breeders, food and carcase swabs and feed, regarding susceptibility to antibiotics
- Molecular and genomic characterization of strains resistant to critically important antibiotics in human and veterinary medicine and the identification of mobile genetic elements involved in resistance dissemination



DATA OVERVIEW (2009-2017)

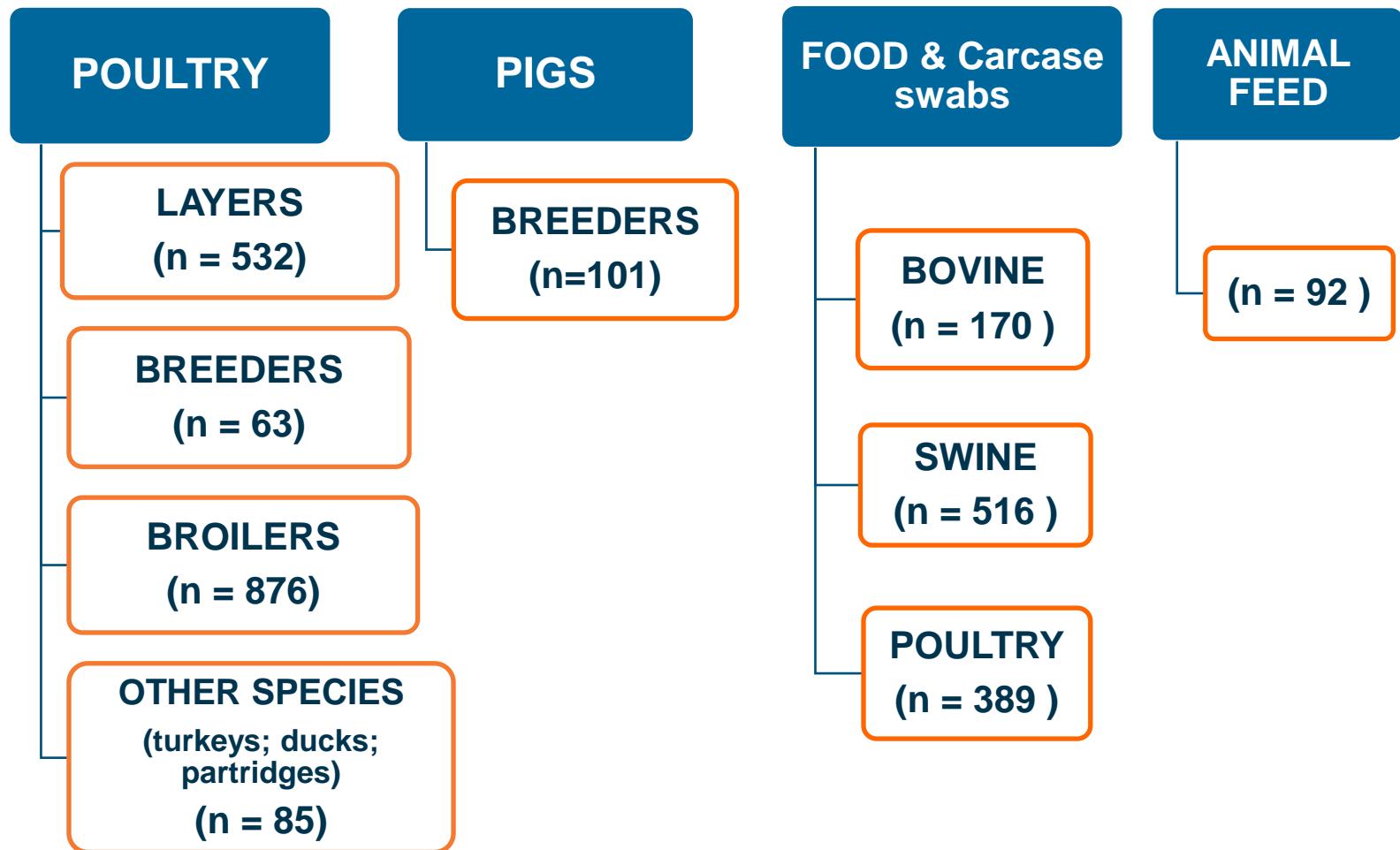
Sampling at poultry farms, feed mills, processing plants and retail stores

- Competent authorities
- Industry sampling by Food Business Operators (FBOp) - HACCP & own checks

TOTAL Nº ISOLATES: 2824

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STRATEGY

Isolation

Serotyping

Phenotyping

Genotyping

ISO 6579

Kauffman and White scheme

MIC determination
ECOFFs -EUCAST

ESBL/PMA β
(bla_{ESBL}; bla_{PMA β})

PMCR
(mcr-1 to mcr-5)

Whole Genome Sequencing (WGS)

