

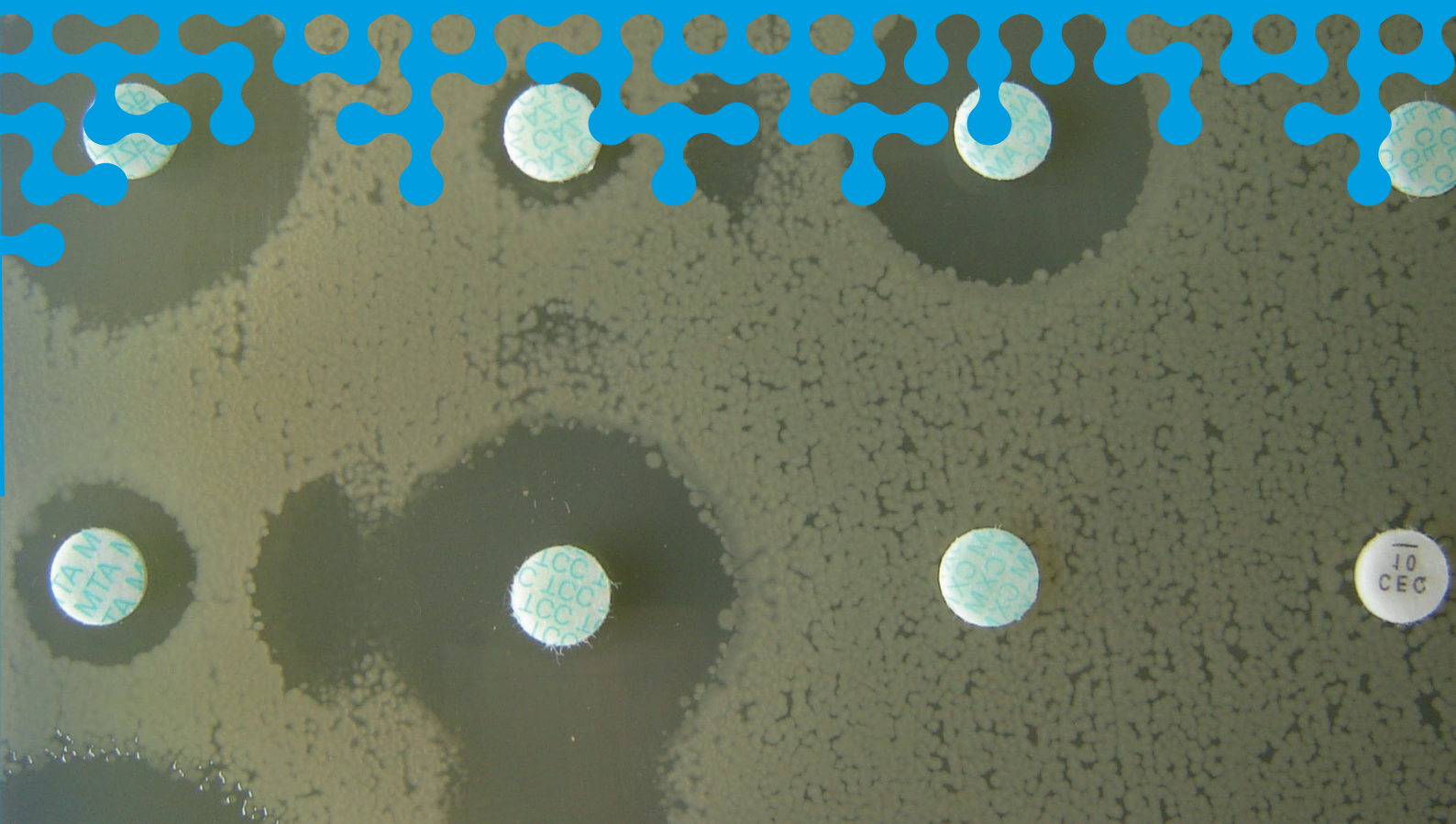


Resapath

French surveillance
network for
antimicrobial resistance
in bacteria
from diseased animals

2018 Annual report

March 2020 - Scientific Publication

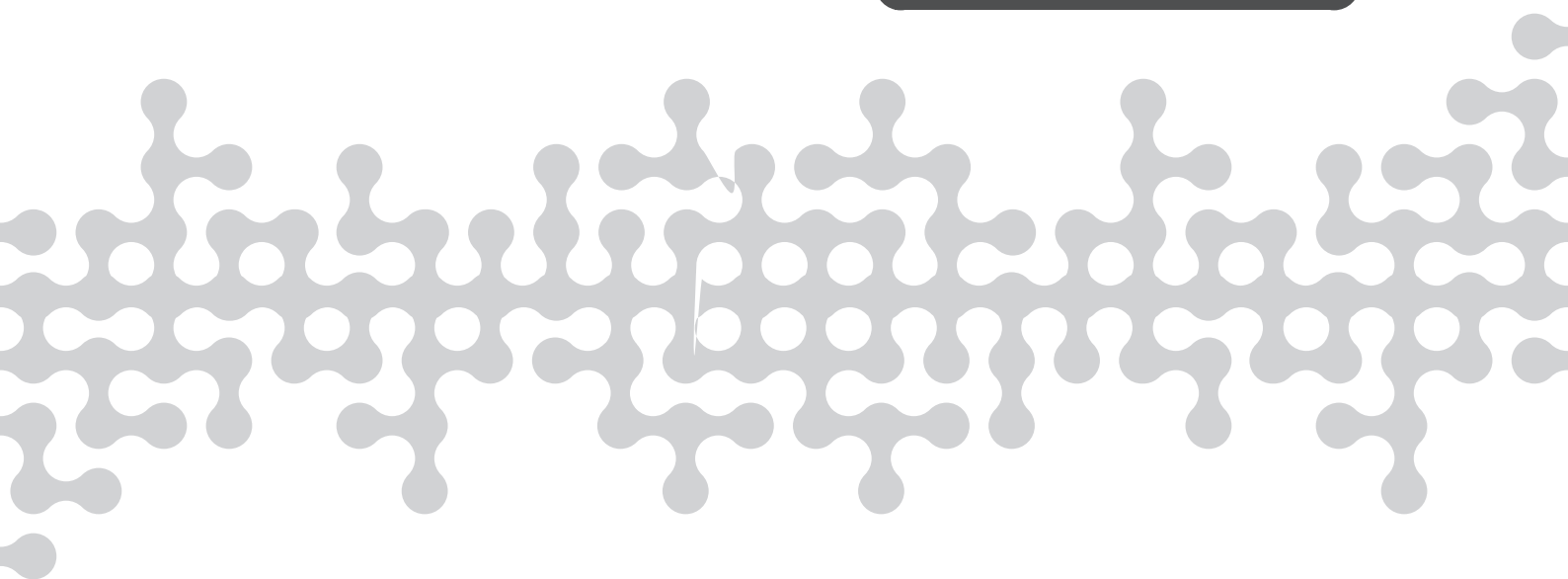


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INTRODUCTION

Monitoring of Antimicrobial Resistance in bacteria from diseased animals in France in 2018: Summary Report of the RESAPATH network (resapath.anses.fr)

The French surveillance network for antimicrobial resistance (AMR) in bacteria from diseased animals (RESAPATH) was set up in 1982 under the name of RESABO (BO for bovines). In 2000, it was expanded to pigs and poultry and in 2007, to other animal species such as small ruminants, companion animals or horses. The RESAPATH is a long-term cooperative effort from 71 veterinary diagnostic laboratories throughout France coordinated by the Lyon and Ploufragan-Plouzané-Niort Laboratories at the French Agency for Food, Environmental and Occupational Health Safety (ANSES). As mentioned below, the information presented here is based on data from this on-going surveillance system estimating the proportions of susceptibilities to relevant antibiotics of bacteria recovered from diseased animals treated by veterinarians as part of their regular clinical services. The RESAPATH is a key component of the strategic National Action Plans (NAPs) (EcoAntibio 1, 2012-2016; EcoAntibio 2: 2017-2021) adopted by the French Ministry of Agriculture, Food and Forest to combat AMR in animals. The RESAPATH is also part of the recent cross-sectorial "One Health" NAP against AMR in humans, animals and the environment adopted by the French Prime Minister on November 17, 2016. Finally, since AMR monitoring in diseased animals is part of the EU strategy to combat AMR globally, the long-term (> 35 years) expertise of ANSES in running the RESAPATH is at the origin of a proposal to ascertain the opportunity for the most appropriate system to report AMR data from diseased animals at EU level in a coordinated way. It has been recently initiated through the Joint Action on Antimicrobial Resistance and Healthcare-Associated Infections (EU-JAMRAI, 2017-2020) where ANSES co-leads Task 7.4.2 on this issue.

The epidemiology of AMR is increasingly complex and we strongly believe that providing annual data of AMR trends in animal pathogens contributes to a comprehensive overview of AMR in veterinary medicine and is a key indicator to assess NAP efficacy in the non-human sector. We especially thank all laboratories and staff who are contributing to these surveillance efforts and to a better control of this major issue in animals.

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ORGANISATION AND KEY FIGURES

The objectives of the RESAPATH are the following:

- To monitor AMR in bacteria isolated from diseased animals in France,
- To collect resistant isolates of particular interest and to characterize their genetic background (including the mechanisms of resistance),
- To provide scientific and technical support on antimicrobial susceptibility testing methods and result interpretation to member laboratories.

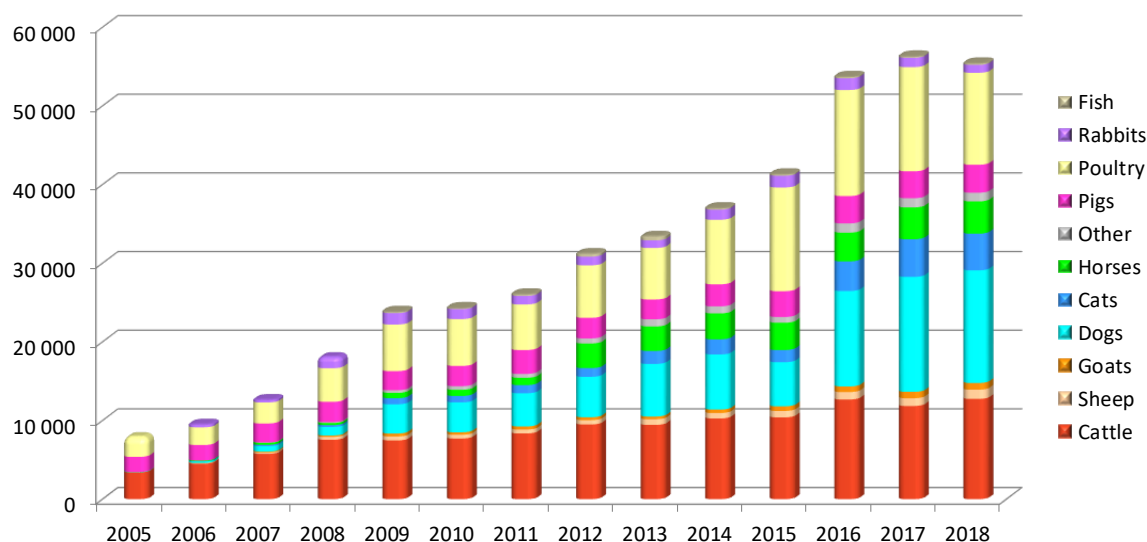
Bacteria recovered from diseased animals and sampled by veterinarians for diagnostic purposes as part of their routine activity are tested for antimicrobial susceptibility by private or public veterinary laboratories throughout France. Antibigrams are performed by disk diffusion according to the guidelines of the veterinary part of the Antibigram Committee of the French Society of Microbiology (CA-SFM) and of the AFNOR NF U47-107 standard, and inhibition zone diameters are transmitted to ANSES. Isolates are then categorized as susceptible (S), intermediate (I) or resistant (R) according to the recommendations provided by the veterinary section of the CA-SFM. Should no established breakpoints be available, critical values provided by the manufacturer for the corresponding molecules are used.

In addition to data collection, the RESAPATH also allows the collection of isolates demonstrating AMR profiles of specific interest, which are then subjected to in-depth molecular studies. Laboratories participate to annual ring trials (External Quality Assurance System), thus contributing to the quality control of the data gathered by the RESAPATH. In addition, annual training sessions, technical support, on-site training and other actions are also provided to the RESAPATH laboratories.

The RESAPATH is the unique veterinary member of the French National Observatory for Epidemiology of Bacterial Resistance to Antimicrobials (ONERBA), which encompasses 16 other surveillance networks throughout France, all in private or public medical practices (community or health-care centers). The RESAPATH is a passive or 'event-based' surveillance network. Member laboratories join the RESAPATH on a voluntary basis and data collected depend on the initial decision of veterinary practitioners. Hence, those data cannot be considered as perfectly representative of the global AMR burden of pathogenic bacteria but stand as a reliable indicator of AMR rates in field conditions. The major impact of the RESAPATH relies on its ability to detect the most resistant and emerging bacteria circulating in animals in France, to measure AMR trends in diseased animals in France (and thus assess NAP efficacy) and to highlight differences or commonalities of resistant bacterial isolates in the animal and human sectors through in-depth molecular and cross-sectorial studies carried out by ANSES in cooperation with National Reference Centers in human medicine.

In 2018, 71 laboratories were members of the RESAPATH and a total of 55,401 antibigrams were transmitted to ANSES, all animal species combined. The evolution of the distribution of antibigrams per animal sector is presented in *Figure 1*.

Figure 1. Annual number of antibigrams collected per animal sector



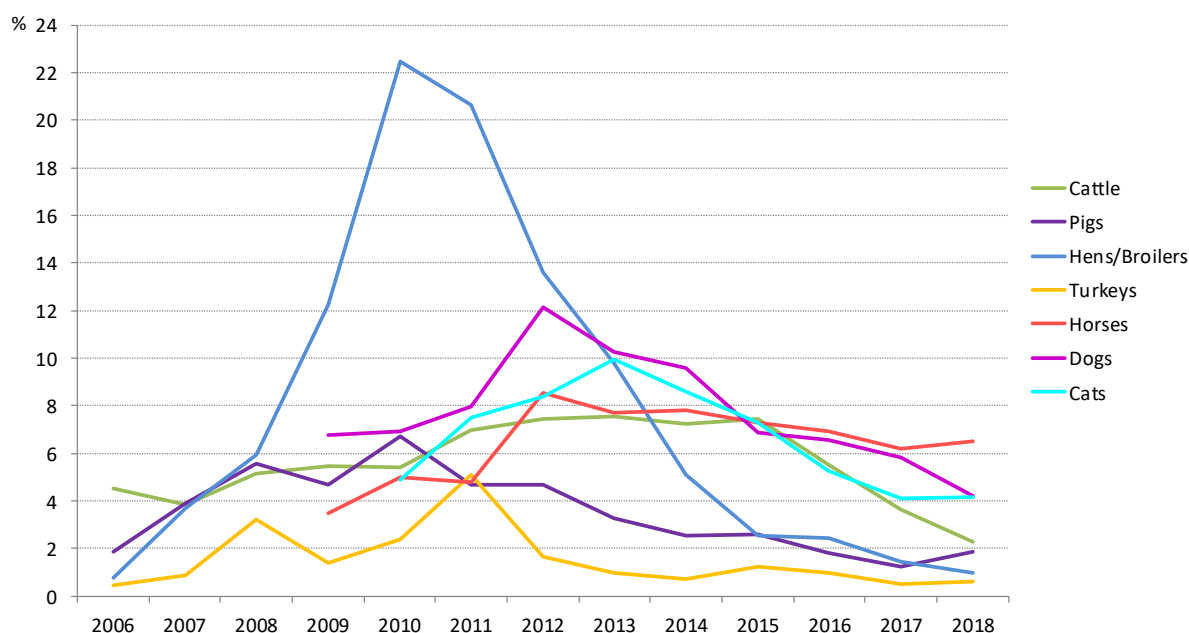
RESISTANCE DATA

This chapter summarizes the key results on AMR trends to the different antimicrobial classes, especially to extended-spectrum cephalosporins (ESCs) and fluoroquinolones (FQs) that are considered of critical importance both in human and veterinary medicines. Other important topics such as resistance trends to other antibiotics or on specific relevant phenotypes are also included. More detailed information on resistance levels per bacterial and animal species are available in annexes at the end of this report.

Resistance to extended-spectrum cephalosporins

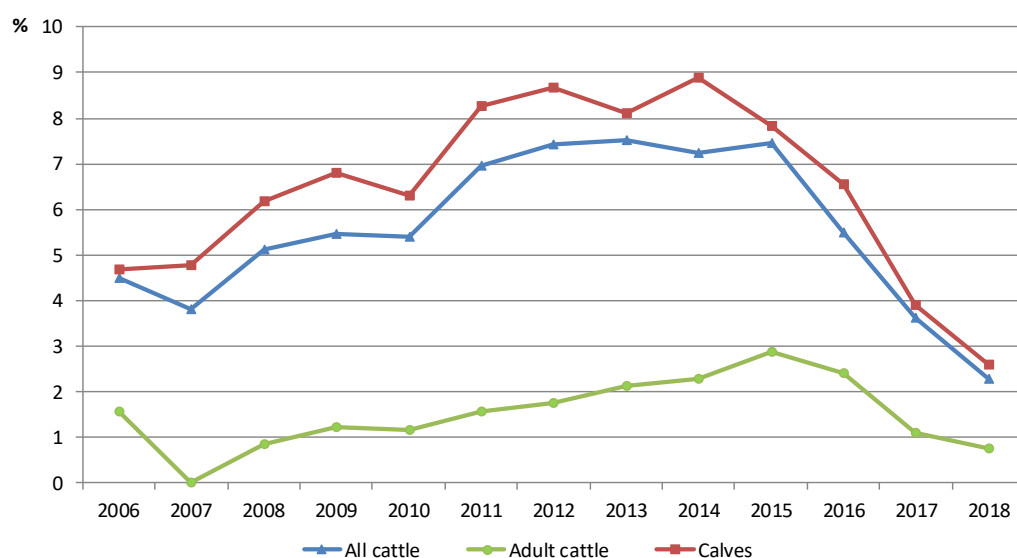
Isolates are routinely tested for their susceptibility to ceftiofur and cefquinome in food animals and horses, and to ceftiofur and ceftiofur in companion animals. Resistance has been mainly observed in *Escherichia coli* and to a lesser extent in *Klebsiella pneumoniae* and *Enterobacter* spp. In 2018, the highest rate of resistance to ceftiofur in clinical *E. coli* isolates of animal origin in France was found in horses (6.5%), followed by cats and dogs (4.0%) (Figure 2). Ceftiofur resistance in *E. coli* isolated from other animal species (poultry, pigs, adult cattle, turkeys, small ruminants) was below 3%. It seems that a plateau was reached in several animal species, a tendency that will have to be monitored in the coming years.