PMQR
qnrA; qnrB; qnrD;
qnrS; oqxAB; qepA;
aac(6')-Ib-cr

CGE webtools
ResFinder
PlasmidFinder
Pathogen Finder

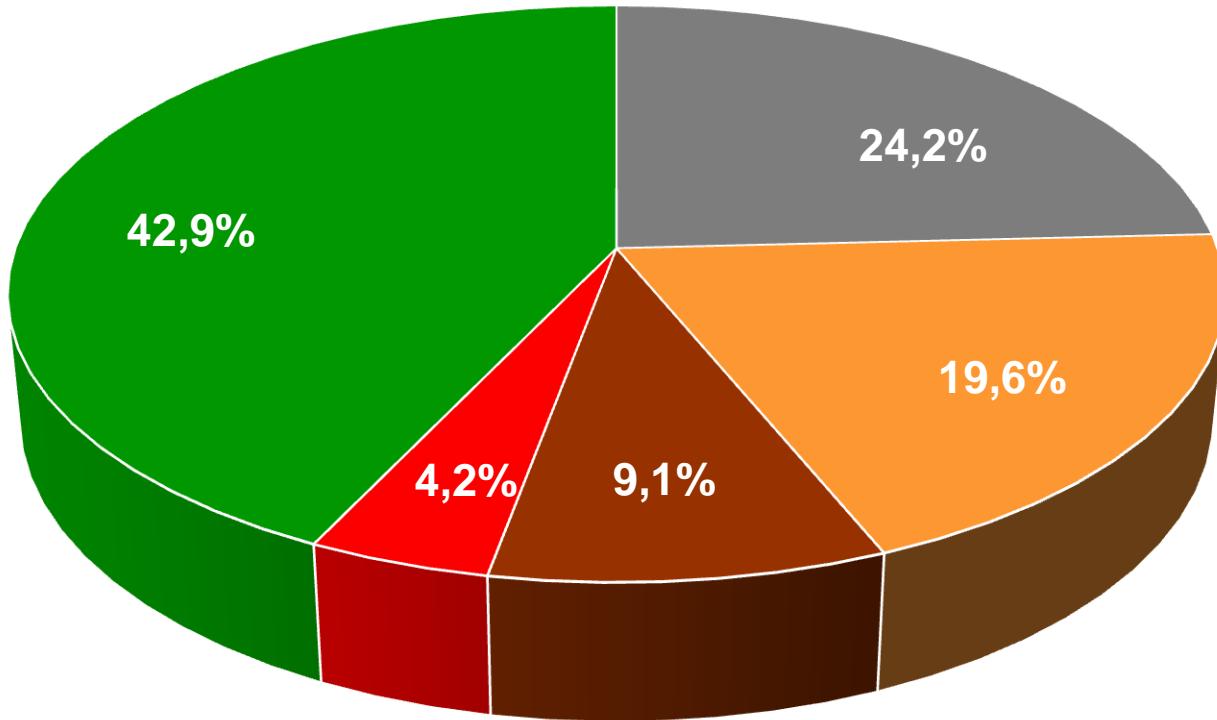
MGE
Integrons (Class 1, 2 & 3)
Plasmids



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ISOLATES (n = 1556)

SEROTYPES (n = 70)



- Enteritidis
- Mbandaka
- Other serotypes (n=66)