Figure 2. Evolution of proportions of *E. coli* isolates non-susceptible (R+I) to ceftiofur in cattle, pigs, poultry, turkeys, horses, cats and dogs (2006-2018)



The analysis of the tendencies should be completed, whenever possible, by data on the pathology or the age group for each animal species. As an example, ESC-R in bovines shows a clear difference in the level of resistance found in adults compared to calves, even though the tendency is identical (Figure 3).

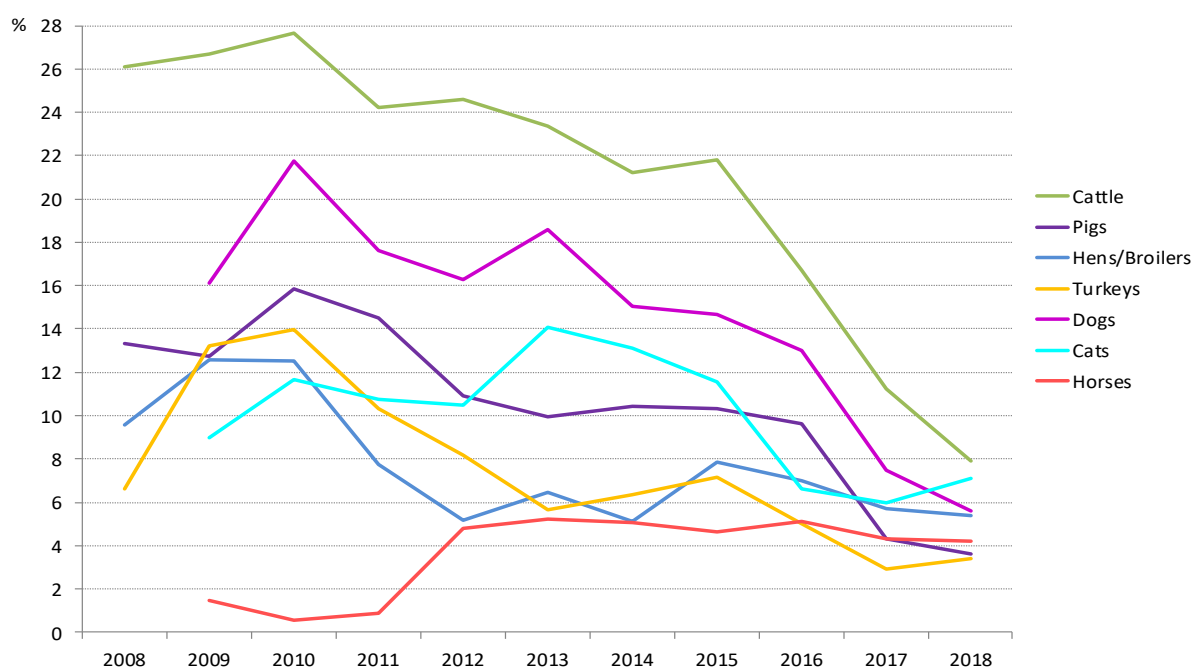
Figure 3. Evolution of proportions of *E. coli* isolates non-susceptible (R+I) to ceftiofur in cattle, adults and calves (2006-2018)



Resistance to fluoroquinolones

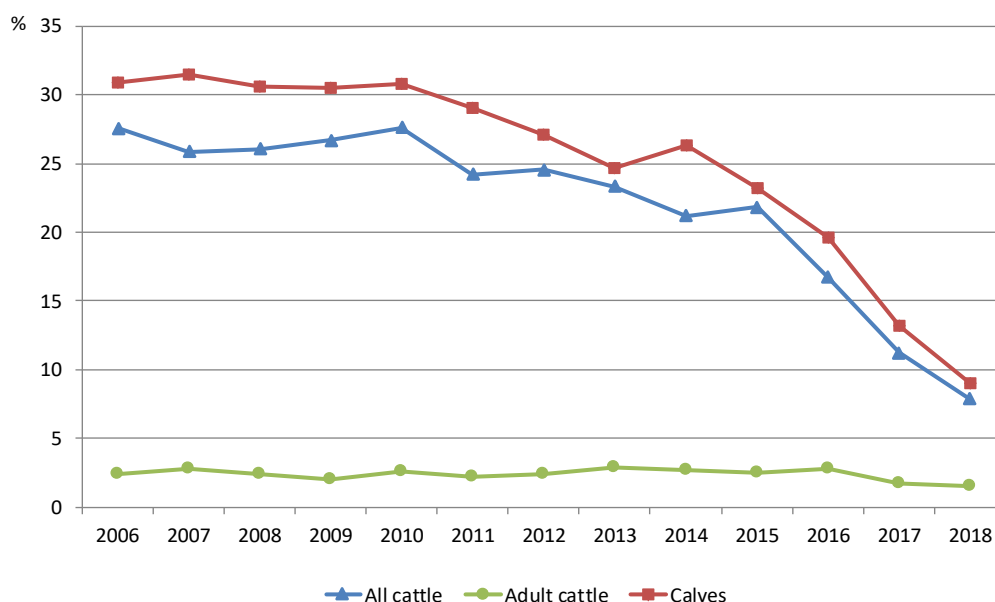
Isolates are routinely tested for their susceptibility to enrofloxacin, marbofloxacin or danofloxacin. Other fluoroquinolones (FQs), such as pradofloxacin in companion animals, are also tested depending on the animal species. In Figure 4, resistance to either enrofloxacin or marbofloxacin in *E. coli* isolated from diseased animals was used as an indicator of resistance to FQs.

Figure 4. Evolution of proportions of *E. coli* isolates non-susceptible (R+I) to enrofloxacin or marbofloxacin in cattle, pigs, poultry, turkeys, horses and dogs (2006-2018)



In 2018, FQ resistance rates in *E. coli* isolates from diseased animals ranged from 4% to 8% in all animal species (Figure 4 and Figure 5). In particular, FQ resistance displayed a marked decrease over the last 4 years for dogs (Figure 4). The large difference between resistance proportions to ESC or FQ that was observed in the past substantially narrowed in 2018.

Figure 5. Evolution of proportions of *E. coli* isolates non-susceptible (R+I) to enrofloxacin or marbofloxacin in cattle, adult cattle and calves(2006-2018)



Resistance to other antibiotics

Trends were investigated for *E. coli*. Antimicrobials that were considered here included those most frequently tested by the RESAPATH laboratories according to relevant classes in veterinary practice (excluding ESCs and FQs that have been studied separately). Seven antibiotics (five classes) were chosen, namely gentamicin, spectinomycin or streptomycin, trimethoprim-sulfonamides in combination, tetracycline, amoxicillin, amoxicillin and clavulanic acid in combination, and a quinolone (nalidixic or oxolinic acid). Trends were analyzed over the 2006-2018 period in cattle, pigs, hens/broilers and turkeys.

For a majority of the antibiotics considered, and in almost all animal species, the overall downward trend identified in recent years continued in 2018 or remained at the same level as 2017.

In cattle, the proportions of resistance observed in 2018 have stabilized compared to 2017 for almost all antibiotics considered, except for the combination amoxicillin-clavulanic acid which slightly increased and the combination trimethoprim-sulfonamides, where the proportions of resistance slowly increased since 2016 to reach the level observed in 2015 (Figure 6).

In pigs, resistance to the combination amoxicillin-clavulanic acid slightly increased since 2015 and resistance to gentamicin increased in 2018. Spectinomycin (or streptomycin) decreased again in 2018 after increasing in 2017 and reached its lowest level since 2006. Resistances to other antibiotics slightly decreased (amoxicillin and trimethoprim-sulfonamides) or stabilized (tetracycline and quinolones) (Figure 7).

Like in 2017, resistance rates in poultry decreased in 2018 for all antimicrobials except for the combination amoxicillin-clavulanic acid which slightly increased (Figure 8). Considering the trend since 2006, the decrease was significant for all antimicrobials studied except for quinolones (stable trend) and gentamicin (in clear decrease since 2015 only).

In turkeys (Figure 9), resistances to amoxicillin and trimethoprim-sulfonamides slightly decreased and resistance to spectinomycin (or streptomycin) significantly decreased to reach its lowest level since 2006. Resistance to gentamicin remained at the same level as 2017. Resistance levels for the others antibiotics (quinolone, tetracycline and the combination amoxicillin-clavulanic acid) slightly increased in 2018 compared to 2017.

Figure 6. Evolution of proportions (%) of *E. coli* isolates non-susceptible (R+I) to seven antimicrobials in cattle (2006-2018)

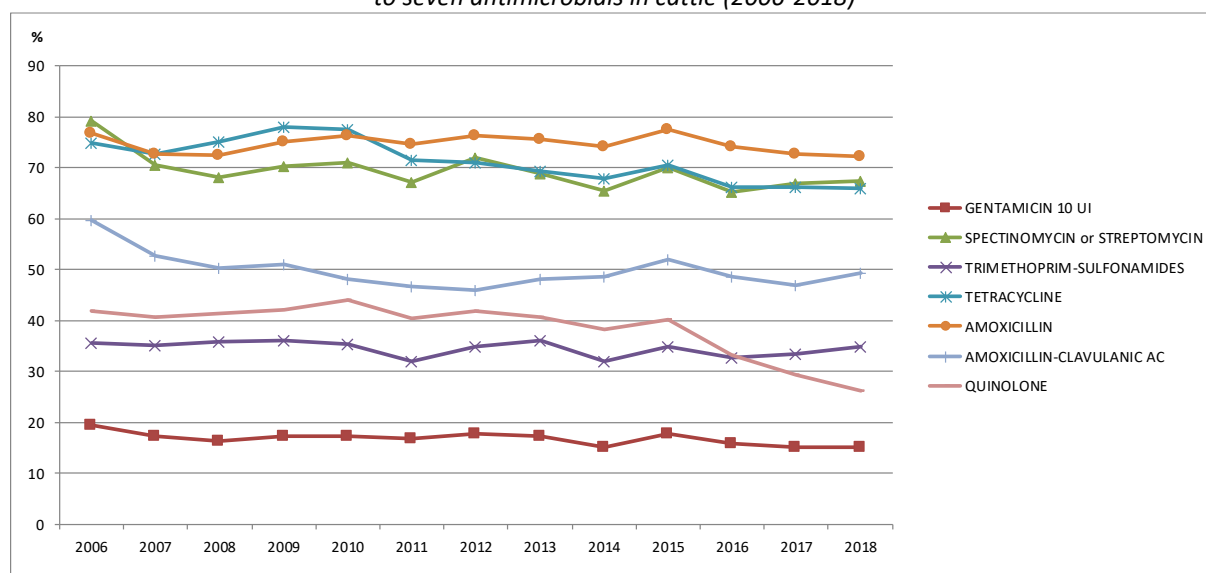


Figure 7. Evolution of proportions (%) of E. coli isolates non-susceptible (R+I) to seven antimicrobial in pigs (2006-2018)

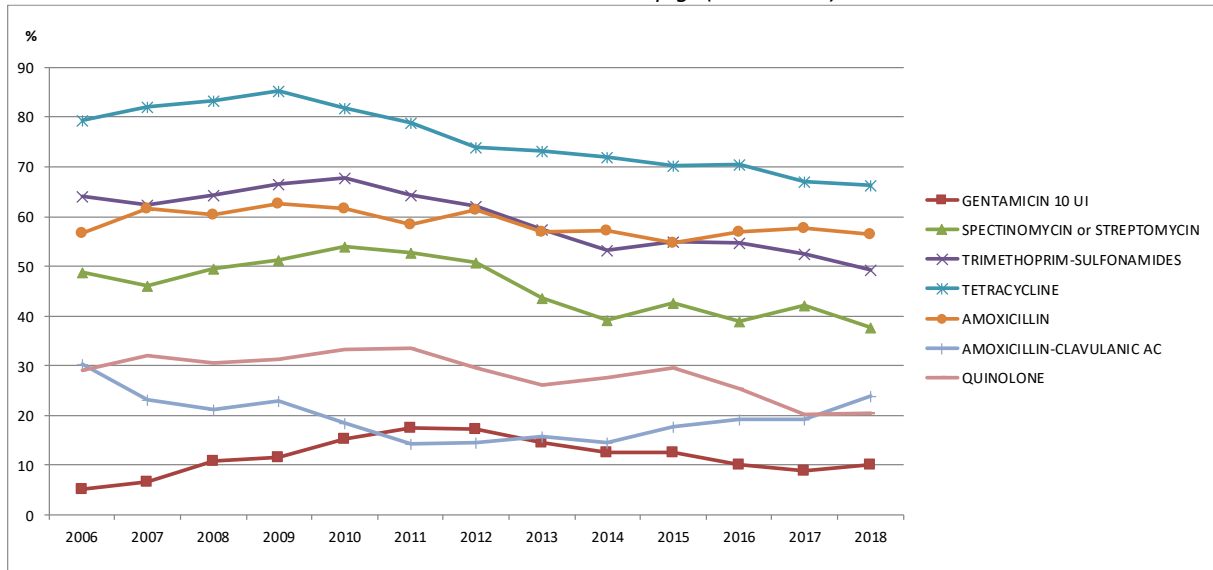


Figure 8. Evolution of proportions (%) of E. coli isolates non-susceptible (R+I) to seven antimicrobials in hens and broilers (2006-2018)

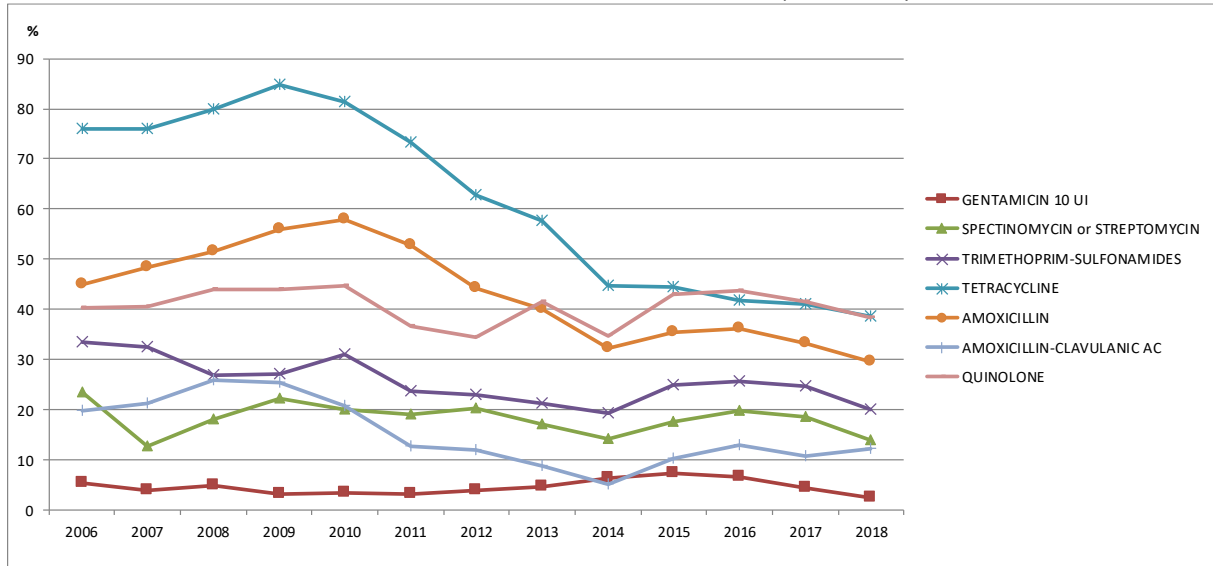
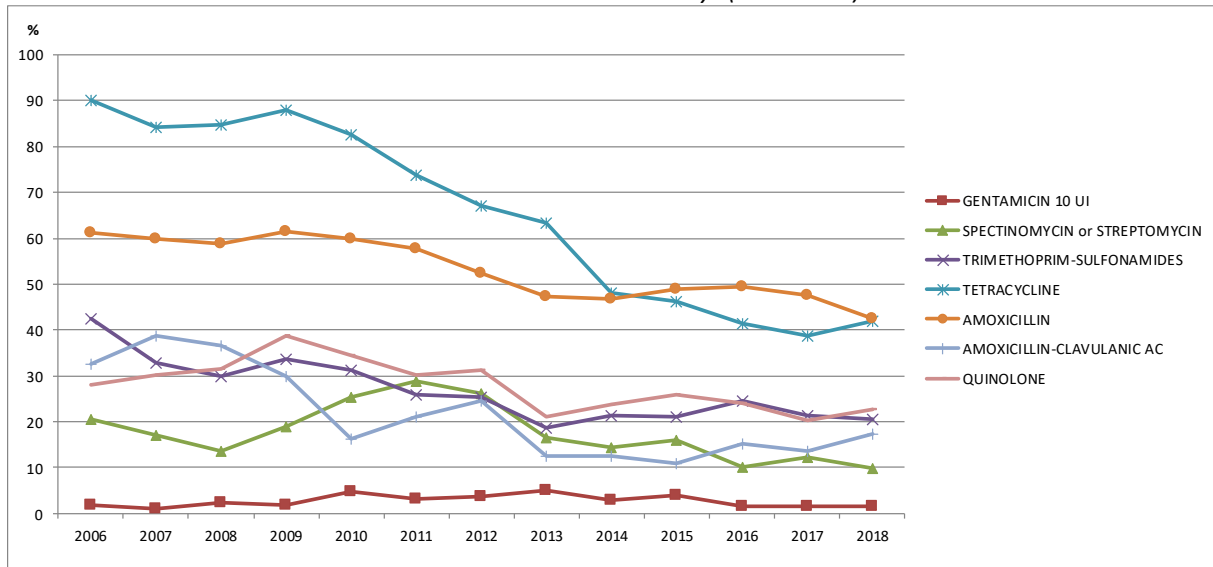


Figure 9. Evolution of proportions (%) of E. coli isolates non-susceptible (R+I) to seven antimicrobials in turkeys (2006-2018)



Multidrug resistance

Multidrug resistance (MDR) was investigated in *E. coli*, the most frequent bacterial species isolated in the RESAPATH. MDR is defined as resistance to at least three different classes of antimicrobials out of the five tested. The selective criteria used to select antimicrobials analyzed here were: *i*) relevance in veterinary and human medicine; *ii*) a single antimicrobial per class (as resistance mechanisms within a class, with the exception of aminoglycosides, often overlap); *iii*) antimicrobials frequently tested by the Resapath laboratories to guarantee a good representativeness of the data. Five antimicrobials were selected, namely ceftiofur, gentamicin, tetracycline, trimethoprim-sulfonamide in combination, and either enrofloxacin or marbofloxacin.

Food-producing animals (cattle, pigs, poultry)

The proportion of isolates without resistance to the five antimicrobials is still very variable among the different production species. The lowest proportion is found in pigs (22.3%) while it reaches more than one strain in two in poultry (53.7% in hens/chickens and 52.6% in turkeys) (Table 1). Between 2011 and 2018, the proportion of isolates susceptible to the five antimicrobials increased slightly but significantly in cattle and doubled for pigs and poultry sectors (Chi² trend, $p < 0,0001$ for the four species) (Figure 10).

The highest proportion of MDR isolates is found in cattle (15.2%), with a significant disparity according to pathologies and age groups. The proportion of MDR accounts for 2.6% in *E. coli* isolated from mastitis, and for 17.1% in digestive diseases which mainly concern young animals. The proportion of MDR is 9.7% for pigs, while being much lower in poultry (3.3% in hens/chickens, 2.9% in turkeys). Over the 2011-2018 period, the proportion of MDR isolates decreased significantly in all production animal species (trend Chi², $p < 0.0001$) (Figure 11).

Horses

For horses, the proportion of isolates susceptible to all the antimicrobials remains high (61.1%). However, contrary to all other species, this proportion significantly decreased over the 2012-2018 period (Chi² trend, $p = 0.003$) (Table 1, Figure 10). For horses, the proportion of isolates presenting only one or two resistances is less frequent than for food-producing animals. In contrast, the proportion of isolates bearing four (4.7%) or five (1.4%) resistances is higher than for food-producing animals. It should be noted that the proportion of MDR isolates in equines has been increasing since 2015, reaching 10.4% in 2018, but this trend is not statistically significant (Figure 11).

Dogs

In 2018, the proportion of susceptible isolates in dogs is 70.7% and follows a significantly increasing trend over the 2013-2018 period. The proportion of MDR isolates is significantly decreasing over the same period and represents 4.8% of the strains in 2018, half as much as in 2013 (Chi², $p < 0.0001$) (Table 1 Figures 10 and 11).

Table 1. Proportions (in %) of resistant *E. coli* isolates (R + I) according to the number of resistances in 2018

Number of resistance(s) (R+I)	Proportion of isolates (%)					
	Cattle (n=6,144)	Pigs (n=1,393)	Hens/Broilers (n=4,640)	Turkeys (n=984)	Horses (n=553)	Dogs (n=2 528)
0	27.2	22.3	53.7	52.6	61.1	70.7
1	36.4	35.5	29.6	28.9	19.5	18.5
2	21.2	32.5	13.4	15.5	8.9	6.1
3	11.7	8.7	3.1	2.8	4.3	2.9
4	3.2	0.9	0.1	0.1	4.7	1.5
5	0.3	0.1	0.0	0.0	1.4	0.4
MDR	15.2	9.7	3.3	2.9	10.4	4.8

To conclude, the results obtained are positive as they show a decrease of MDR over the 2011-2018 period for all animal species. However, the situation remains complex concerning resistance associations such as the joint resistances to critically important antimicrobials. For example, ceftiofur-resistant isolates often have higher proportions of co-resistances than those observed for ceftiofur-susceptible isolates. In cattle, 86% of ceftiofur-resistant isolates were also resistant to tetracyclines and 23% to fluoroquinolones, whereas these proportions are of 67% and 8% if all isolates are taken into account. These differences are found in all species and significant for cattle, horses and dogs (Chi² $p < 0.001$).

Figure 10. Evolution of proportions (%) of *E. coli* isolates **susceptible** to all five antimicrobials considered in the different animal species

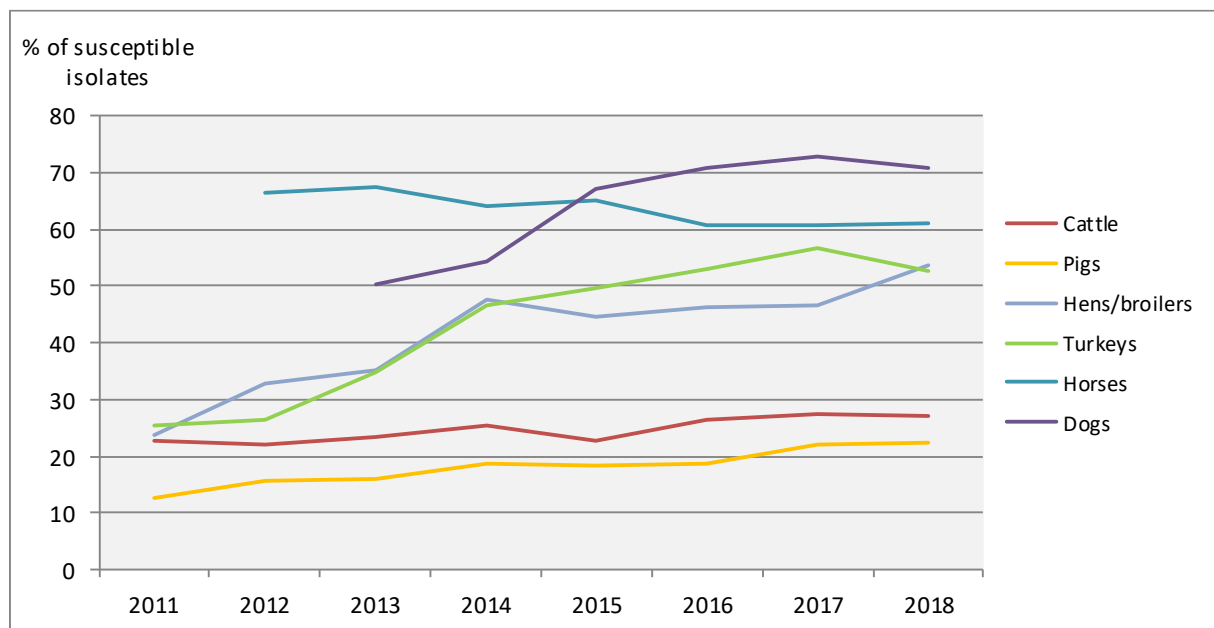
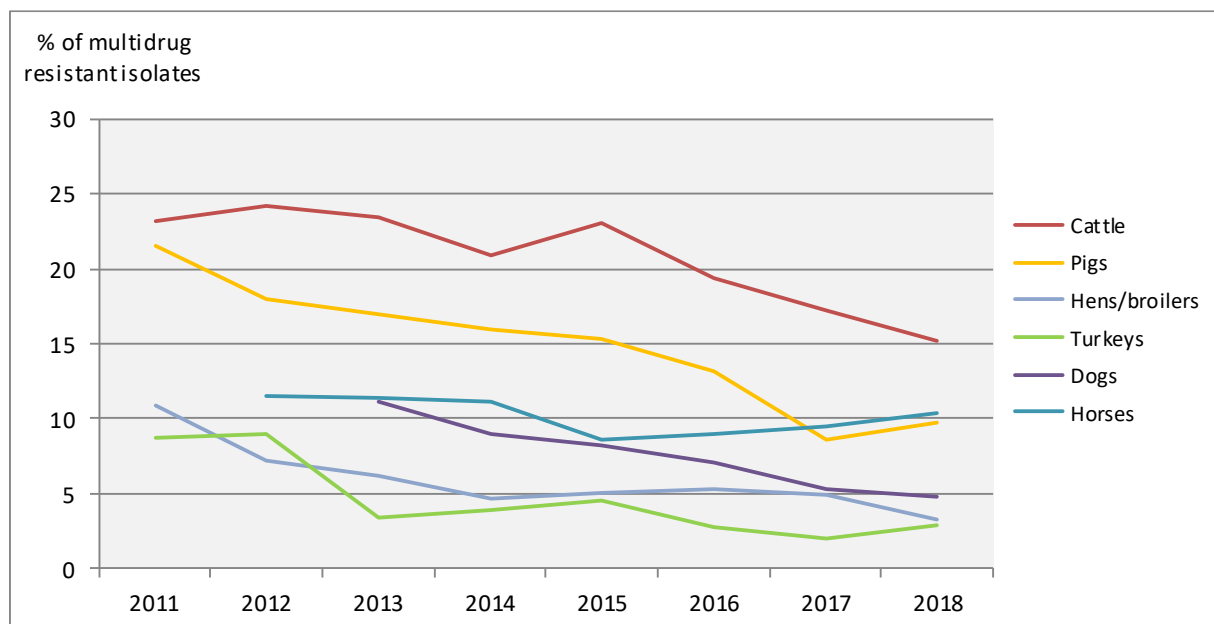


Figure 11. Evolution of proportions (%) of **multidrug resistant** *E. coli* isolates (resistant to at least three out of the five antimicrobials considered) in the different animal species



Colistin resistance in veterinary medicine

Since the renewed interest for colistin in human medicine in case of therapeutic failures, notably to treat carbapenem-resistant Enterobacterales, its use in veterinary medicine has been questioned by different institutions (European Medicine Agency^{1,2}, ANSES³, European Commission⁴). However, colistin use in veterinary medicine has only been seriously challenged since the description of the first plasmid-borne colistin-resistance gene *mcr-1* in China, 2015. Today, the *mcr* family has expanded and is now counting nine members, some of which encompassing several variants. In France, only *mcr-3* was identified beside *mcr-1*. This *mcr-3* gene was detected in the bovine sector associated to an epidemic burst and was always co-expressed with the particular CTX-M-55 enzyme. Of note, non-transmissible molecular mechanisms have also been described, such as *mgrB* mutations in *Klebsiella pneumoniae*, and the first veterinary isolate presenting an *mgrB* mutation originated from a French bovine mastitis.⁵

In France, the *mcr-1* gene of animal origin has been described first in *Salmonella*⁶, and then in *E. coli* from bovines (21% of ESBL-producing *E. coli* co-carried the *mcr-1* gene) or swines, where 70 *mcr-1* positive *E. coli* were detected among 79 colistin-resistant isolates collected between 2009 and 2013.⁷ *E. coli* with *mcr-1* gene were also reported from animals at slaughter (turkeys, broilers and pigs) in 2 to 6% of fecal samples plated on agar without colistin supplementation.⁸ Interestingly, while colistin use was decreasing, the proportion of ESBL-producing *E. coli* co-harboring the *mcr-1* gene was increasing, suggesting complex factors for the selection of colistin resistance.⁹ In 2017, the Ministry of the Agriculture launched the EcoAntibio 2 plan which includes a specific point (action 12, axis 2) entirely dedicated to colistin, with the objective of reducing its use by half over five years in poultry, swine and cattle.

To determine the MIC to colistin, microdilution assay is the only recommended method.¹⁰ This method is not well-adapted to the routine work of French veterinary laboratories still using disc diffusion, a method which is not entirely reliable for detecting colistin resistance in a clinical perspective. Nevertheless, since biases were *a priori* constant, the evolution of the resistance over the years is considered reliable from an epidemiological perspective. Moreover, according to experimental data accumulated by the veterinary laboratories as well as the ANSES laboratories, interpretation rules for diameters zones around the colistin disc (50 µg) were defined. Indeed for *E. coli*, diameters of <15 mm or ≥18 mm correspond to MICs of >2 mg/L (resistant) or <2 mg/L (susceptible), respectively. Intermediate diameters (15, 16 and 17 mm) are non-informative and require the determination of the MIC. However, the probability for the MIC to be >2 mg/L (resistant) is decreasing in parallel with the increase in diameters.

- ¹ European Medicines Agency (2013). Use of colistin products in animals within the European Union: Development of resistance and possible impact on human and animal health. EMA/755938/2012, 19 July 2013. URL : http://www.ema.europa.eu/docs/en_GB/document_library/Report/2013/07/WC500146813.pdf
- ² European Medicines Agency (2014). Answers to the requests for scientific advice on the impact on public health and animal health of the use of antibiotics in animals. EMA/381884/2014, 18 December 2014.
- ³ Avis de l'Anses relatif à l'évaluation des risques d'émergence d'antibiorésistance liés aux modes d'utilisation des antibiotiques dans le domaine de la santé animale (2014). URL : <https://www.anses.fr/fr/system/files/SANT2011sa0071Ra.pdf>.
- ⁴ Décision adoptée le 16 mars 2015, suite à un référé pris au titre de l'article 35 de la directive 2001/82/CE relative aux médicaments vétérinaires et concernant toutes les AMM de formes orales de colistine (EMA/EC/2015)
- ⁵ Kieffer N., Poirel L., Nordmann P., Madec J.-Y., Haenni M. (2015). Emergence of colistin resistance in *Klebsiella pneumoniae* from veterinary medicine. *Journal of Antimicrobial Chemotherapy*, 70 (4): 1265-1267. <http://www.ncbi.nlm.nih.gov/pubmed/25428921>
- ⁶ Webb H.E., Granier S.A., Marault M., Millemann Y., Den Bakker H.C., Nightingale K.K., Bugarel M., Ison S.A., Scott H.M. and Loneragan G.H. (2016). Dissemination of the *mcr-1* colistin resistance gene. *Lancet Infectious Diseases*, 16, 144-145. doi: 10.1016/S1473-3099(15)00538-1.
- ⁷ Delannoy S., Le Devendec L., Jouy E., Fach P., Drider D., Kempf I. (2017). Characterization of colistin-resistant *Escherichia coli* isolated from diseased pigs in France. *Frontiers in Microbiology*, 8, 2278. doi: 10.3389/fmicb.2017.02278.
- ⁸ Perrin-Guyomard A., Bruneau M., Houee P., Deleurme K., Legrandois P., Poirier C., Soumet C., and Sanders P. (2016). Prevalence of *mcr-1* in commensal *Escherichia coli* from French livestock, 2007 to 2014. *Euro surveillance*, 21. doi: 10.2807/1560-7917.ES.2016.21.6.30135.
- ⁹ Haenni M., Metayer V., Gay E., and Madec J.-Y. (2016). Increasing trends in *mcr-1* prevalence among extended-spectrum-beta-lactamase-producing *Escherichia coli* isolates from French calves despite decreasing exposure to colistin. *Antimicrobial Agents Chemotherapy* 60, 6433-6434. doi: 10.1128/AAC.01147-16.
- ¹⁰ CLSI-EUCAST (2016). Polymyxin Breakpoints Working Group. Recommendations for MIC determination of colistin (polymyxin E). URL: http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/General_documents/Recommendations_for_MIC_determination_of_colistin_March_2016.pdf

During 2018, some diagnostic laboratories involved in RESAPATH performed, in parallel to the disk diffusion method, an alternative test called “Colispot”.¹¹ This liquid diffusion method developed in ANSES laboratories is in perfect agreement with MICs obtained using the microdilution method for 197 *E. coli*.¹² Data provided by diagnostic laboratories in routine conditions confirm the very good correlation between an inhibition zone diameter ≥ 18 mm and the susceptibility to colistin. Indeed, among 3,644 *E. coli* susceptible to colistin using disk diffusion, only six (0.2%) were resistant by liquid diffusion. Among 179 not interpretable *E. coli* (inhibition zone diameters of 15, 16 or 17 mm), the liquid diffusion results indicated a susceptibility for 131 strains (73.2%) and a resistance for the 48 others (26.8%). Finally, among 19 *E. coli* with an inhibition zone diameter < 15 mm, 14 were also classified resistant using liquid diffusion method but five were found susceptible.

The evolution of the proportions of the different diameters was observed between 2003 and 2017 (Figures 12 to 16) and a Chi² test for trend was performed on diameters ≥ 18 mm. Susceptible isolates are on a continuous and significant increasing trend in all animal species albeit with various dynamics (Figure 12 and 16). Overall, these data suggest that the spread of colistin-resistant *E. coli* that are pathogenic for animals is under control in France.

Figure 12. Relative proportion of diameters < 15 mm. 15 mm. 16 mm. 17 mm and ≥ 18 mm around the colistin disc (50 μ g) for *E. coli* isolated from **digestive pathologies in piglets** (n min.: 296 (2005); n max.: 812 (2018))

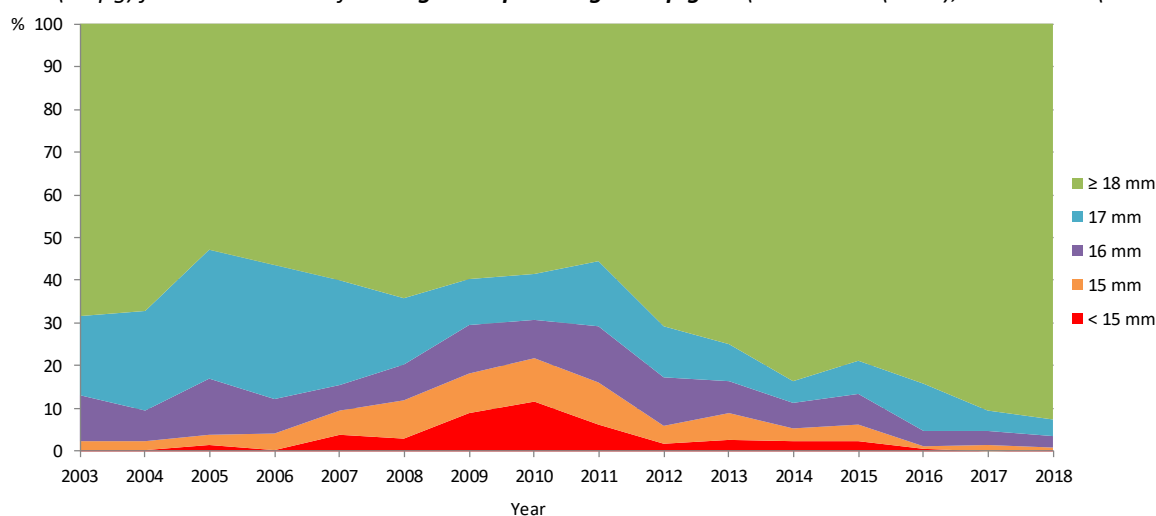
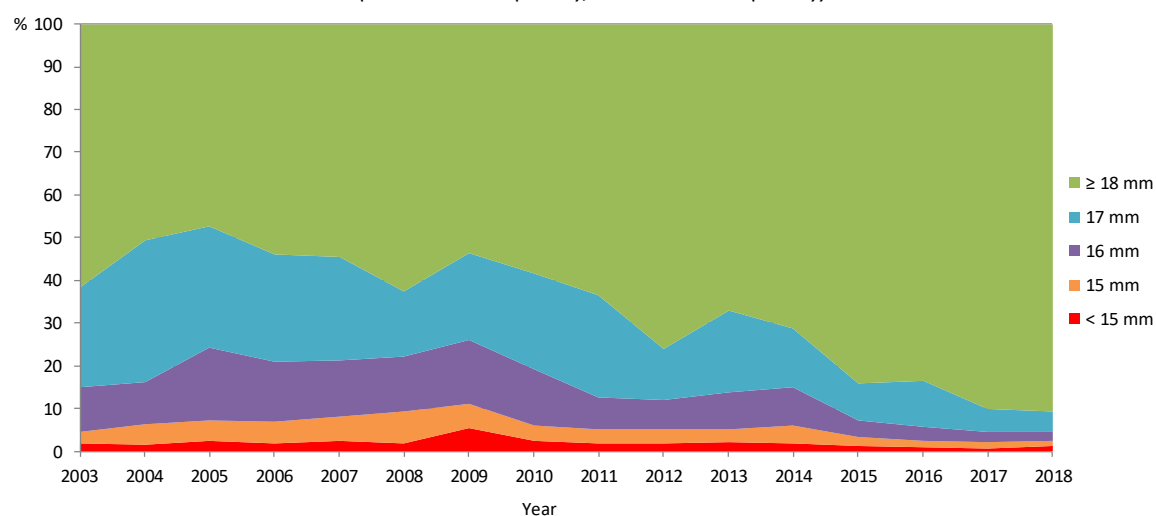


Figure 13. Relative proportion of diameters < 15 mm. 15 mm. 16 mm. 17 mm and ≥ 18 mm around the colistin disc (50 μ g) for *E. coli* isolated from **digestive pathologies in veal calves** (n min.: 1.139 (2003); n max.: 4.219 (2016))



¹¹ Jouy E., Haenni M., Le Devendec L., Le Roux A., Châtre P., Madec J.Y., Kempf I. (2017). Improvement in routine detection of colistin resistance in *E. coli* isolated in veterinary diagnostic laboratories. *Journal of Microbiological Methods*, 132:125-127.