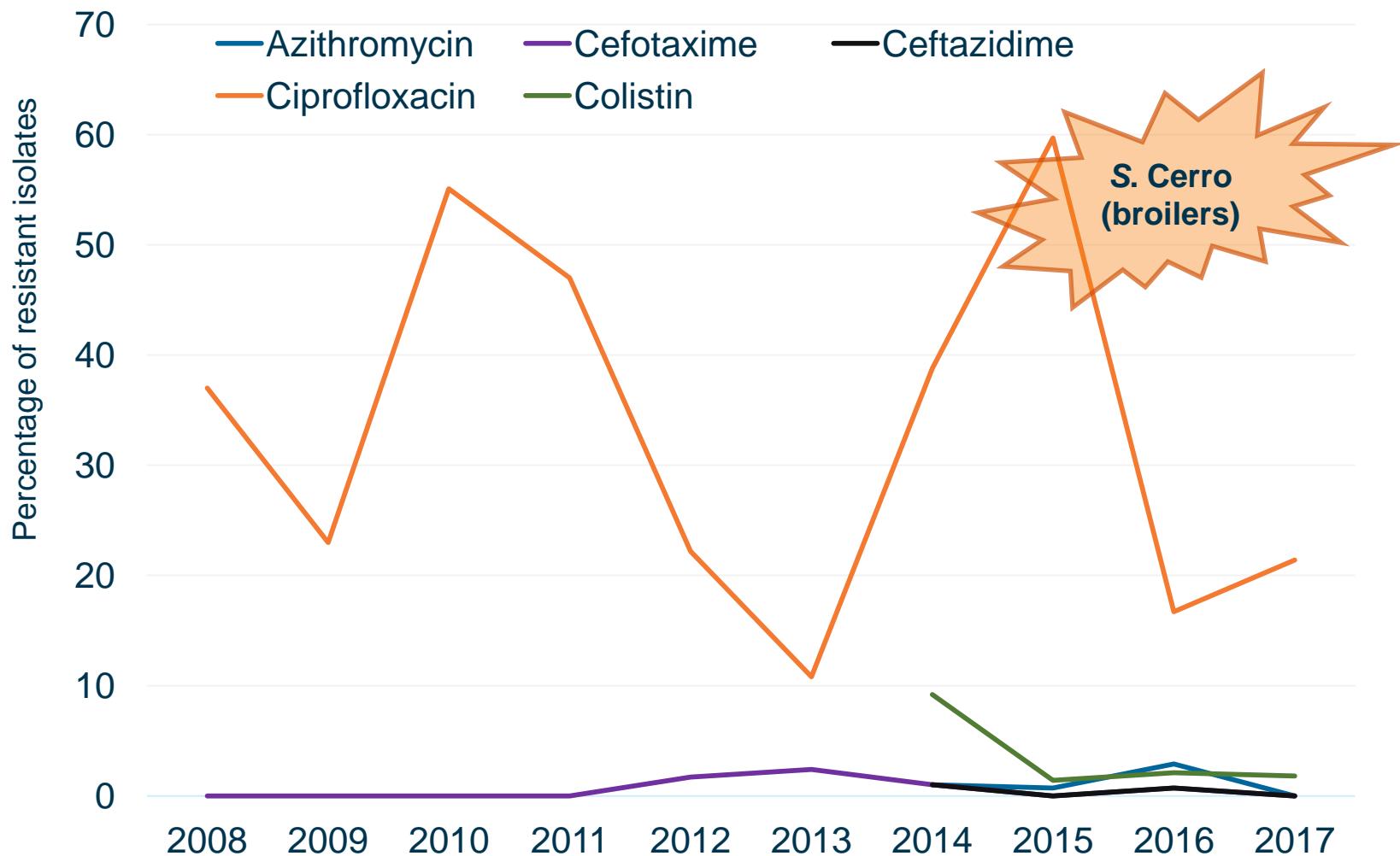
- Havana
- Typhimurium



CRITICALLY IMPORTANT ANTIMICROBIALS

AMR

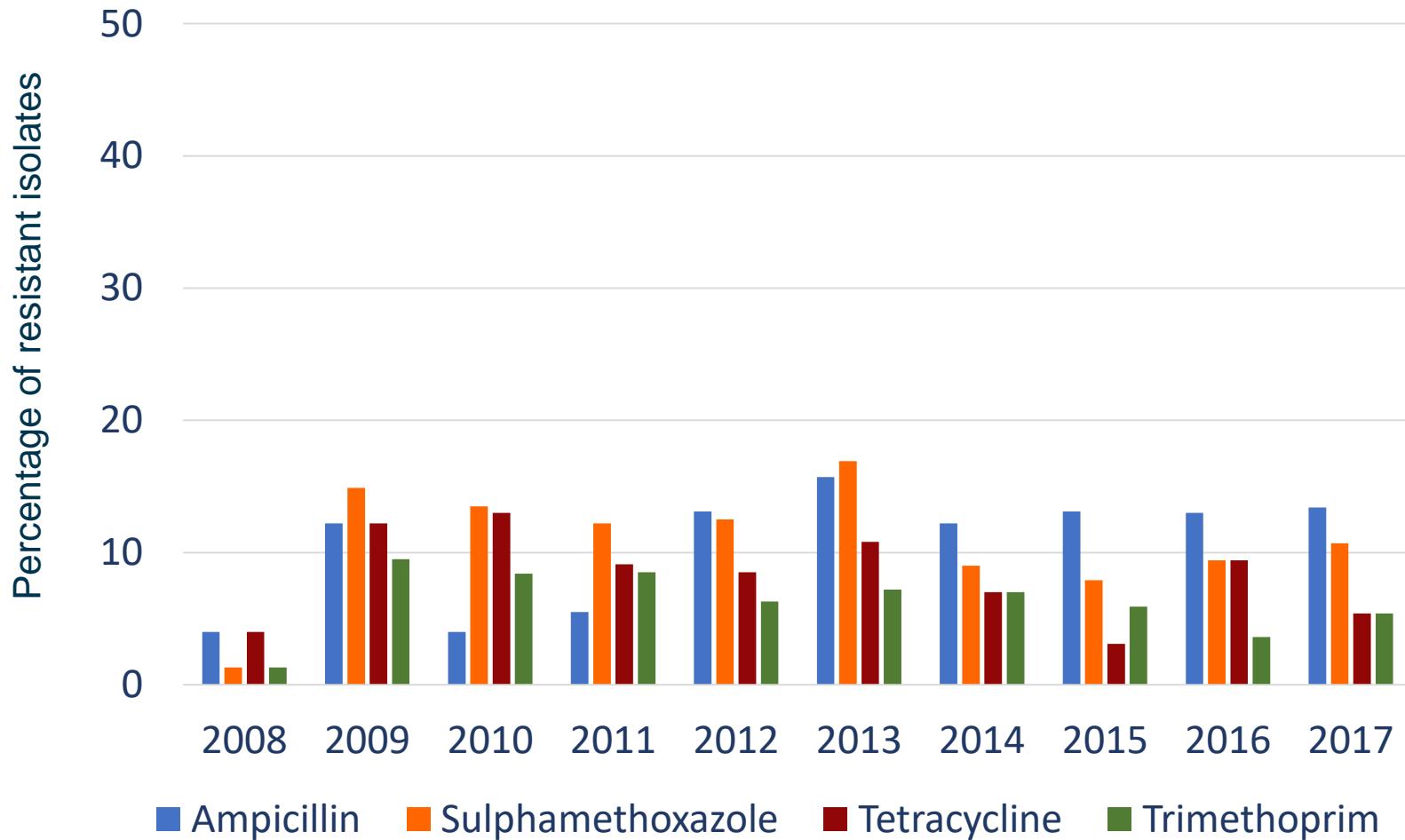
P O U L T R Y





IMPORTANT ANTIMICROBIALS

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POULTRY

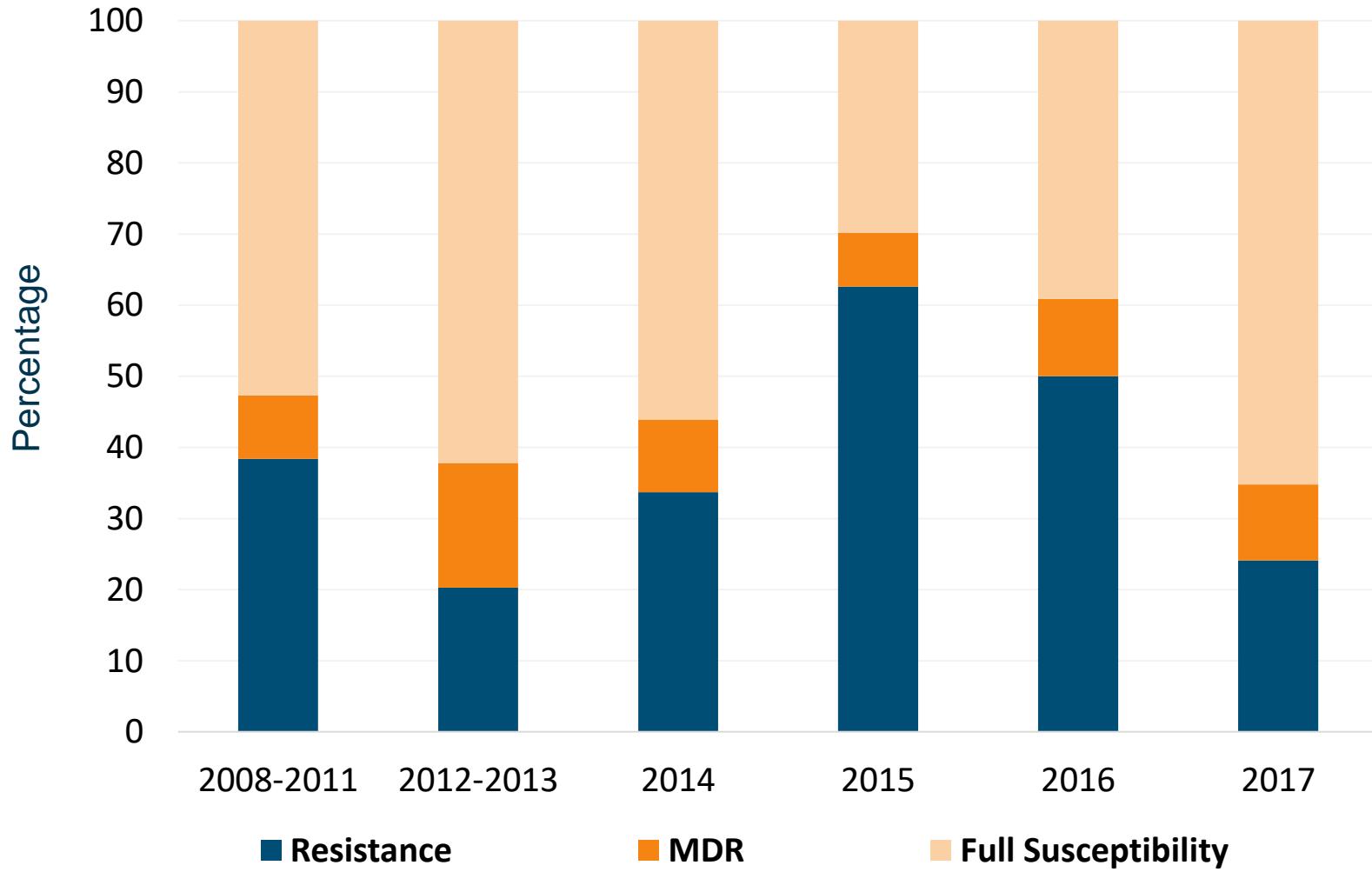




AMR