¹² Anses (2018). French surveillance network for antimicrobial resistance in pathogenic bacteria of animal origin. 2016 Annual Report. (https://resapath.anses.fr/resapath_uploadfiles/files/Documents/2016_RESAPATH%20Rapport%20Annuel_GB.pdf).

Figure 14. Relative proportion of diameters < 15 mm. 15 mm. 16 mm. 17 mm and $\geq$ 18 mm around the colistin disc (50 μ g) for *E. coli* isolated from **bovine mastitis** (n min.: 188 (2004); n max.: 1.212 (2018))

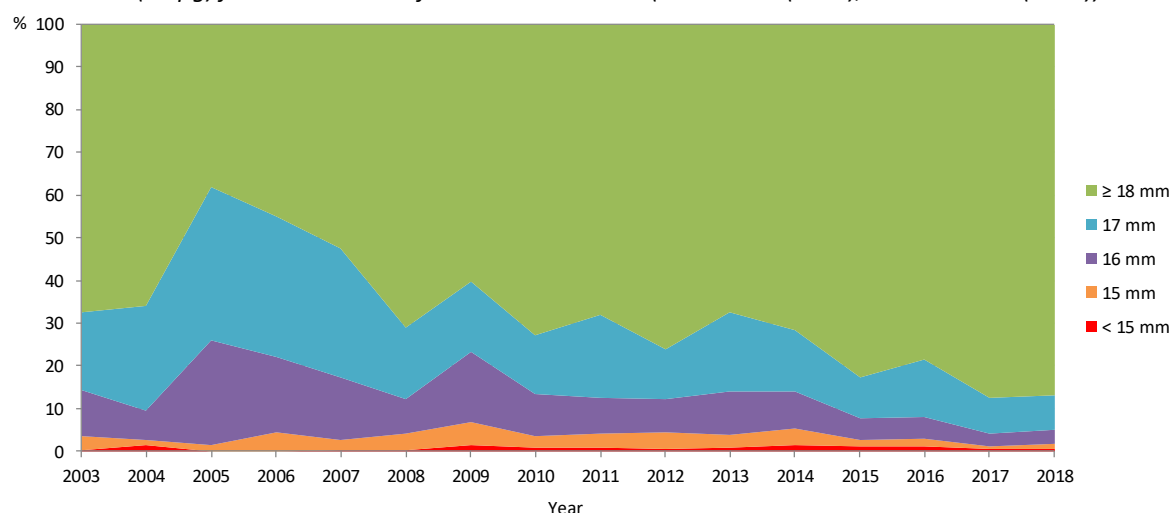


Figure 15. Relative proportion of diameters < 15 mm. 15 mm. 16 mm. 17 mm and $\geq$ 18 mm around the colistin disc (50 μ g) for *E. coli* isolated from **turkey** (n min.: 862 (2013); n max.: 2.220 (2015))

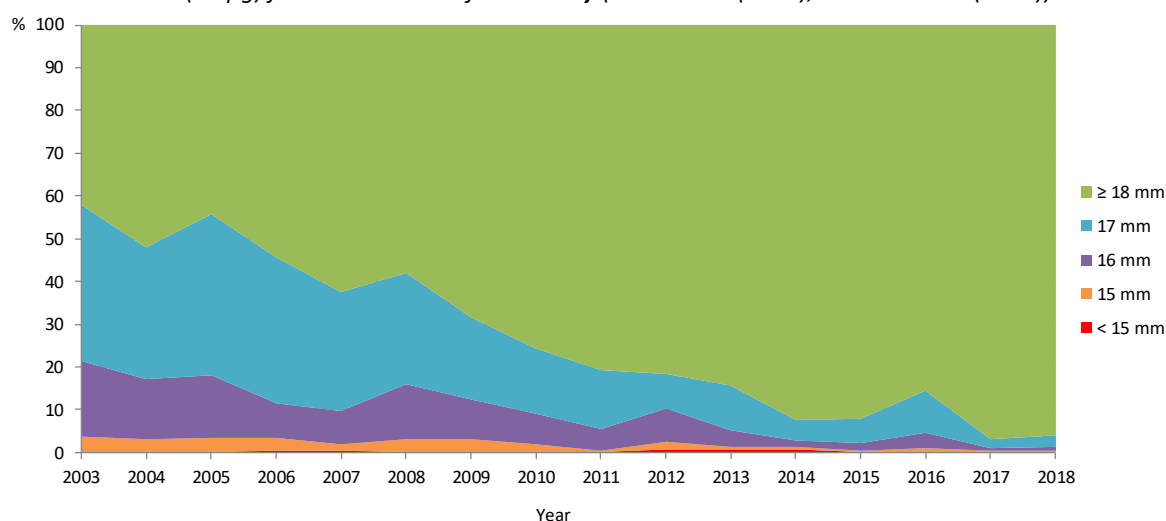
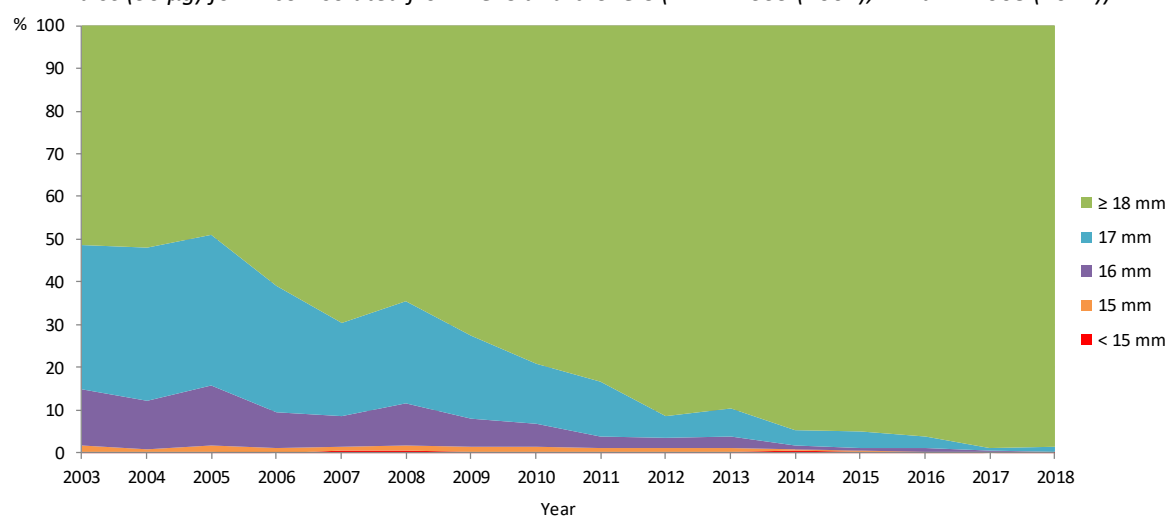


Figure 16. Relative proportion of diameters < 15 mm. 15 mm. 16 mm. 17 mm and $\geq$ 18 mm around the colistin disc (50 μ g) for *E. coli* isolated from **hens and broilers** (n min.: 559 (2004); n max.: 7.008 (2017))



Antimicrobial resistance of *Pasteurella multocida* isolated from food-producing animals and pets

Pasteurella multocida is a zoonotic bacterium that can infect a wide range of species, including humans. In animals, *P. multocida* primarily causes respiratory diseases, leading to significant economic losses, particularly in production animals such as cattle, swine and rabbits. Surveillance of *P. multocida* resistance in food-producing animals is essential to guide the first-line treatment of respiratory diseases and to limit losses. Since *Pasteurella* are the most common bacteria isolated from dog and cat bites, this surveillance is also needed to guide treatment in humans in case of bites. Data collected between 2012 and 2017 by the RESAPATH were analysed in order to characterize the phenotypic resistance of *P. multocida* strains isolated from respiratory infections in food-producing animals (cattle, swine, sheep, duck and rabbit) and pets (dog and cat)¹³. Resistances to eight antibiotic families of interest in human and veterinary medicine were studied.

Over the whole period (2012-2017), resistance proportions of *P. multocida* were almost all below 25%, and all resistance proportions were below 10% for rabbits, sheep and dogs (Table 2). The highest resistance proportions to enrofloxacin were identified for cattle (4.5% [3.5; 5.6]) and dogs (5.2% [3.1; 8.1]). Despite its frequent use in livestock, resistance to florfenicol was less than 1% in *P. multocida* strains, regardless of the animal species considered.

Since the 1950s, penicillins have generally been used as empirical treatments of cat and dog bites, before antibiogram results are obtained. According to the results of our study, given the low resistance of *P. multocida* isolates from dogs (4.9% [2.8; 7.9]) and cats (4.1% [2.7; 5.9]) to penicillins, the use of these antibiotics is still a valid therapeutic option.

Table 2. Antimicrobial resistance in clinical *Pasteurella multocida* isolated from diseased food-producing animals and pets in France over the period 2012-2017 in a context of respiratory disease

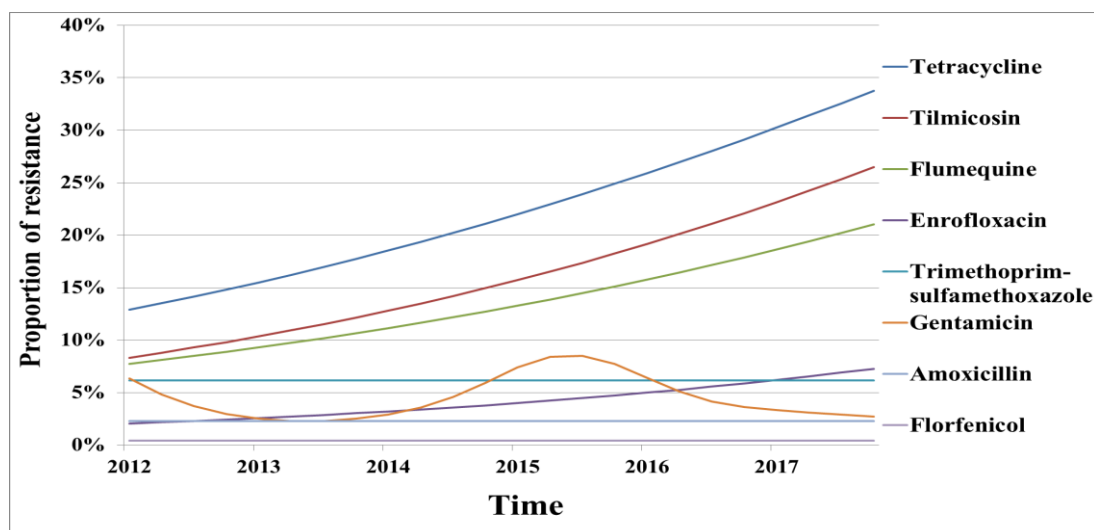
	Cat	Dog	Cattle	Duck	Sheep	Swine	Rabbit
Amoxicillin	4.1	4.9	2.3	0.9	2.3	0.3	1.3
Gentamicin	9.3	6.0	4.6	Not-tested	6.7	3.5	1.8
Tetracyclin	4.1	4.2	23.4	13.0	4.5	6.7	3.5
Trimethoprim-sulfamethoxazole	13.0	7.5	6.2	11.4	7.1	15.4	3.2
Florfenicol	0.5	0.0	0.4	0.3	0.0	0.8	0.0
Tilmicosin	7.4	Not-tested	17.2	0.9	7.3	2.1	5.1
Quinolone ¹	3.6	8.7	14.3	26.1	2.7	2.7	6.9
Enrofloxacin	2.6	5.2	4.5	3.7	1.4	0.5	0.2

¹ Nalidixic acid for dog, cat and sheep, flumequine otherwise

Time series analyses were performed for cattle isolates, for which we had sufficient data. Models revealed continuous increases in resistance to tetracycline, tilmicosin, flumequine and enrofloxacin (Figure 17), whereas the overall use of antibiotics in cattle decreased over the same period in France. Furthermore, these trends contrast with decreasing resistance trends of *Escherichia coli* strains isolated from cattle in recent years. These differences likely reflect differing practices according to the pathological contexts, stressing the importance of monitoring bacteria other than *E. coli*, which is commonly monitored.

¹³ Bourély C., Cazeau G., Jouy E., Haenni M., Madec J-Y., Jarrige N., Leblond A., Gay E. (2019). Antimicrobial resistance of *Pasteurella multocida* isolated from diseased food-producing animals and pets. *Veterinary Microbiology*. 235:280-284.

Figure 17. Trends for antimicrobial resistance in *P. multocida* isolates from cattle with respiratory diseases during the 2012-2017 period



Antimicrobial resistance in streptococci of animal origin: what's new in France?

Streptococcus agalactiae has been for long time a major etiological agent of clinical mastitis in bovines. Nowadays, *S. agalactiae* is sporadically reported leaving its primacy to *Streptococcus uberis*, followed by *Streptococcus dysgalactiae* subsp. *dysgalactiae*. *S. dysgalactiae* subsp. *equisimilis* is rare among bovines. Other streptococci are responsible for infections in animals, such as *S. suis* for swine and *S. canis* for dog. Moreover, *S. suis*, together with other few streptococcal species (e.g. *S. dysgalactiae* subsp. *equisimilis*), may cause severe zoonotic infections in humans. Globally, first line treatment of streptococcal infections in animals include penicillins, alone or in combination with aminoglycosides, macrolides, and tetracyclines. No isolates resistant to penicillin G has been, so far, isolated in France.

The rates of erythromycin and lincomycin resistance in *S. uberis* observed in 2018 are 15% and 18%, respectively, thus decreasing compared to 2015 (20% for both antibiotics), but similar to 2007 (17%). The comparable levels of erythromycin and lincomycin resistance suggests the circulation of a cross-resistance mechanism, such as the methylation of the target site of these antibiotics. An analysis on 125 isolates collected during the 2007-2008 period highlighted the presence of the *erm(B)* gene in 111 isolates¹⁴. The remaining 14 isolates were resistant only to lincomycin and harbored the *lnu(B)* gene. Tetracycline resistance rose during the 2006-2015 period (from 14% to 21%), and remained stable (20%). Resistance to streptomycin is stable (14%) compared to 2015 (16%), whereas resistance to other aminoglycosides remains low (2% for gentamicin, and 7% for kanamycin).

In *S. dysgalactiae*, resistance to erythromycin (16%) decreased compared to 2015 (22%), however lincomycin resistance remained stable (12%). Similarly to *S. uberis*, the most common resistance mechanisms conferring macrolides resistance is the *erm(B)* gene. A decrease of streptomycin resistance has been observed since 2015 (6% versus 3% in 2018), whereas tetracycline resistance is stable and elevated (80%). Most likely, this prevalence is linked to the mobility of the conjugative transposon Tn916 harboring the *tet(M)* gene.

Resistance level in streptococci of animal origin is stable¹⁵, however surveillance is crucial for detecting emergencies. Indeed, high level of gentamicin resistance has been detected in *S. dysgalactiae* subsp. *equisimilis* isolated from horses since 2017. This resistance is conferred by genes acquired by horizontal transfer and the dissemination of such resistance among isolates with zoonotic potential deserves further surveillance.

¹⁴ Haenni M., Saras E., Chaussière S., Treilles M. and Madec J.-Y. (2011). *ermB*-mediated erythromycin resistance in *Streptococcus uberis* from bovine mastitis in France. *The Veterinary Journal*, 189 (3): 356-358.

¹⁵ Haenni M., Lupo A., Madec J.-Y. (2018). Antimicrobial Resistance in *Streptococcus* spp. *Microbiological Spectrum*, 6 (2). <https://doi:10.1128/microbiolspec.ARBA-0008-2017>

Evolution of *Staphylococcus pseudintermedius* clones in France

S. pseudintermedius is both a commensal and opportunistic pathogen in dogs. It is not considered a zoonotic pathogen *per se* even though human cases have been sporadically reported. Methicillin-resistant *S. pseudintermedius* (MRSP) has emerged in the 2000s, causing serious therapeutic troubles because of their associated multi-resistance. Numerous studies showed the dominance of a limited number of specific clones, namely ST71 in Europe, ST68 in the USA and ST45/ST112 in Asia. Recently, studies performed in Northern Europe showed that the dominance of ST71 was decreasing, while other clones (among which the ST258) were on an increasing trend. Of note, those clones tend to be more susceptible to antibiotics, which may be considered a good news.

In France, the same decreasing trend of ST71 proportion was observed between two collections of dogs' isolates obtained through the Résapath network, one dating from 2012-2013 (95 isolates) and the second one from 2015-2016 (85 isolates)¹⁶. In line with other data in Europe, results also showed the emergence of numerous different clones that were globally more susceptible than the ST71 lineage. Only the two ST258 and ST496 clones seemed to emerge and will have to be monitored. Whole-genome sequencing performed on a subset of isolates further proved that ST71 and ST496 formed highly homogeneous clusters, while isolates belonging to ST258 were more diverse. Furthermore, ST496 showed an impressive arsenal of resistance genes so that it would escape the action of all veterinary-licensed antibiotics. This clone is a major exception to the global decrease in antibiotic resistance in MRSP, so that its emergence will have to be surveyed.

Emergence of ST131 *E. coli* belonging to the C1-M27 clade in French dogs

The spread of *E. coli* producing Extended-Spectrum Beta-Lactamases (ESBLs) in companion animals is a public health issue given the close contacts with humans. In veterinary medicine, ESBLs are spread by a large variety of *E. coli* genetic backgrounds, while the unique ST131 clone is responsible for the majority of *E. coli* infections in humans. For this reason, the sporadic detection of ST131 clones in dogs has often been considered a spillover effect of its presence in humans.

In France, 269 *E. coli* isolate presenting either an ESBL (n=204), a pAmpC phenotype (n=63) or both (n=2) were collected through the Resapath network between 2010 and 2016. MLST typing of all B2 isolates revealed that 56 isolates belonged to the ST131 clone (56/269, 20.8%)¹⁷. All ST131 isolates presented an ESBL phenotype, principally due to the presence of the *bla*_{CTX-M-15} gene. Most of the isolates (50/56) presented the *fimH30* allele indicating the dominance of the widely disseminated clade C ST131 *E. coli*. Additionally, seven isolates carrying the *bla*_{CTX-M-27} and one carrying the *bla*_{CTX-M-14} gene belonged to the C1-M27 clade, which recently emerged in humans. First identified in Japan, this CA-M27 clade is now spreading worldwide, including in France¹⁸.