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RESISTANCE VERSUS FULL SUSCEPTIBILITY



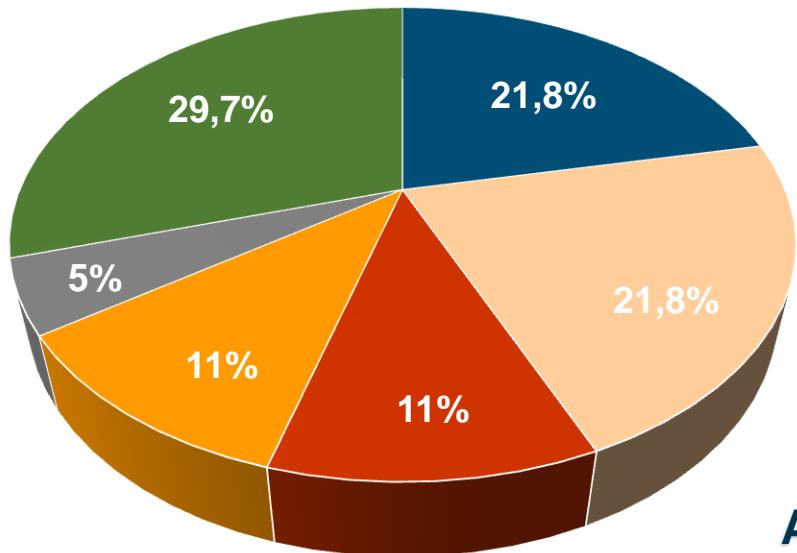


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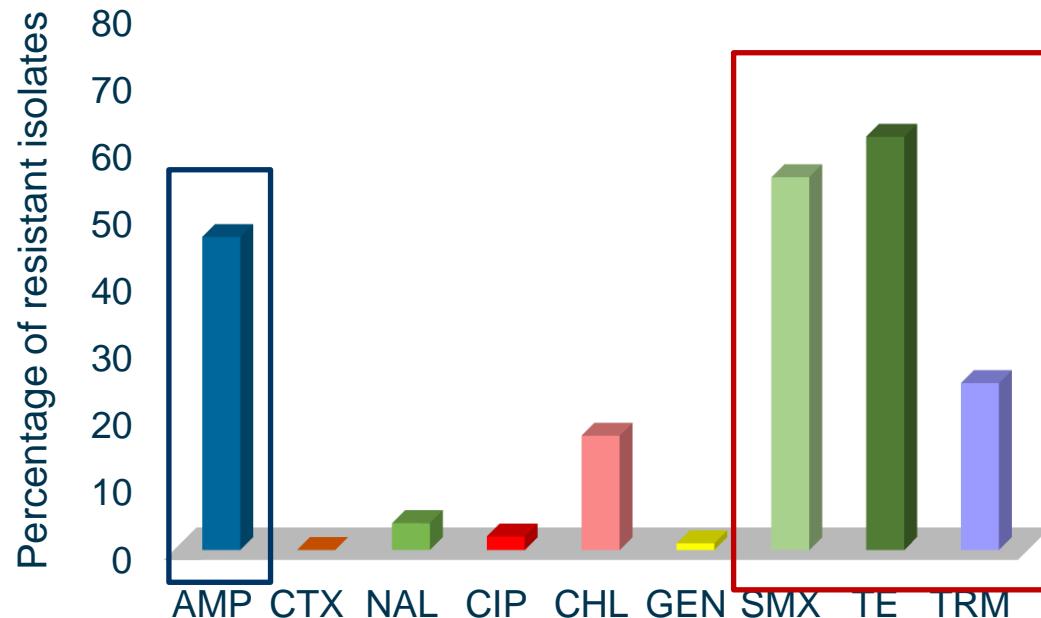
ISOLATES (n = 101)



SEROTYPES (n = 18)

- Rissen
- Typhimurium
- Derby
- London
- I 4,[5],12:i:-
- Other serotypes (n=13)