Our results demonstrate a high proportion of the ST131 clone in dogs, as well as the presence of the C1-M27 clade that can be traced back to 2011. These data question the potential adaptation of certain ST131 lineages to the animal host, a hypothesis that is currently investigated using whole-genome analysis.

¹⁶ Bergot M., Martins-Simoes P., Kilian H., Chatre P., Worthing K.A., Norris J.M., Madec J.Y., Laurent F., and Haenni M. (2018). Evolution of the population structure of *Staphylococcus pseudintermedius* in France. *Frontiers in Microbiology*, 9: 3055.

¹⁷ Melo L.C., Haenni M., Saras E., Duprilot M., Nicolas-Chanoine M.H., and Madec J.Y. (2019). Emergence of the C1-M27 cluster in ST131 *Escherichia coli* from companion animals in France. *Journal of Antimicrobial Chemotherapy*, in press.

¹⁸ Birgy A., Bidet P., Levy C., Sobral E., Cohen R., and Bonacorsi S. (2017). CTX-M-27-producing *Escherichia coli* of Sequence Type 131 and clade C1-M27, France. *Emerging Infectious Disease*, 23: 885.

ESBL in animals: a few examples outside France – comparison with the Resapath data

Resistance to extended-spectrum cephalosporins is often mediated by genes encoding extended-spectrum beta-lactamases (ESBLs), which are mostly carried by plasmids. All Enterobacterales can display *bla*_{ESBL} genes, but the most frequent ones are by far *Escherichia coli* and *Klebsiella pneumoniae*. In order to put the Resapath data in the international context, it is valuable to compare ESBLs types reported in French animals with those in other countries, in Europe and beyond. These comparative studies were mainly performed with Sweden, Tunisia, Lebanon and Brazil.

E. coli responsible from bovine mastitis are globally susceptible to antibiotics and only a few of them carry *bla*_{ESBL} genes. This is the case in most European countries, and also in Tunisia. ESBLs in bovine mastitis in France are mainly due to the presence of the CTX-M-1 enzyme. On the contrary, the CTX-M-15 enzyme – which is widespread in the human sector worldwide – is dominating in bovines in Tunisia^{19,20,21}. In Lebanon, the carriage rate of ESBL-positive *E. coli* is higher than in France, with 84% of positive farms, and the CTX-M-15 enzyme is also widely distributed²². In this country, carbapenemase-producing (OXA-48) *K. pneumoniae* have also been detected in raw milk from healthy cows on farm²³, a situation that has never been found in Europe.

Another comparative study performed on ESBL-producing *E. coli* in horses between Sweden and France revealed a particular epidemiology of plasmids carrying the *bla*_{CTX-M-1} gene. Similar IncHI1 plasmids differing by only a few nucleotides were detected in both countries, and in about 80% of the ESBL-producing *E. coli*²⁴. A similar observation was made in Czech Republic, Denmark and the Netherlands.

Finally, a comparison between ESBL-producing *E. coli* from Brazil and France proved that the most frequent ESBL enzymes found in dogs were those dominating in humans in each country, namely CTX-M-15 in France and CTX-M-8 in Brazil^{25,26}. The *bla*_{ESBL}-carrying plasmids circulating in Brazil mostly belonged to the IncI1 type that had already been reported in Brazilian dogs (especially the IncI1/ST113 subtype), and which differs from the IncF plasmid more frequently found in France²⁷.

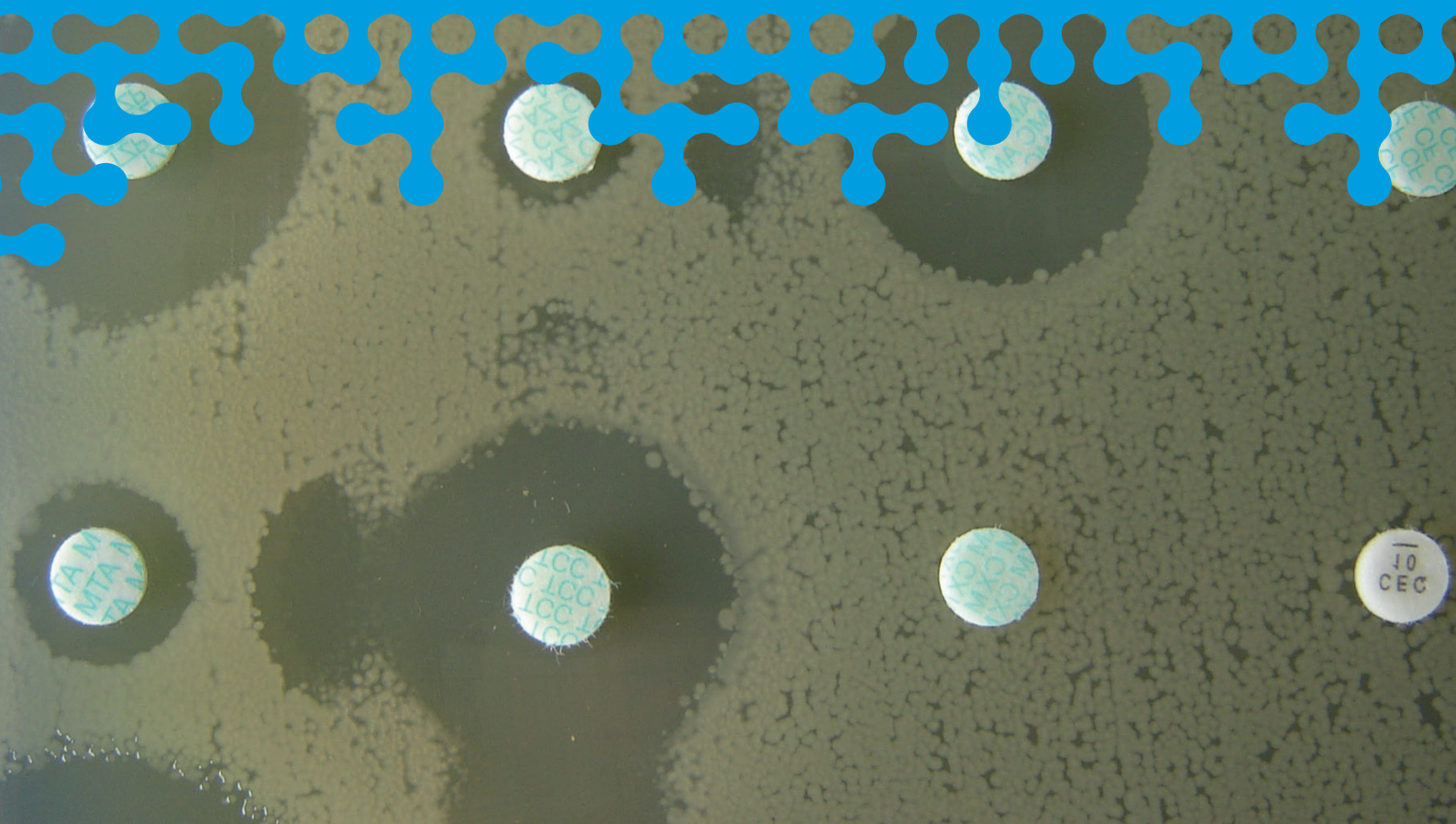
These studies are only few examples of similarities and discrepancies between resistance determinants (clones, plasmids) spreading in France or in other countries in the animal sector. Such studies are of help in formulating hypotheses on the distribution of these genetic determinants, their transmission from or to humans, correlations with antibiotic use or the impact of animal trade in disseminating resistance genes and resistant bacteria.

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- ¹⁹ Saidani M, Messadi L, Soudani A, Daaloul-Jedidi M, Châtre P, Ben Chehida F, Mamlouk A, Mahjoub W, Madec J.-Y., Haenni M. (2018). Epidemiology, Antimicrobial Resistance, and Extended-Spectrum Beta-Lactamase-Producing Enterobacteriaceae in Clinical Bovine Mastitis in Tunisia. *Microbial Drug Resistance*, 24 (8): 1242-1248.
- ²⁰ Grami R., Dahmen S., Mansour W., Mehri W., Haenni M., Aouni M., Madec J.-Y. (2014). *bla*_{CTX-M-15}-carrying F2:A-B- plasmid in *Escherichia coli* from cattle milk in Tunisia. *Microbial Drug Resistance*, 20(4): 344-349
- ²¹ Dahmen S., Métayer V., Gay E., Madec J.-Y., Haenni M. (2013). [Characterization of extended-spectrum beta-lactamase \(ESBL\)-carrying plasmids and clones of Enterobacteriaceae causing cattle mastitis in France](#). *Veterinary Microbiology*, 162: 793-799.
- ²² Diab M., Hamze M., Madec J.-Y., Haenni M. (2017). High Prevalence of Non-ST131 CTX-M-15-Producing *Escherichia coli* in Healthy Cattle in Lebanon. *Microbial Drug Resistance*, 23(2): 261-266
- ²³ Diab M., Hamze M., Bonnet R., Saras E., Madec J.-Y., Haenni M. (2017). OXA-48 and CTX-M-15 extended-spectrum beta-lactamases in raw milk in Lebanon: epidemic spread of dominant *Klebsiella pneumoniae* clones. *Journal of Medical Microbiology*, 66 (11): 1688-1691.
- ²⁴ Lupo A., Haenni M., Saras E., Gradin J., Madec J.-Y., Börjesson S. (2018) Is *bla*_{CTX-M-1} riding the same plasmid among horses in Sweden and France? *Microbial Drug Resistance* 24 (10): 1580-1586.
- ²⁵ Melo L. C., Oresco C., Leigue L., Netto H. M., Melville P. A., Benites N. R., Saras E., Haenni M., Lincopan N., Madec J.-Y. (2018). Prevalence and molecular features of ESBL/pAmpC-producing Enterobacteriaceae in healthy and diseased companion animals in Brazil. *Veterinary Microbiology*, 221: 59-66.
- ²⁶ Dahmen S, Haenni M, Châtre P, Madec JY. (2013). [Characterization of *bla*_{CTX-M}/IncFII plasmids and clones of *Escherichia coli* from pets in France](#). *Journal of Antimicrobial Chemotherapy*, 68(12): 2797-2801.
- ²⁷ Dahmen S., Haenni M. and Madec J.-Y. (2012) IncI1/ST3 plasmids contribute to the dissemination of the *bla*_{CTX-M-1} gene in *Escherichia coli* from several animal species in France. *Journal of Antimicrobial Chemotherapy*, 67(12): 3011-3012.



Annex 1

List of the RESAPATH laboratories



Laboratories members

Laboratoire Départemental d'Analyses - BOURG EN BRESSE (01)
Eurofins Laboratoire Cœur de France - MOULINS (03)
Laboratoire Départemental Vétérinaire et Hygiène Alimentaire - GAP (05)
Laboratoire Vétérinaire Départemental - SOPHIA ANTIPOLIS (06)
Laboratoire Départemental d'Analyses - HAGNICOURT (08)
Laboratoire Départemental d'Analyses - TROYES (10)
Aveyron Labo - RODEZ (12)
Laboratoire Départemental d'Analyses - MARSEILLE (13)
ANSES Laboratoire de pathologie équine de Dozulé - GOUSTRANVILLE (14)
LABEO Frank Duncombe - CAEN (14)
Laboratoire Départemental d'Analyses et de Recherches - AURILLAC (15)
Laboratoire Départemental d'Analyses de la Charente - ANGOULEME (16)
Laboratoire Départemental d'Analyses - BOURGES (18)
Laboratoire Départemental de la Côte d'Or - DIJON (21)
LABOCEA Ploufragan - PLOUFRAGAN (22)
LABOFARM - LOUDEAC (22)
Laboratoire Départemental d'Analyse - (23) AJAIN
Laboratoire Départemental d'Analyse et de Recherche - COULOUNIEUX CHAMIERES (24)
Laboratoire Vétérinaire Départemental - BESANCON (25)
LBAA - BOURG DE PEAGE (26)
ALCYON - LANDERNEAU (29)
LABOCEA Quimper - QUIMPER (29)
Laboratoire Départemental d'Analyses - NIMES (30)
SOCSA Analyse - L'UNION (31)
Laboratoire Départemental Vétérinaire et des Eaux - AUCH (32)
Laboratoire Départemental Vétérinaire - MONTPELLIER (34)
Bio-Chêne Vert - CHATEAUBOURG (35)
Biovilaine - REDON (35)
LABOCEA- FOUGERES (35)
Laboratoire de Touraine - TOURS (37)
Laboratoire Vétérinaire Départemental - GRENOBLE (38)
Laboratoire Départemental d'Analyses - POLIGNY (39)
Laboratoire des Pyrénées et des Landes - MONT-DE-MARSAN (40)
Laboratoire TERANA LOIRE- MONTBRISON (42)
INOVALYS Nantes - NANTES (44)
Laboratoire Départemental d'Analyses - MENDE (48)
INOVALYS Angers - ANGERS (49)
Laboratoire HGRTS Pays de Loire - MAUGES SUR LOIRE (49)
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Laboratoire Vétérinaire et Alimentaire - MALZEVILLE (54)
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Laboratoire RESALAB-Bretagne - GUENIN (56)
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 TERANA Puy-de-Dôme- LEMPDES (63)
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 Laboratoire Vétérinaire Départemental - LIMOGES (87)
 Laboratoire Vétérinaire Départemental - EPINAL (88)
 Laboratoire de bactériologie – Biopôle ALFORT - MAISONS-ALFORT (94)
 VEBIO - ARCUEIL (94)



Annex 2

Cattle

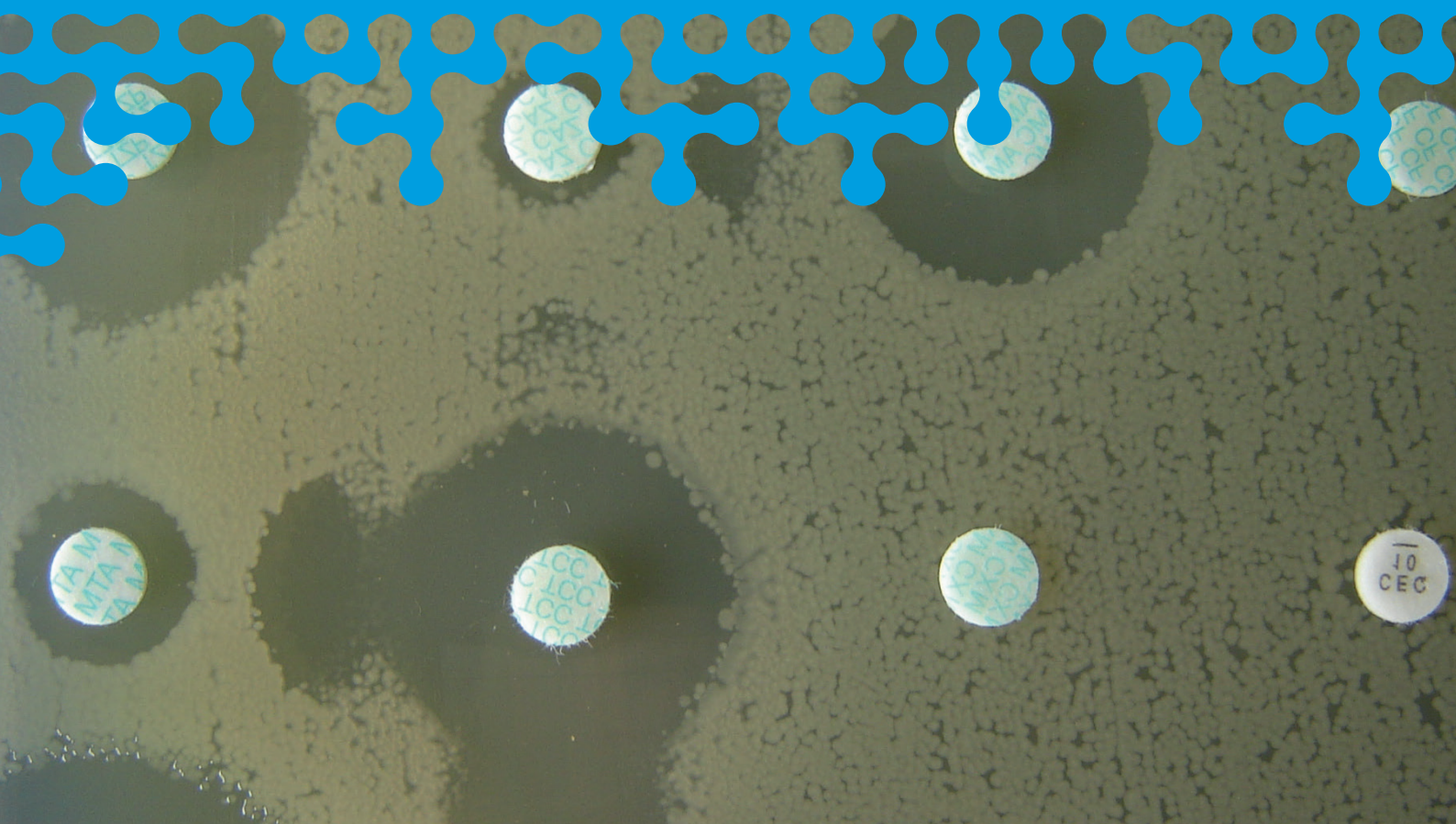
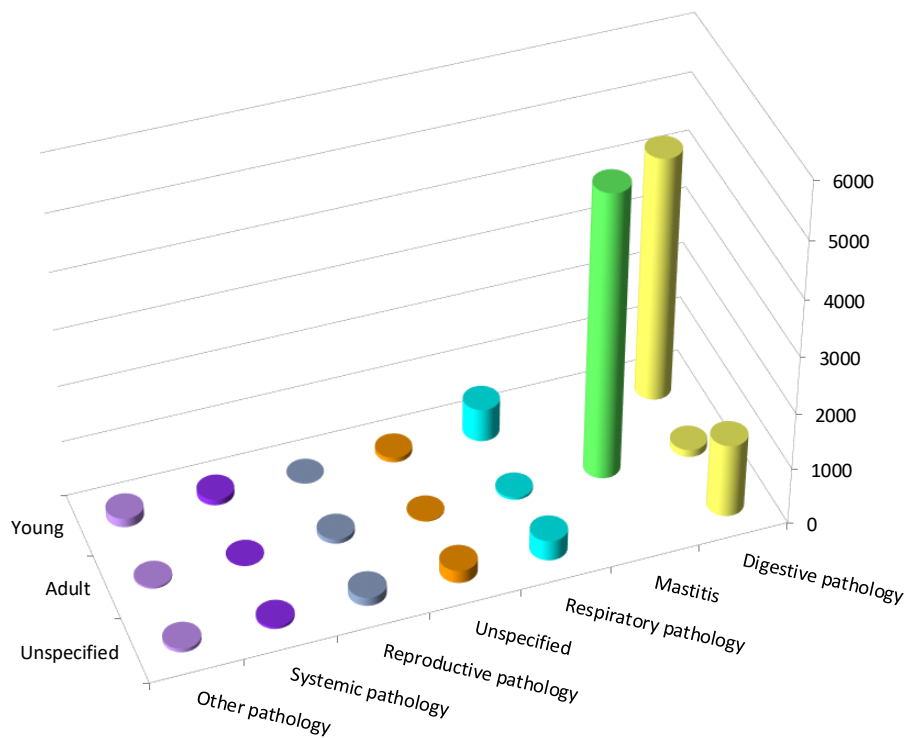