ANTIMICROBIAL RESISTANCE



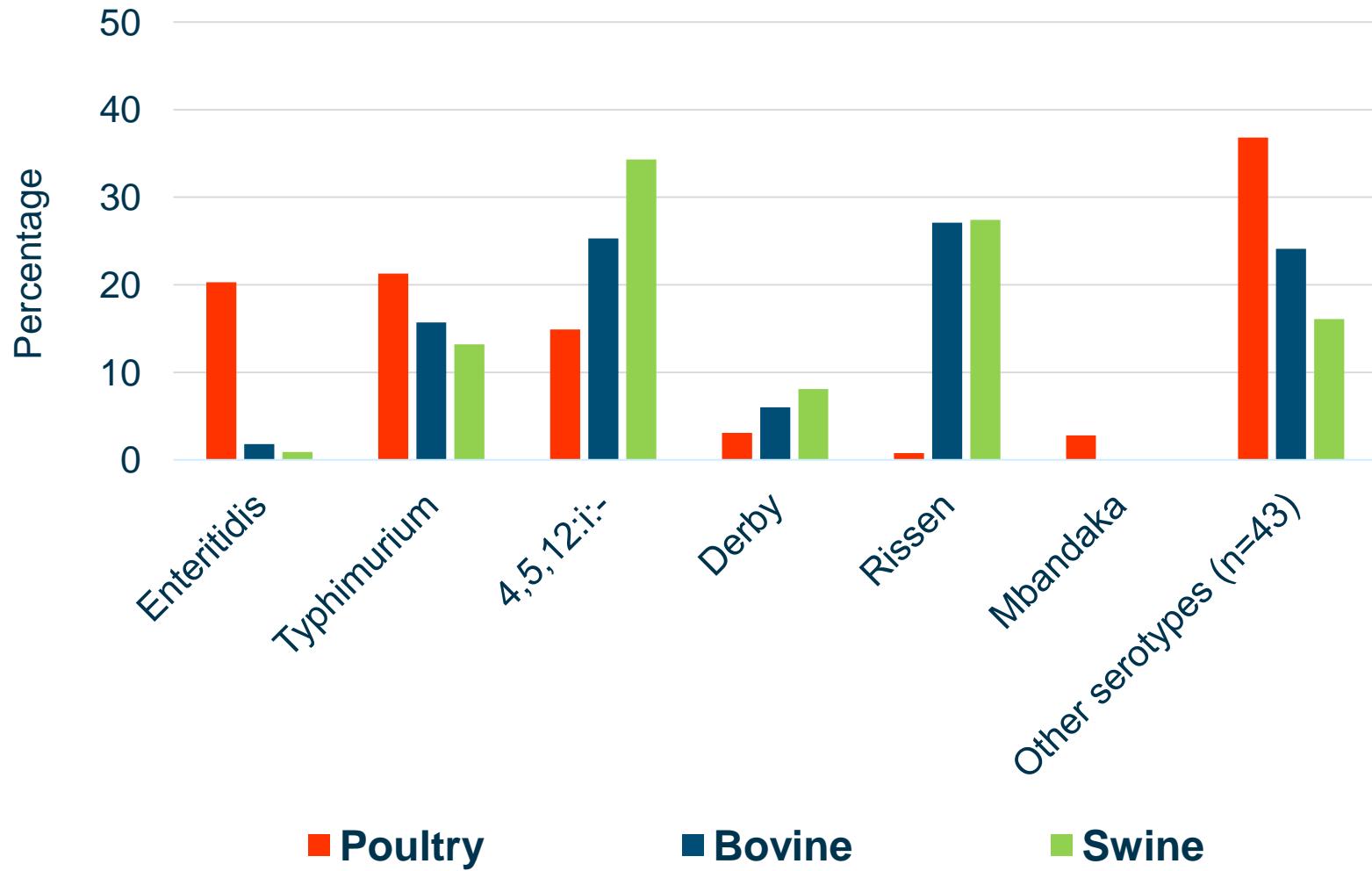
AMP, ampicillin
CTX, cefotaxime
NAL, nalidixic acid
CIP, ciprofloxacin
CHL, chloramphenicol
GEN, gentamicin
SMX, sulphamethoxazole
TE, tetracycline
TRM, trimethoprim



ISOLATES (n = 1075)

SEROTYPES (n = 49)

FOOD

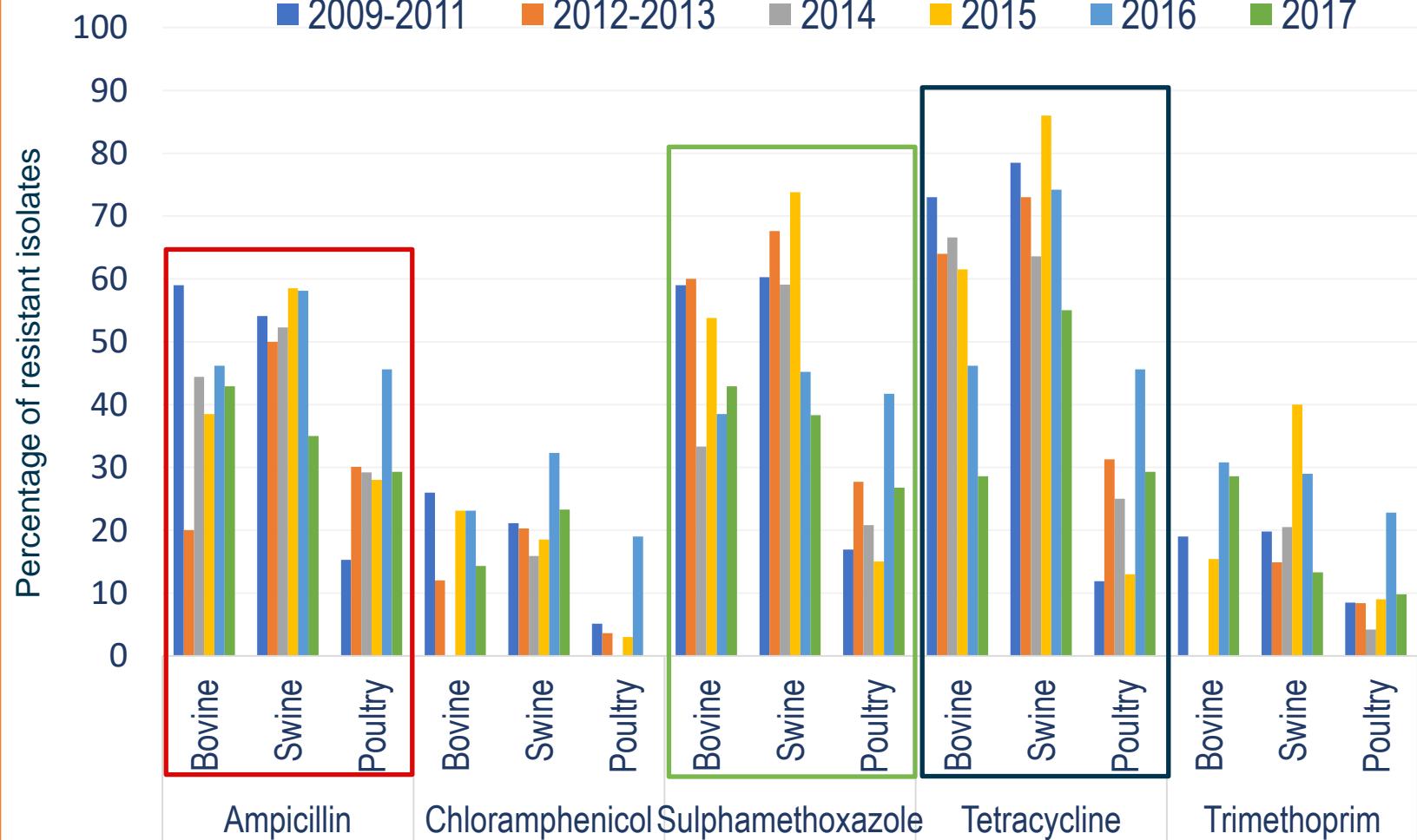




IMPORTANT ANTIMICROBIALS

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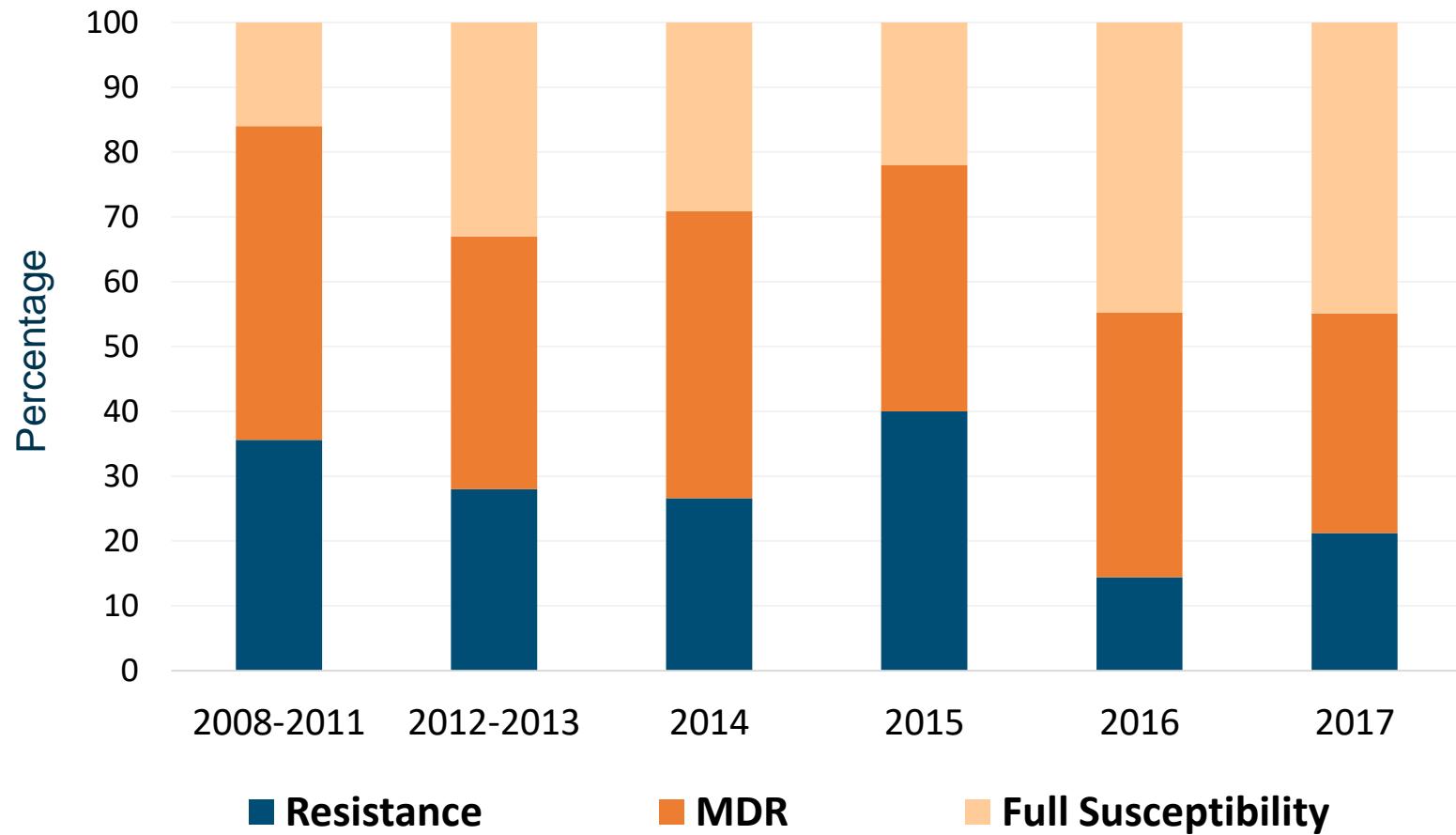
DOOF





RESISTANCE VERSUS FULL SUSCEPTIBILITY

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FOOD

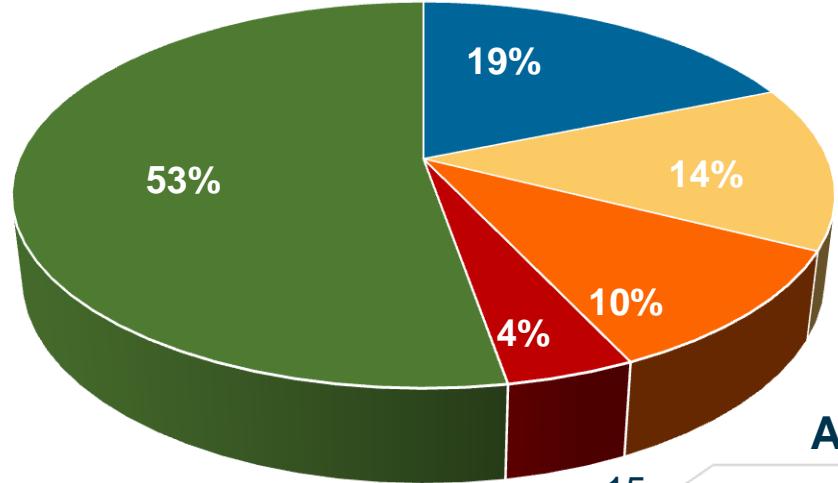




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ISOLATES (n = 92)