Figure 1 - Cattle 2018 – Number of antibiograms by age group and pathology

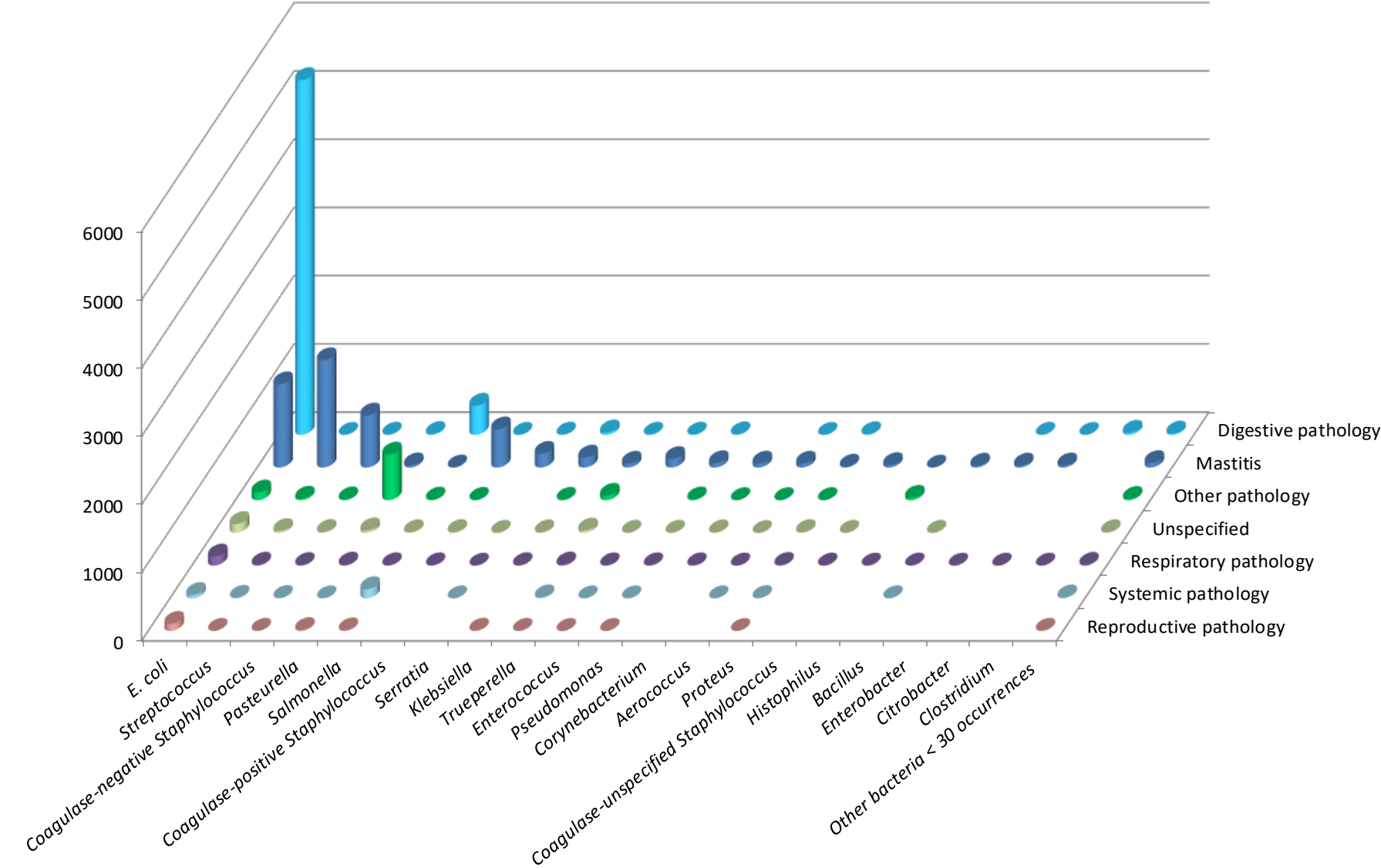


Note: all values are detailed in table 1 (including other pathologies, representing less than 1%, grouped together)

Table 1 - Cattle 2018 – Number of antibiograms by age group and pathology

Pathology N (%)	Age group N (%)			Total N (%)
	Adult	Young	Unspecified	
Digestive pathology	128 (1.00)	4,339 (34.05)	1,291 (10.13)	5,758 (45.18)
Mastitis	5,055 (39.67)			5,055 (39.67)
Respiratory pathology	42 (0.33)	582 (4.57)	356 (2.79)	980 (7.69)
Unspecified	15 (0.12)	81 (0.64)	222 (1.74)	318 (2.50)
Reproductive pathology	81 (0.64)	1 (0.01)	149 (1.17)	231 (1.81)
Systemic pathology	5 (0.04)	104 (0.82)	43 (0.34)	152 (1.19)
Septicemia		74 (0.58)	6 (0.05)	80 (0.63)
Kidney and urinary tract pathology	10 (0.08)	18 (0.14)	18 (0.14)	46 (0.36)
Arthritis	6 (0.05)	15 (0.12)	13 (0.10)	34 (0.27)
Omphalitis		26 (0.20)		26 (0.2)
Nervous system pathology	3 (0.02)	13 (0.10)	6 (0.05)	22 (0.17)
Skin and soft tissue infections	10 (0.08)	1 (0.01)	8 (0.06)	19 (0.15)
Cardiac pathology		7 (0.05)	5 (0.04)	12 (0.09)
Ocular pathology	1 (0.01)	2 (0.02)	7 (0.05)	10 (0.08)
Oral pathology		1 (0.01)		1 (0.01)
Total N (%)	5,356 (42.03)	5,264 (41.31)	2,124 (16.67)	12,744 (100.00)

Figure 2 - Cattle 2018 – Number of antibiograms by bacteria and pathology (all age groups included)



Note: only values for pathologies >1% and bacterial groups having more than 30 occurrences are represented. Detailed values are presented in table 2 below.

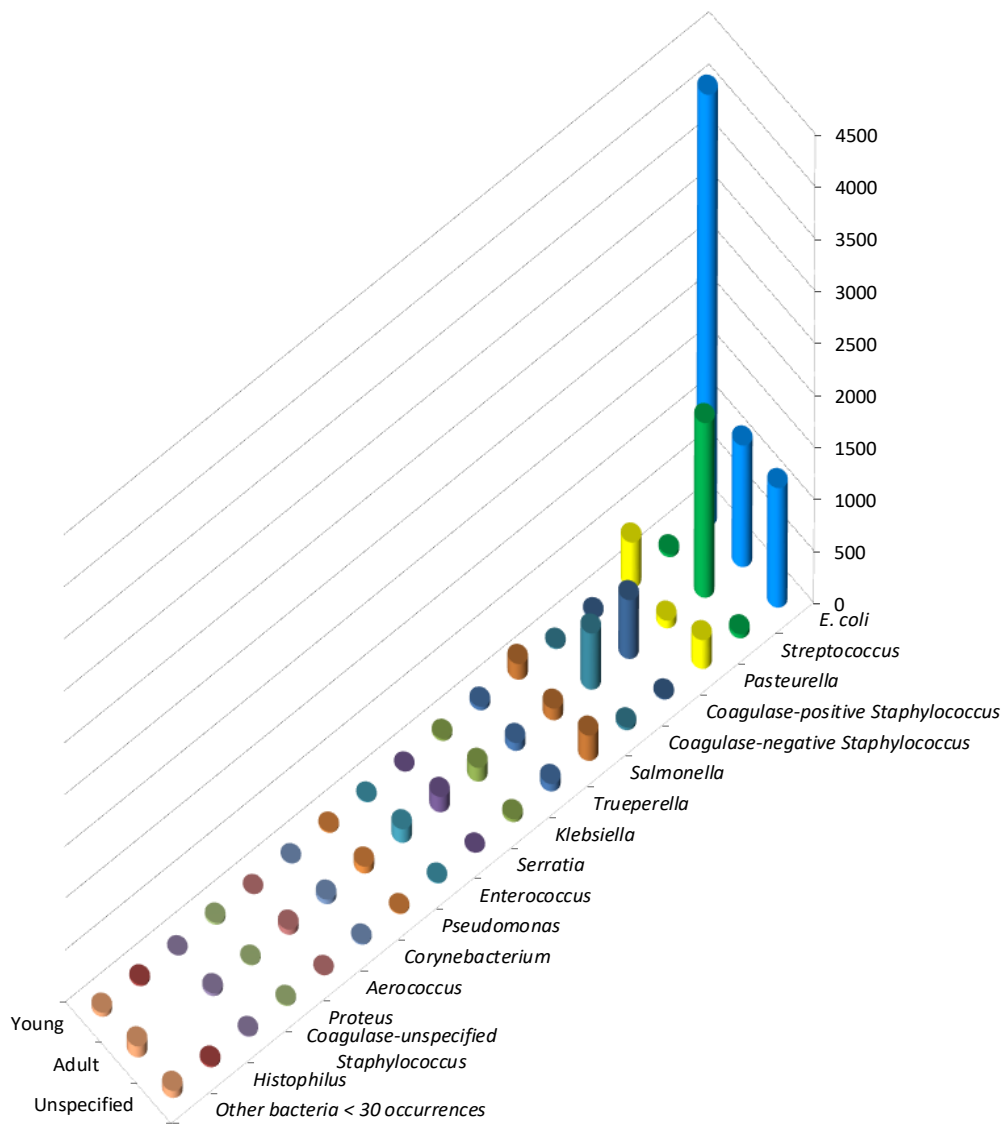
Table 2, part1 - Cattle 2018 – Number of antibiograms by bacteria and pathology (all age groups included)

Bacteria N (%)	Pathology N (%)															Total N (%)
	Digestive pathology	Mastitis	Respiratory pathology	Unspecified	Reproductive pathology	Systemic pathology	Septicemia	Kidney and urinary tract pathology	Arthritis	Omphalitis	Nervous system pathology	Skin and soft tissue infections	Cardiac pathology	Ocular pathology	Oral pathology	
<i>E. coli</i>	5,199 (40.8)	1,220 (9.57)	114 (0.89)	129 (1.01)	49 (0.38)	105 (0.82)	62 (0.49)	30 (0.24)	10 (0.08)	10 (0.08)	13 (0.10)	1 (0.01)	7 (0.05)			6,949 (54.53)
<i>Streptococcus</i>	1 (0.01)	1,572 (12.34)	23 (0.18)	27 (0.21)	7 (0.05)	3 (0.02)	1 (0.01)	3 (0.02)	2 (0.02)	3 (0.02)	1 (0.01)	2 (0.02)		1 (0.01)	1 (0.01)	1,647 (12.92)
<i>Coagulase-negative Staphylococcus</i>	3 (0.02)	762 (5.98)	13 (0.10)	14 (0.11)	5 (0.04)	4 (0.03)			2 (0.02)	2 (0.02)		2 (0.02)	1 (0.01)	2 (0.02)		810 (6.36)
<i>Pasteurella</i>	12 (0.09)	32 (0.25)	670 (5.26)	38 (0.30)	1 (0.01)	13 (0.1)	6 (0.05)	2 (0.02)	3 (0.02)	1 (0.01)	1 (0.01)		2 (0.02)			781 (6.13)
<i>Salmonella</i>	427 (3.35)	2 (0.02)	9 (0.07)	10 (0.08)	133 (1.04)	10 (0.08)	4 (0.03)	1 (0.01)			1 (0.01)					597 (4.68)
<i>Coagulase positive Staphylococcus</i>	1 (0.01)	559 (4.39)	6 (0.05)	12 (0.09)					1 (0.01)			4 (0.03)				583 (4.57)
<i>Serratia</i>	3 (0.02)	201 (1.58)		2 (0.02)	1 (0.01)			1 (0.01)								208 (1.63)
<i>Klebsiella</i>	35 (0.27)	146 (1.15)	6 (0.05)	8 (0.06)		6 (0.05)	5 (0.04)		1 (0.01)		1 (0.01)					208 (1.63)
<i>Trueperella</i>	2 (0.02)	56 (0.44)	65 (0.51)	35 (0.27)	14 (0.11)	3 (0.02)		2 (0.02)	9 (0.07)	2 (0.02)	1 (0.01)	2 (0.02)		1 (0.01)		192 (1.51)
<i>Enterococcus</i>	3 (0.02)	124 (0.97)		3 (0.02)	1 (0.01)	1 (0.01)			1 (0.01)			1 (0.01)	2 (0.02)			136 (1.07)
<i>Pseudomonas</i>	8 (0.06)	64 (0.50)	12 (0.09)	4 (0.03)	1 (0.01)	2 (0.02)	1 (0.01)		1 (0.01)	1 (0.01)	2 (0.02)					96 (0.75)
<i>Corynebacterium</i>		58 (0.46)	2 (0.02)	8 (0.06)				1 (0.01)	1 (0.01)	1 (0.01)		2 (0.02)				73 (0.57)
<i>Aerococcus</i>	1 (0.01)	56 (0.44)	2 (0.02)	1 (0.01)	1 (0.01)			2 (0.02)								63 (0.49)
<i>Proteus</i>	10 (0.08)	13 (0.10)	3 (0.02)	12 (0.09)	4 (0.03)	1 (0.01)	1 (0.01)	2 (0.02)	1 (0.01)	4 (0.03)		2 (0.02)				53 (0.42)
<i>Coagulase-unspecified Staphylococcus</i>		36 (0.28)		3 (0.02)				1 (0.01)				1 (0.01)				41 (0.32)

Table 2. part2 - Cattle 2018 – Number of antibiograms by bacteria and pathology (all age groups included)

Bacteria N (%)	Pathology N (%)															Total N (%)
	Digestive pathology	Mastitis	Respiratory pathology	Unspecified	Reproductive pathology	Systemic pathology	Septicemia	Kidney and urinary tract pathology	Arthritis	Omphalitis	Nervous system pathology	Skin and soft tissue infections	Cardiac pathology	Ocular pathology	Oral pathology	
<i>Histophilus</i>		1 (0.01)	36 (0.28)													37 (0.29)
<i>Bacillus</i>		27 (0.21)		2 (0.02)	2 (0.02)				1 (0.01)			1 (0.01)				33 (0.26)
<i>Enterobacter</i>	2 (0.02)	29 (0.23)							1 (0.01)							32 (0.25)
<i>Citrobacter</i>	1 (0.01)	31 (0.24)														32 (0.25)
<i>Clostridium</i>	31 (0.24)															31 (0.24)
<i>Other bacteria < 30 occurrences</i>	19 (0.15)	66 (0.52)	19 (0.15)	10 (0.08)	12 (0.09)	4 (0.03)		1 (0.01)		2 (0.02)	2 (0.02)	1 (0.01)		6 (0.05)		142 (1.11)
Total N (%)	5,758 (45.18)	5,055 (39.67)	980 (7.69)	318 (2.50)	231 (1.81)	152 (1.19)	80 (0.63)	46 (0.36)	34 (0.27)	26 (0.20)	22 (0.17)	19 (0.15)	12 (0.09)	10 (0.08)	1 (0.01)	12,744 (100.00)

Figure 3 - Cattle 2018 – Number of antibiograms by bacteria and age group



Note: only bacterial groups having more than 30 occurrences are represented. Detailed values are presented in table 3 below.

Table 3 - Cattle 2018 – Number of antibiograms by bacteria and age group

Bacteria N (%)	Age group N (%)			Total N (%)
	Adult	Young	Unspecified	
<i>E. coli</i>	1,311 (10.29)	4,450 (34.92)	1,188 (9.32)	6,949 (54.53)
<i>Streptococcus</i>	1,582 (12.41)	23 (0.18)	42 (0.33)	1,647 (12.92)
<i>Coagulase-negative Staphylococcus</i>	769 (6.03)	12 (0.09)	29 (0.23)	810 (6.36)
<i>Pasteurella</i>	67 (0.53)	457 (3.59)	257 (2.02)	781 (6.13)
<i>Salmonella</i>	98 (0.77)	148 (1.16)	351 (2.75)	597 (4.68)
<i>Coagulase-positive Staphylococcus</i>	560 (4.39)	4 (0.03)	19 (0.15)	583 (4.57)
<i>Serratia</i>	202 (1.59)	2 (0.02)	4 (0.03)	208 (1.63)
<i>Klebsiella</i>	146 (1.15)	40 (0.31)	22 (0.17)	208 (1.63)
<i>Trueperella</i>	80 (0.63)	46 (0.36)	66 (0.52)	192 (1.51)
<i>Enterococcus</i>	125 (0.98)	2 (0.02)	9 (0.07)	136 (1.07)
<i>Pseudomonas</i>	65 (0.51)	10 (0.08)	21 (0.16)	96 (0.75)
<i>Corynebacterium</i>	63 (0.49)	4 (0.03)	6 (0.05)	73 (0.57)
<i>Aerococcus</i>	58 (0.46)	1 (0.01)	4 (0.03)	63 (0.49)
<i>Proteus</i>	19 (0.15)	18 (0.14)	16 (0.13)	53 (0.42)
<i>Coagulase-unspecified Staphylococcus</i>	37 (0.29)		4 (0.03)	41 (0.32)
<i>Histophilus</i>	2 (0.02)	20 (0.16)	15 (0.12)	37 (0.29)
<i>Bacillus</i>	29 (0.23)		4 (0.03)	33 (0.26)
<i>Enterobacter</i>	31 (0.24)	1 (0.01)		32 (0.25)
<i>Citrobacter</i>	31 (0.24)	1 (0.01)		32 (0.25)
<i>Clostridium</i>		5 (0.04)	26 (0.20)	31 (0.24)
<i>Other bacteria < 30 occurrences</i>	81 (0.64)	20 (0.16)	41 (0.32)	142 (1.11)
Total N (%)	5,356 (42.03)	5,264 (41.31)	2,124 (16.67)	12,744 (100.00)

Table 4 - Cattle 2018 – Digestive pathology – Young animals – *E. coli*: susceptibility to antibiotics (proportion)
(N= 4,148)

Antibiotic	Total (N)	% S
Amoxicillin	4,048	17
Amoxicillin-Clavulanic ac.	4,142	44
Cephalexin	3,611	84
Cephalothin	841	77
Cefoxitin	3,641	91
Cefuroxime	1,829	83
Cefoperazone	1,100	92
Cefovecin	75	96
Ceftiofur	4,120	97
Cefquinome 30 µg	3,832	94
Streptomycin 10 UI	2,501	17
Spectinomycin	1,567	55
Kanamycin 30 UI	1,349	38
Gentamicin 10 UI	4,117	81
Neomycin	3,041	48
Apramycin	2,057	94
Tetracycline	3,931	24
Doxycycline	225	12
Chloramphenicol	202	56
Florfenicol	2,971	76
Nalidixic ac.	2,528	70
Oxolinic ac.	712	69
Flumequine	1,443	68
Enrofloxacin	3,537	91
Marbofloxacin	3,003	91
Danofloxacin	1,171	91
Sulfonamides	892	22
Trimethoprim	517	62
Trimethoprim-Sulfonamides	4,146	60