- Enteritidis
- Mbandaka
- Other serotypes (n=24)

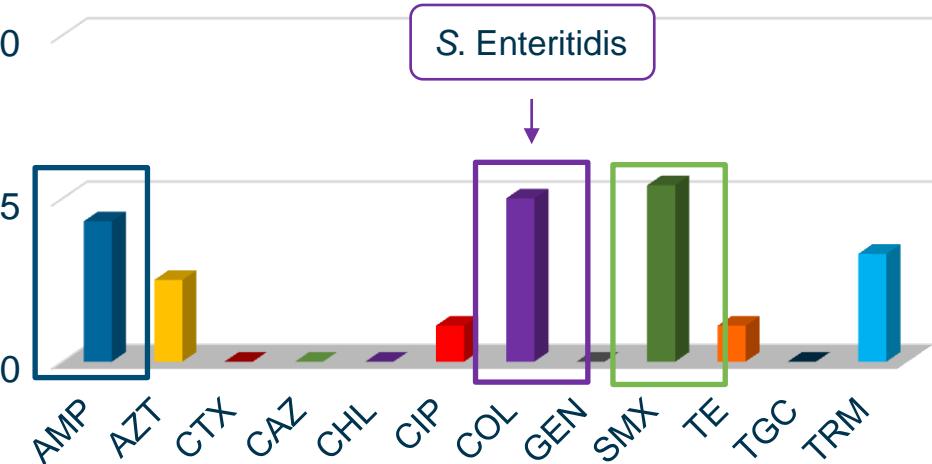


SEROTYPES (n = 28)

- Havana
- Typhimurium

ANTIMICROBIAL RESISTANCE

Percentage of resistance



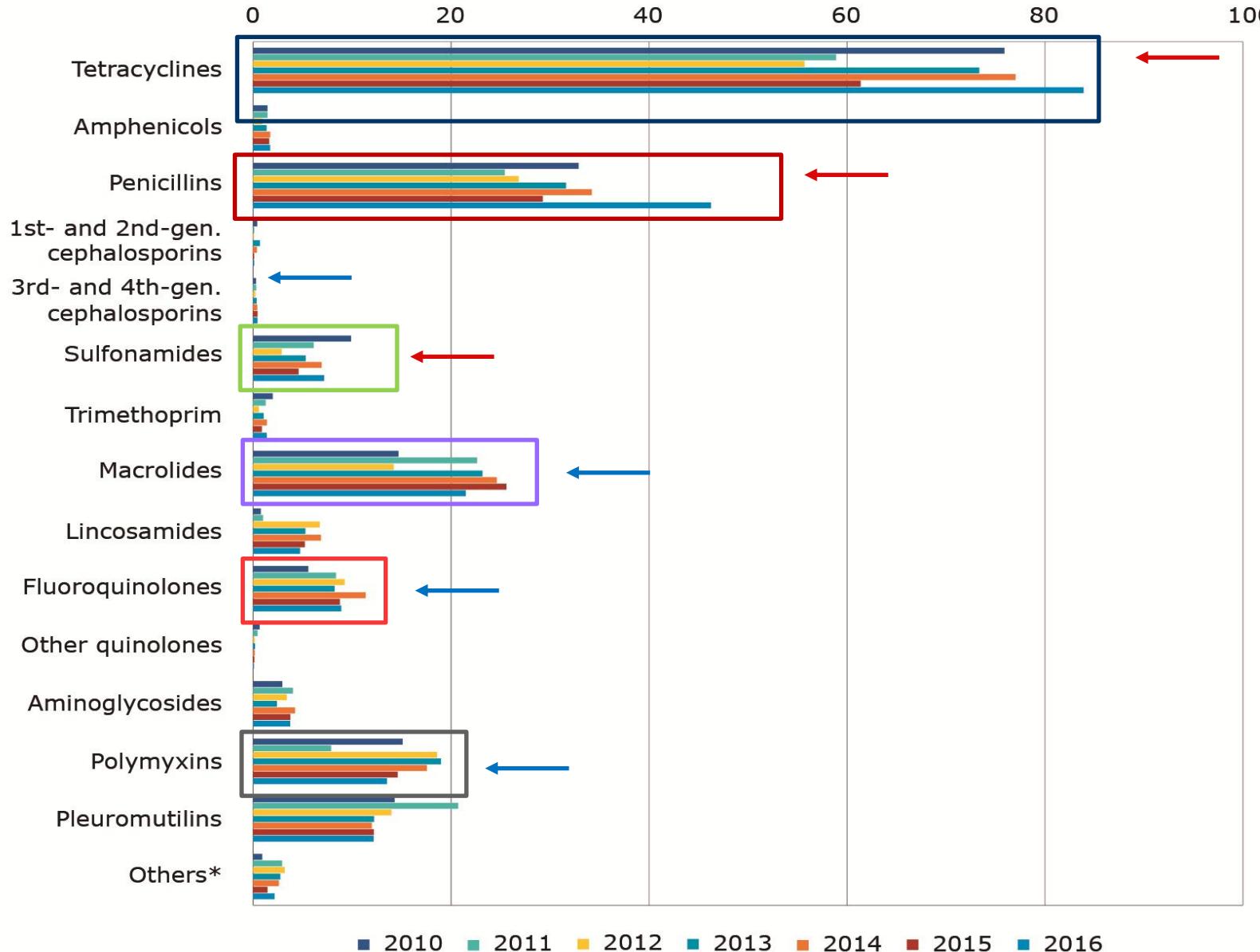
AMP, ampicillin
AZT, azithromycin
CTX, cefotaxime
CAZ, ceftazidime
NAL, nalidixic acid
CIP, ciprofloxacin
CHL, chloramphenicol
COL, colistin
GEN, gentamicin
SMX, sulphamethoxazole
TE, tetracycline
TGC, tigecycline
TRM, trimethoprim

EMA (2018), 8th ESVAC (Trends from 2010-2016)

PORTUGAL

mg/PCU

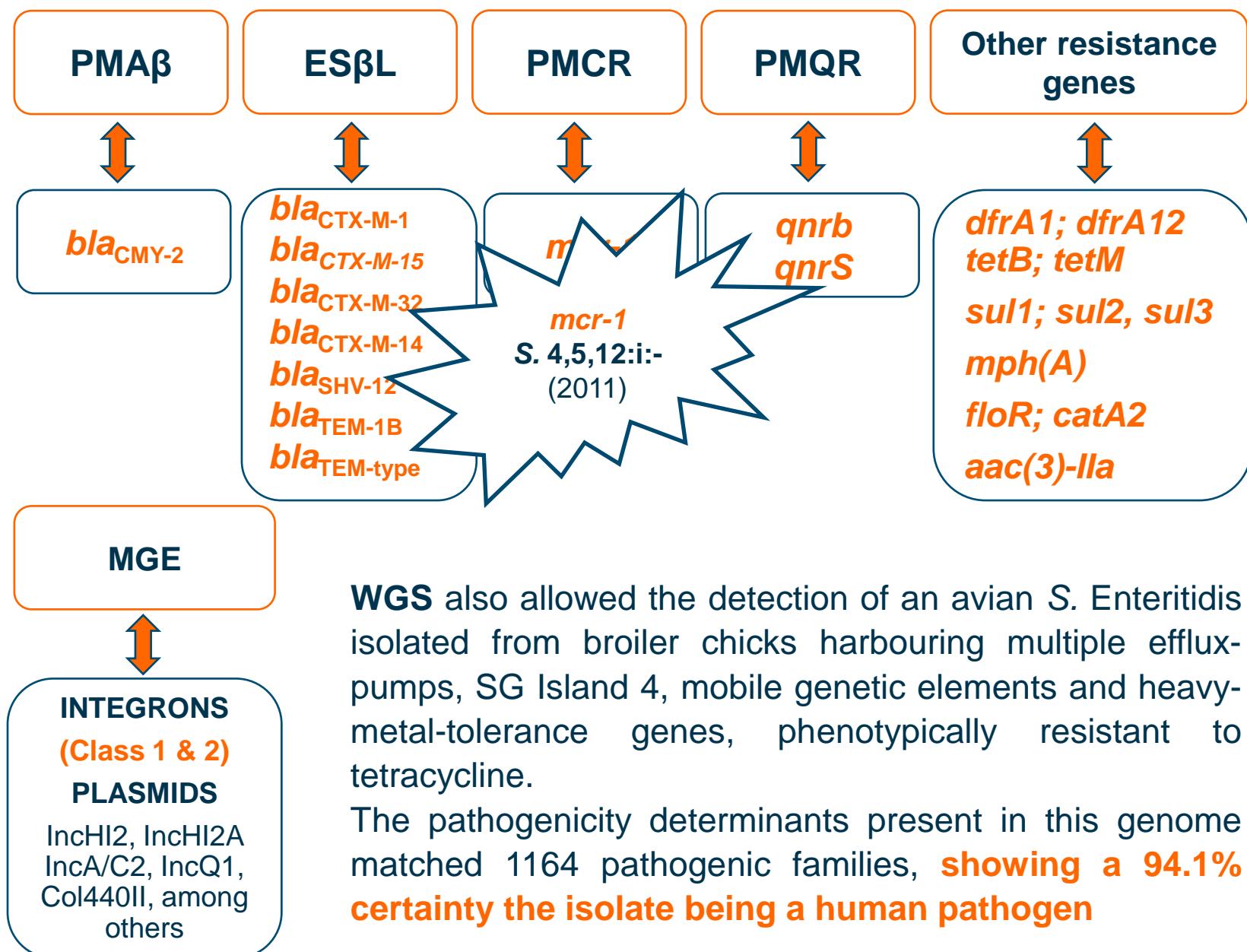
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GENOTYPING



MOLECULAR AND GENOMIC TYPING



WGS also allowed the detection of an avian *S. Enteritidis* isolated from broiler chicks harbouring multiple efflux-pumps, SG Island 4, mobile genetic elements and heavy-metal-tolerance genes, phenotypically resistant to tetracycline.

The pathogenicity determinants present in this genome matched 1164 pathogenic families, **showing a 94.1% certainty the isolate being a human pathogen**



- ❑ **Great variability of serotypes** suggesting diversity of sources of infection: breeding flocks, hatcheries, feed and feedstuffs, environment, human contact, animal facilities and equipment

- ❑ **Antibiotic susceptibility greatly related with the animal species, matrix, serotype, genotype and the antibiotic consumption**

- ❑ **High prevalence of resistance to ciprofloxacin**, particularly in poultry and poultry food;

- ❑ **Colistin resistance** in diverse serotypes, particularly in serotype **Enteridis**, although the first *mcr-1* gene detected (2011) was in *S. 4,5,12:i:-*

- ❑ **Low prevalence of resistance to 3rd generation cephalosporins/cephamycins**

- ❑ **Multidrug resistance is worrisome**, particularly in food



- **High diversity of resistance determinants to critical important antibiotics:** ESBL and/or PMA β (bla_{TEM-1} , $bla_{TEM\text{-type}}$, bla_{SHV-12} , $bla_{CTX-M-1}$, $bla_{CTX-M-1\text{group}}$, $bla_{CTX-M-14}$, $bla_{CTX-M-15}$, $bla_{CTX-M-32}$, bla_{CMY-2}), PMQR ($qnrB$, $qnrS$) and PMCR ($mcr-1$)

The accomplishment of *Salmonella* National Control Plans together with the implementation in 2014 of a National Action Plan for the Reduction of Use of Antibiotics in Animals, to promote the prudent use of antimicrobials and raise awareness about antimicrobial resistance, is having some effect on the increase of **Full Susceptibility of *Salmonella enterica*** isolated from **Poultry and Food**



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Thank you for your attention!

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