Table 5 - Cattle 2018 – Mastitis – Adults – *E. coli*: susceptibility to antibiotics (proportion) (N= 1,220)

Antibiotic	Total (N)	% S
Amoxicillin	1,193	66
Amoxicillin-Clavulanic ac.	1,219	77
Cephalexin	1,113	86
Cephalothin	351	89
Cefoxitin	1,083	95
Cefuroxime	593	92
Cefoperazone	737	98
Cefovecin	108	97
Ceftiofur	1,103	99
Cefquinome 30 µg	1,067	99
Streptomycin 10 UI	745	72
Spectinomycin	234	92
Kanamycin 30 UI	546	88
Gentamicin 10 UI	1,216	98
Neomycin	778	88
Apramycin	395	99
Tetracycline	1,076	76
Chloramphenicol	58	88
Florfenicol	787	94
Nalidixic ac.	811	96
Oxolinic ac.	163	95
Flumequine	324	89
Enrofloxacin	1,040	99
Marbofloxacin	1,005	99
Danofloxacin	387	99
Sulfonamides	258	75
Trimethoprim	223	82
Trimethoprim-Sulfonamides	1,176	87

Table 6 - Cattle 2018 – All pathologies and age groups included – *Salmonella* Typhimurium: susceptibility to antibiotics (proportion) (N= 241)

Antibiotic	Total (N)	% S
Amoxicillin	238	17
Amoxicillin-Clavulanic ac.	241	51
Cephalexin	226	99
Cephalothin	77	95
Cefoxitin	221	99
Cefuroxime	110	95
Cefoperazone	90	58
Ceftiofur	238	100
Cefquinome 30 µg	189	100
Streptomycin 10 UI	130	8
Spectinomycin	100	49
Kanamycin 30 UI	84	94
Gentamicin 10 UI	223	97
Neomycin	188	95
Apramycin	138	99
Tetracycline	232	16
Florfenicol	207	55
Nalidixic ac.	137	88
Oxolinic ac.	83	95
Flumequine	93	96
Enrofloxacin	214	99
Marbofloxacin	214	100
Danofloxacin	89	98
Sulfonamides	69	0
Trimethoprim	58	95
Trimethoprim-Sulfonamides	241	94

Table 7 - Cattle 2018 – All pathologies and age groups included – *Salmonella* Mbandaka: susceptibility to antibiotics (proportion) (N= 79)

Antibiotic	Total (N)	% S
Amoxicillin	77	97
Amoxicillin-Clavulanic ac.	79	99
Cephalexin	77	97
Cephalothin	53	94
Cefoxitin	79	100
Cefuroxime	54	98
Cefoperazone	64	100
Ceftiofur	78	100
Cefquinome 30 µg	70	100
Streptomycin 10 UI	60	82
Kanamycin 30 UI	60	100
Gentamicin 10 UI	79	100
Neomycin	79	100
Tetracycline	79	97
Florfenicol	79	100
Nalidixic ac.	54	100
Enrofloxacin	79	100
Marbofloxacin	78	100
Danofloxacin	63	100
Sulfonamides	58	81
Trimethoprim	54	96
Trimethoprim-Sulfonamides	79	97

Table 8 - Cattle 2018 – All pathologies and age groups included – *Salmonella* Montevideo: susceptibility to antibiotics (proportion) (N= 140)

Antibiotic	Total (N)	% S
Amoxicillin	131	99
Amoxicillin-Clavulanic ac.	140	99
Cephalexin	129	100
Cephalothin	97	100
Cefoxitin	140	99
Cefuroxime	100	97
Cefoperazone	117	100
Ceftiofur	139	100
Cefquinome 30 µg	138	100
Streptomycin 10 UI	118	92
Spectinomycin	30	93
Kanamycin 30 UI	117	97
Gentamicin 10 UI	140	99
Neomycin	134	97
Apramycin	40	100
Tetracycline	139	97
Florfenicol	136	99
Nalidixic ac.	108	100
Flumequine	31	97
Enrofloxacin	136	100
Marbofloxacin	135	100
Danofloxacin	115	100
Sulfonamides	97	99
Trimethoprim	89	99
Trimethoprim-Sulfonamides	139	99

Table 9 - Cattle 2018 – Respiratory pathology – Young animals – *Pasteurella multocida*: susceptibility to antibiotics (proportion) (N= 238)

Antibiotic	Total (N)	% S
Amoxicillin	232	99
Amoxicillin-Clavulanic ac.	229	99
Cephalexin	98	100
Ceftiofur	233	100
Cefquinome 30 µg	206	99
Streptomycin 10 UI	176	36
Kanamycin 30 UI	34	76
Gentamicin 10 UI	210	97
Neomycin	49	67
Tetracycline	227	63
Doxycycline	128	61
Florfenicol	235	100
Nalidixic ac.	87	87
Oxolinic ac.	115	61
Flumequine	142	70
Enrofloxacin	237	91
Marbofloxacin	204	99
Danofloxacin	31	100
Trimethoprim-Sulfonamides	237	88

Table 10 - Cattle 2018 – Respiratory pathology – Young animals – *Mannheimia haemolytica*: susceptibility to antibiotics (proportion) (N= 154)

Antibiotic	Total (N)	% S
Amoxicillin	150	90
Amoxicillin-Clavulanic ac.	139	97
Cephalexin	63	100
Ceftiofur	152	99
Cefquinome 30 µg	117	99
Streptomycin 10 UI	93	16
Gentamicin 10 UI	117	86
Neomycin	37	51
Tetracycline	149	75
Doxycycline	74	64
Florfenicol	152	98
Nalidixic ac.	67	76
Oxolinic ac.	55	75
Flumequine	86	80
Enrofloxacin	153	95
Marbofloxacin	117	98
Trimethoprim-Sulfonamides	154	95

Table 11 - Cattle 2018 – Mastitis – Adults – *Serratia Marcescens*: susceptibility to antibiotics (proportion)
(N= 172)

Antibiotic	Total (N)	% S
Amoxicillin-Clavulanic ac.	169	14
Cephalothin	56	5
Cefoxitin	150	27
Cefuroxime	78	4
Cefoperazone	108	98
Ceftiofur	168	98
Cefquinome 30 µg	161	100
Streptomycin 10 UI	120	55
Kanamycin 30 UI	89	100
Gentamicin 10 UI	172	100
Neomycin	112	98
Apramycin	49	100
Tetracycline	157	4
Florfenicol	103	91
Nalidixic ac.	101	99
Flumequine	72	94
Enrofloxacin	147	99
Marbofloxacin	144	100
Danofloxacin	62	98
Sulfonamides	32	100
Trimethoprim	31	100
Trimethoprim-Sulfonamides	164	99

Table 12 - Cattle 2018 – Mastitis – Adults – *Klebsiella pneumoniae*: susceptibility to antibiotics (proportion)
(N= 88)

Antibiotic	Total (N)	% S
Amoxicillin-Clavulanic ac.	88	84
Cefoxitin	73	93
Cefuroxime	38	95
Cefoperazone	53	98
Ceftiofur	71	99
Cefquinome 30 µg	77	97
Streptomycin 10 UI	65	85
Kanamycin 30 UI	34	97
Gentamicin 10 UI	88	99
Neomycin	53	100
Tetracycline	82	79
Florfenicol	48	100
Nalidixic ac.	49	98
Flumequine	35	94
Enrofloxacin	70	100
Marbofloxacin	71	100
Trimethoprim-Sulfonamides	85	92

Table 13 - Cattle 2018 – Mastitis – Adults – Coagulase-positive *Staphylococcus*: susceptibility to antibiotics (proportion) (N= 559)

Antibiotic	Total (N)	% S
Penicillin G	553	80
Cefoxitin	521	82
Oxacillin	56	96
Cefovecin	130	98
Erythromycin	495	95
Tylosin	379	98
Spiramycin	550	97
Lincomycin	547	96
Pirlimycin	53	94
Streptomycin 10 UI	436	91
Kanamycin 30 UI	351	99
Gentamicin 10 UI	543	99
Neomycin	344	99
Tetracycline	519	92
Florfenicol	177	99
Enrofloxacin	445	99
Marbofloxacin	499	99
Trimethoprim-Sulfonamides	482	100
Rifampicin	143	99

Table 14 - Cattle 2018 – Mastitis – Adults – Coagulase-negative *Staphylococcus*: susceptibility to antibiotics (proportion) (N= 762)

Antibiotic	Total (N)	% S
Penicillin G	758	73
Cefoxitin	706	94
Oxacillin	98	96
Cefovecin	138	96
Erythromycin	703	87
Tylosin	508	93
Spiramycin	755	92
Lincomycin	756	82
Pirlimycin	55	96
Streptomycin 10 UI	555	86
Kanamycin 30 UI	448	98
Gentamicin 10 UI	751	99
Neomycin	509	99
Tetracycline	731	87
Florfenicol	272	98
Enrofloxacin	633	99
Marbofloxacin	653	99
Trimethoprim-Sulfonamides	645	97
Rifampicin	239	97

Table 15 - Cattle 2018 – Mastitis – Adults – *Streptococcus uberis*: susceptibility to antibiotics (proportion)
(N= 1,250)

Antibiotic	Total (N)	% S
Oxacillin	1,052	88
Cefovecin	32	94
Erythromycin	1,178	85
Tulathromycin	31	90
Tylosin	761	79
Spiramycin	1,208	82
Lincomycin	1,215	82
Streptomycin 500 µg	1,089	86
Kanamycin 1000 µg	904	93
Gentamicin 500 µg	1,153	98
Tetracycline	1,139	80
Doxycycline	45	93
Florfenicol	457	96
Enrofloxacin	1,068	63
Marbofloxacin	1,001	92
Trimethoprim-Sulfonamides	1,164	78
Rifampicin	359	50

Table 16 - Cattle 2018 – Mastitis – Adults – *Streptococcus dysgalactiae*: susceptibility to antibiotics (proportion)
(N= 207)

Antibiotic	Total (N)	% S
Oxacillin	182	98
Erythromycin	184	84
Tylosin	140	86
Spiramycin	202	91
Lincomycin	201	88
Streptomycin 500 µg	176	97
Kanamycin 1000 µg	152	98
Gentamicin 500 µg	189	99
Tetracycline	183	19
Florfenicol	66	95
Enrofloxacin	172	53
Marbofloxacin	161	92
Trimethoprim-Sulfonamides	180	85
Rifampicin	57	54



Annex 3

Sheep

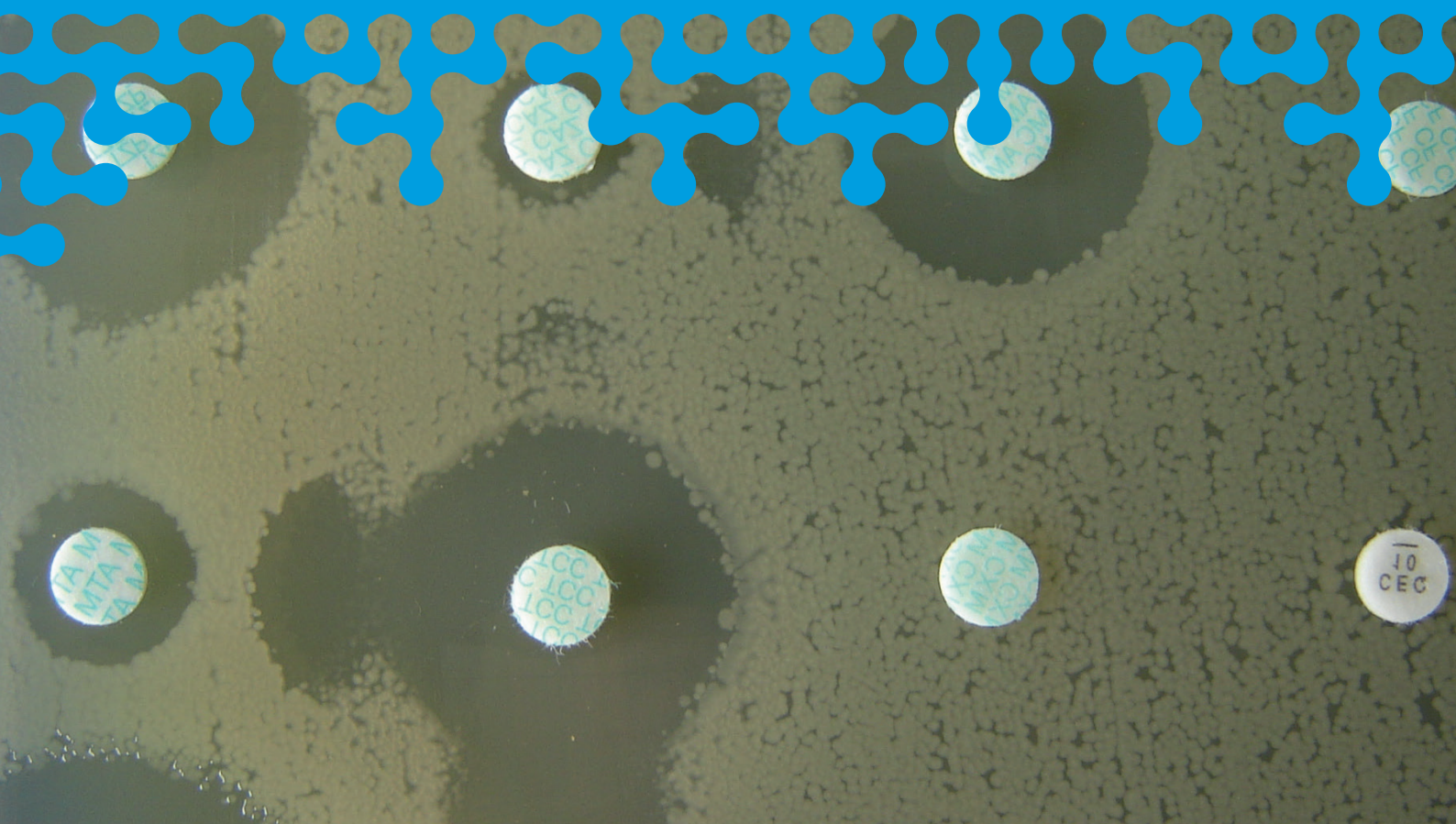
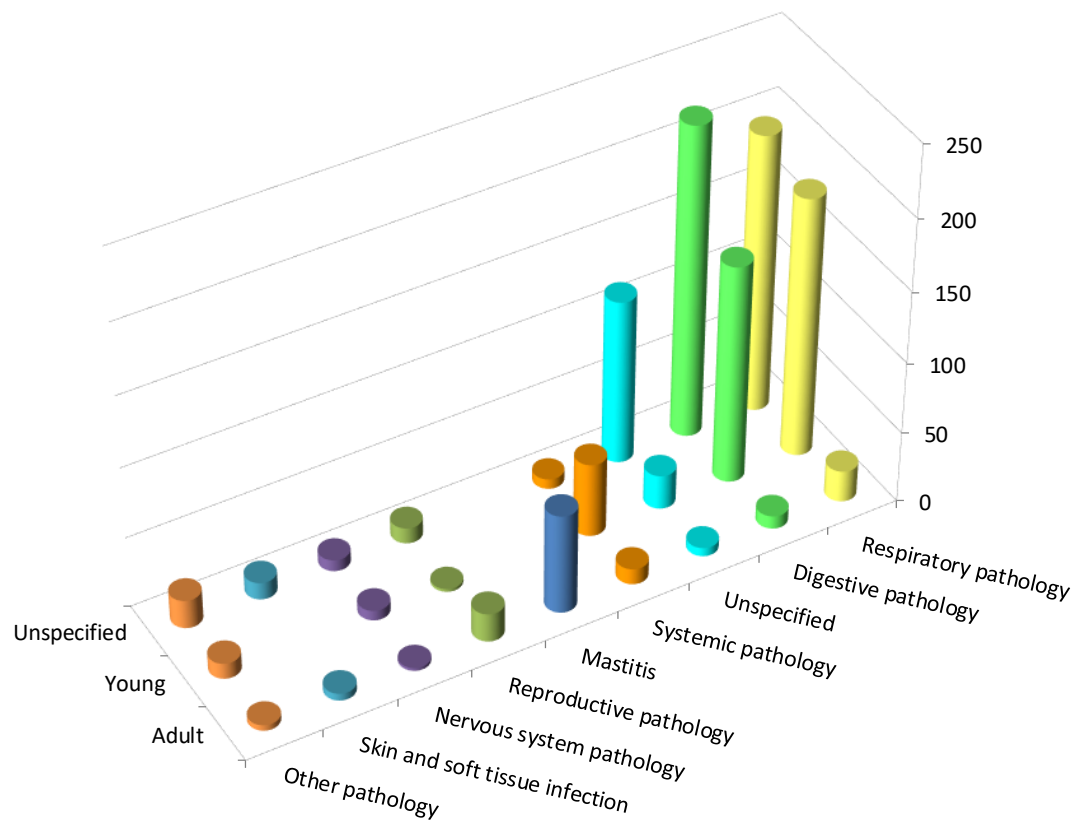


Figure 1 - Sheep 2018 – Number of antibiograms by age group and pathology

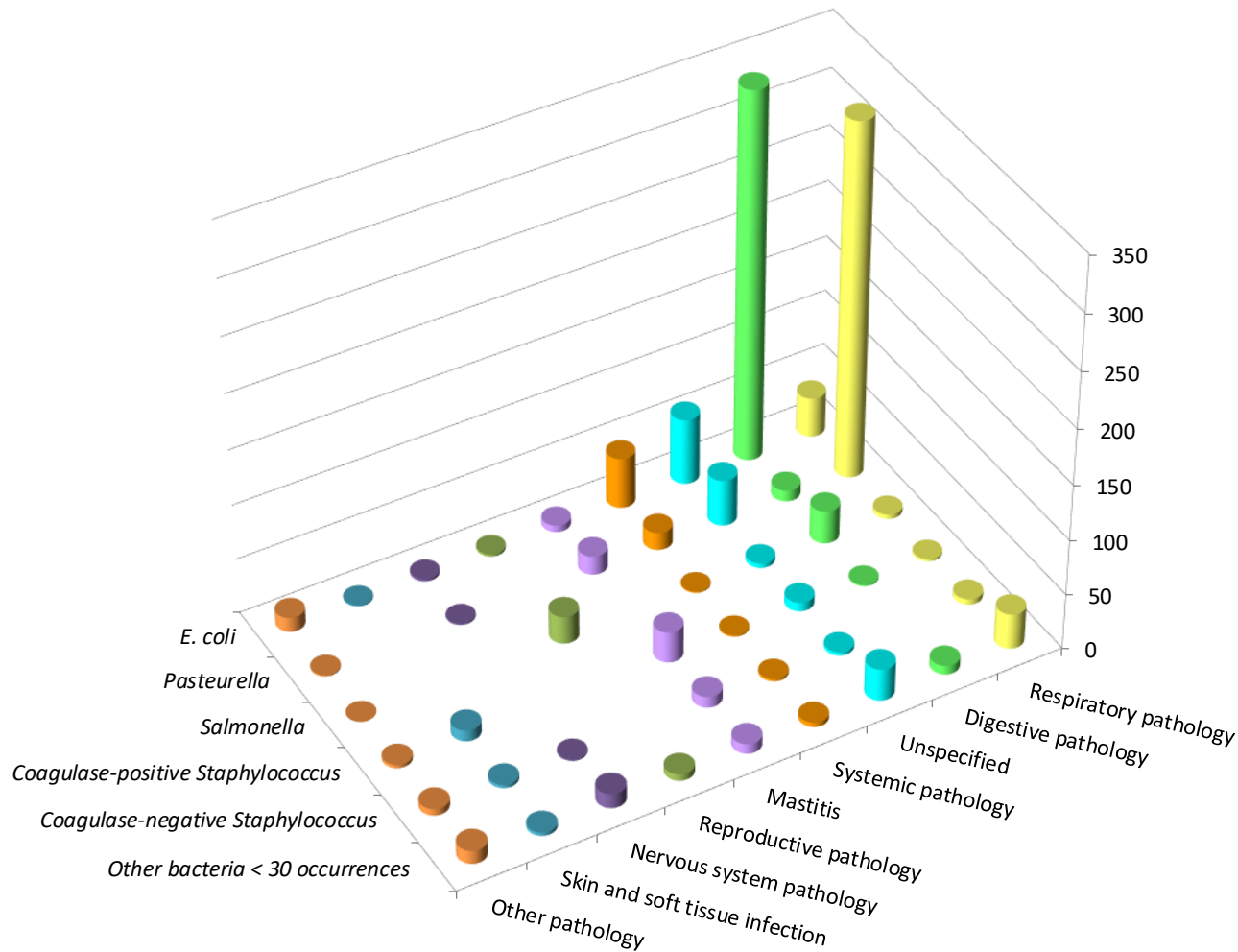


Note: all values are detailed in table 1 (including other pathologies. representing less than 1%, grouped together)

Table 1 - Sheep 2018 – Number of antibiograms by age group and pathology

Pathology N (%)	Age group N (%)			Total N (%)
	Unspecified	Young	Adult	
Respiratory pathology	196 (16.7)	183 (15.6)	22 (1.9)	401 (34.2)
Digestive pathology	220 (18.8)	154 (13.1)	9 (0.8)	383 (32.7)
Unspecified	116 (9.9)	24 (2)	6 (0.5)	146 (12.5)
Systemic pathology	7 (0.6)	52 (4.4)	11 (0.9)	70 (6.0)
Mastitis			70 (6)	70 (6.0)
Reproductive pathology	11 (0.9)	2 (0.2)	20 (1.7)	33 (2.8)
Nervous system pathology	8 (0.7)	7 (0.6)	2 (0.2)	17 (1.5)
Skin and soft tissue infections	12 (1)		5 (0.4)	17 (1.5)
Arthritis	8 (0.7)	1 (0.1)		9 (0.8)
Septicemia	2 (0.2)	6 (0.5)		8 (0.7)
Ocular pathology	3 (0.3)		4 (0.3)	7 (0.6)
Cardiac pathology	3 (0.3)	2 (0.2)		5 (0.4)
Kidney and urinary tract pathology	3 (0.3)	1 (0.1)		4 (0.3)
Bone pathology	1 (0.1)			1 (0.1)
Omphalitis		1 (0.1)		1 (0.1)
Total N (%)	590 (50.3)	433 (36.9)	149 (12.7)	1,172 (100.0)

Figure 2 - Sheep 2018 – Number of antibiograms by bacterial group and pathology



Note: only values for pathologies >1% and bacterial groups having more than 30 occurrences are represented. Detailed values are presented in table 2 below.

Table 2 - Sheep 2018 – Number of antibiograms by bacterial group and pathology

Bacteria N (%)	Pathology N (%)															Total N (%)
	Respiratory pathology	Digestive pathology	Unspecified	Systemic pathology	Mastitis	Reproductive pathology	Nervous system pathology	Skin and soft tissue infections	Arthritis	Septicemia	Ocular pathology	Cardiac pathology	Kidney and urinary tract pathology	Bone pathology	Omphalitis	
<i>E. coli</i>	36 (3.1)	334 (28.5)	60 (5.1)	46 (3.9)	6 (0.5)	2 (0.2)	2 (0.2)	1 (0.1)		6 (0.5)		3 (0.3)	3 (0.3)		1 (0.1)	500 (42.7)
<i>Pasteurella</i>	322 (27.5)	10 (0.9)	42 (3.6)	16 (1.4)	17 (1.5)		1 (0.1)			1 (0.1)						409 (34.9)
<i>Salmonella</i>	4 (0.3)	30 (2.6)	4 (0.3)	1 (0.1)		25 (2.1)										64 (5.5)
<i>Coagulase-positive Staphylococcus</i>	2 (0.2)	1 (0.1)	8 (0.7)	1 (0.1)	28 (2.4)			10 (0.9)	1 (0.1)	1 (0.1)	1 (0.1)					53 (4.5)
<i>Coagulase-negative Staphylococcus</i>	5 (0.4)		3 (0.3)	2 (0.2)	10 (0.9)		1 (0.1)	3 (0.3)			4 (0.3)	1 (0.1)		1 (0.1)		30 (2.6)
<i>Other bacteria < 30 occurrences</i>	32 (2.7)	8 (0.7)	29 (2.5)	4 (0.3)	9 (0.8)	6 (0.5)	13 (1.1)	3 (0.3)	8 (0.7)		2 (0.2)	1 (0.1)	1 (0.1)			116 (9.9)
Total N (%)	401 (34.2)	383 (32.7)	146 (12.5)	70 (6.0)	70 (6.0)	33 (2.8)	17 (1.5)	17 (1.5)	9 (0.8)	8 (0.7)	7 (0.6)	5 (0.4)	4 (0.3)	1 (0.1)	1 (0.1)	1,172 (100.0)

Table 3 - Sheep 2018 – Digestive pathology – *E. coli*: susceptibility to antibiotics (proportion) (N= 334)

Antibiotic	Total (N)	% S
Amoxicillin	332	45
Amoxicillin-Clavulanic ac.	333	66
Cephalexin	313	92
Cephalothin	44	77
Cefoxitin	294	98
Cefuroxime	69	94
Cefoperazone	39	100
Ceftiofur	332	99
Cefquinome 30 µg	284	99
Streptomycin 10 UI	265	41
Spectinomycin	68	93
Kanamycin 30 UI	46	91
Gentamicin 10 UI	332	95
Neomycin	154	91
Apramycin	58	98
Tetracycline	311	44
Florfenicol	264	89
Nalidixic ac.	293	92
Enrofloxacin	318	96
Marbofloxacin	129	99
Danofloxacin	58	98
Sulfonamides	73	44
Trimethoprim	34	71
Trimethoprim-Sulfonamides	334	61

Table 4 - Sheep 2018 – Respiratory pathology – All age groups – *Mannheimia haemolytica*: susceptibility to antibiotics (proportion) (N= 196)

Antibiotic	Total (N)	% S
Amoxicillin	191	98
Amoxicillin-Clavulanic ac.	182	99
Cephalexin	161	99
Cefoxitin	107	100
Ceftiofur	193	99
Cefquinome 30 µg	166	98
Streptomycin 10 UI	145	19
Gentamicin 10 UI	178	93
Neomycin	45	49
Tetracycline	192	91
Florfenicol	194	99
Nalidixic ac.	160	89
Enrofloxacin	191	95
Marbofloxacin	77	100
Danofloxacin	30	87
Trimethoprim-Sulfonamides	196	96



Annex 4

Goats

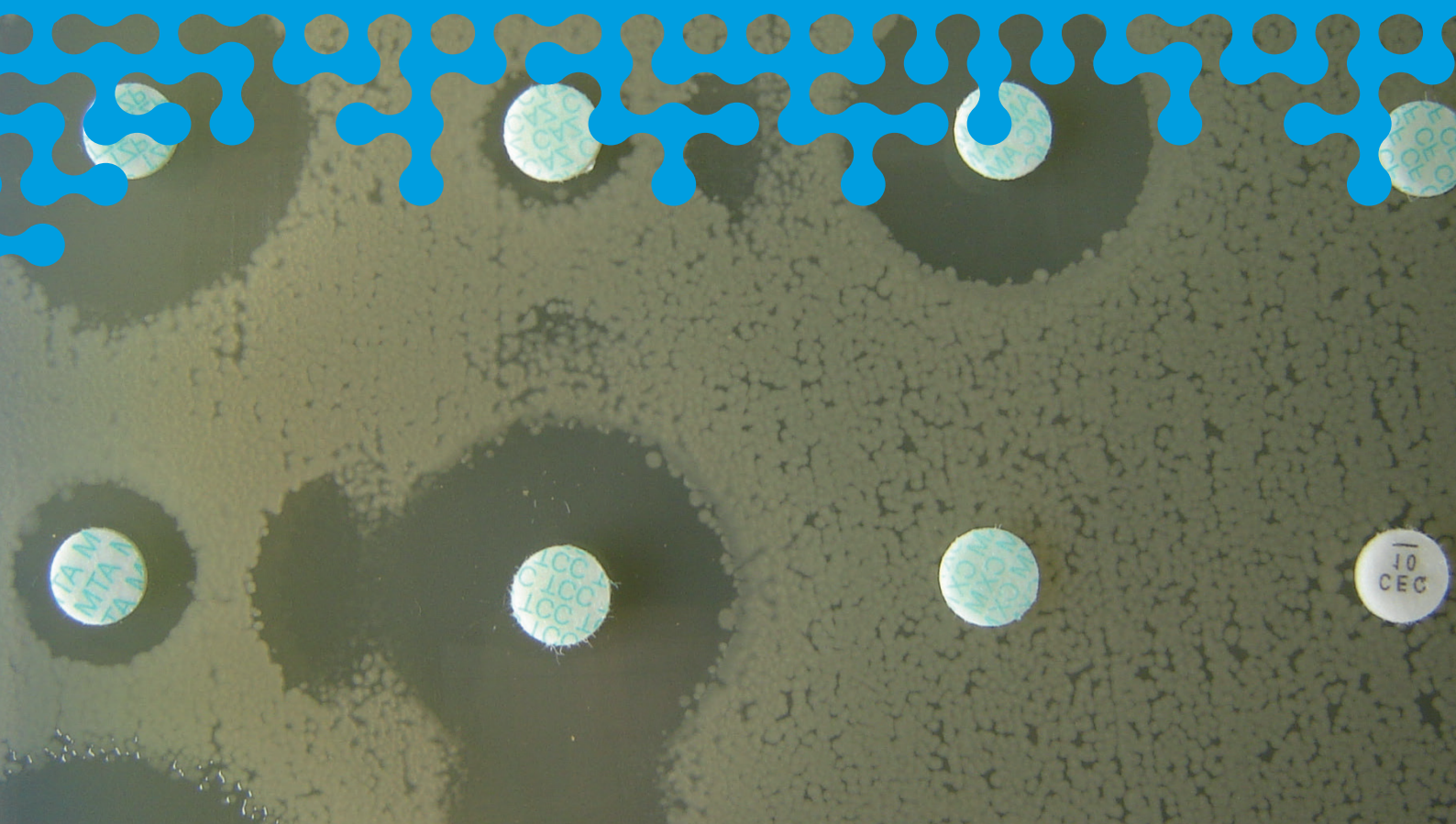
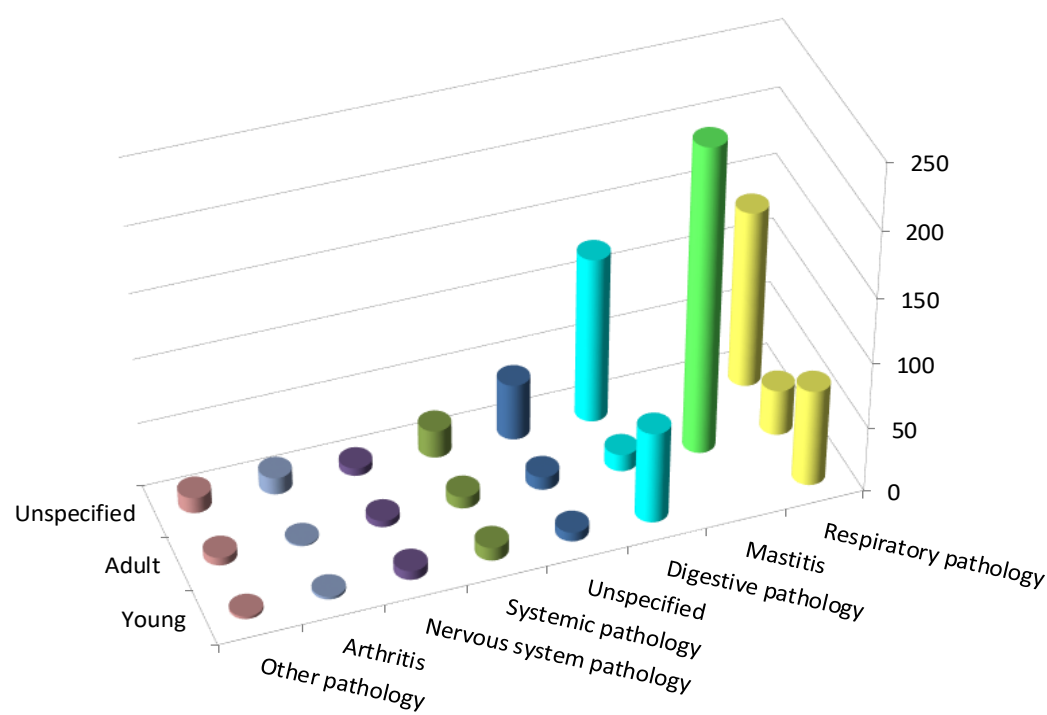


Figure 1 - Goats 2018 – Number of antibiograms by age group and pathology

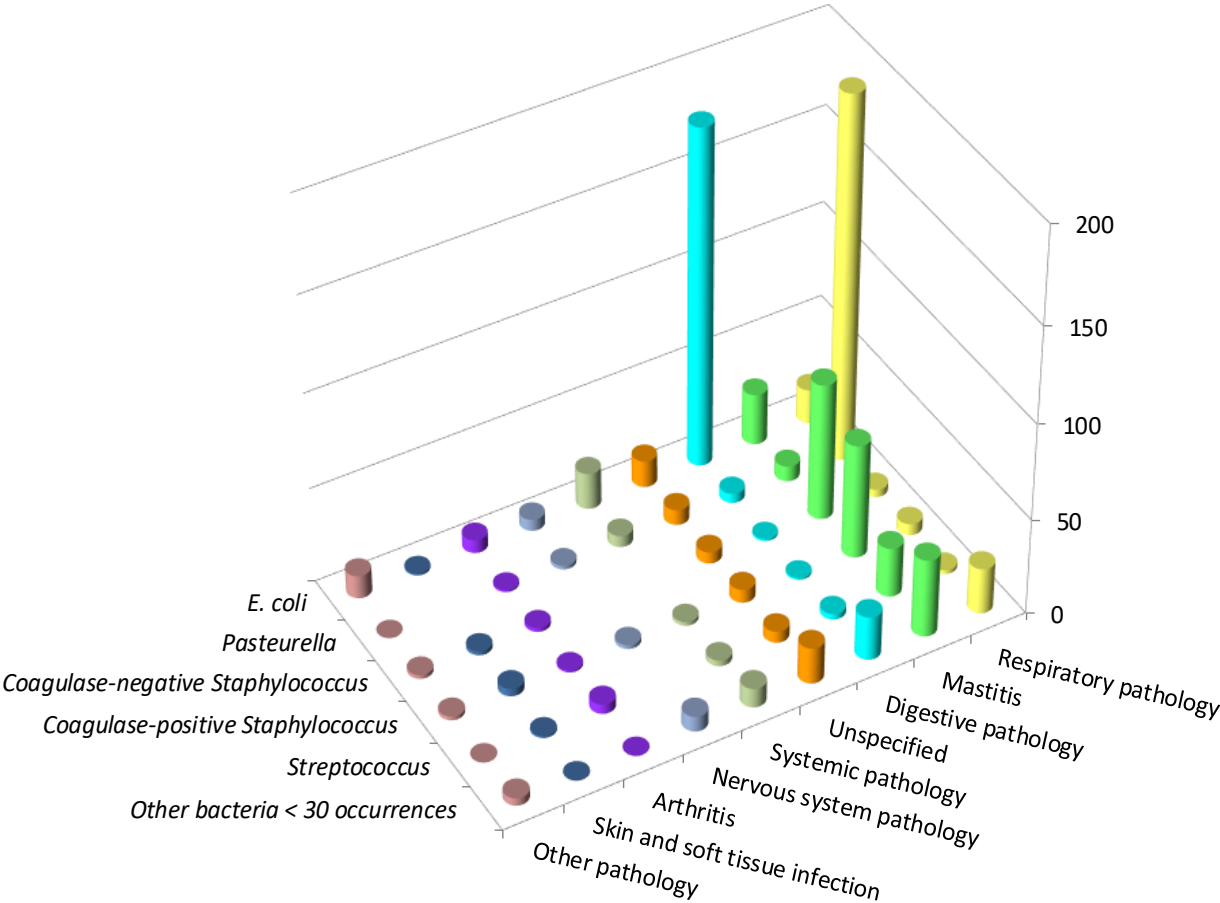


Note: all values are detailed in table 1 (including other pathologies. representing less than 1%. grouped together)

Table 1 - Goats 2018 – Number of antibiograms by age group and pathology

Pathology N (%)	Age group N (%)			Total N (%)
	Unspecified	Adult	Young	
Respiratory pathology	136 (16.0)	35 (4.1)	74 (8.7)	245 (28.8)
Mastitis		234 (27.5)		234 (27.5)
Digestive pathology	127 (14.9)	13 (1.5)	70 (8.2)	210 (24.7)
Unspecified	43 (5.1)	10 (1.2)	7 (0.8)	60 (7.1)
Systemic pathology	21 (2.5)	9 (1.1)	10 (1.2)	40 (4.7)
Nervous system pathology	6 (0.7)	5 (0.6)	7 (0.8)	18 (2.1)
Arthritis	13 (1.5)	1 (0.1)	2 (0.2)	16 (1.9)
Skin and soft tissue infections	4 (0.5)	3 (0.4)	1 (0.1)	8 (0.9)
Reproductive pathology	3 (0.4)	3 (0.4)		6 (0.7)
Kidney and urinary tract pathology	4 (0.5)	1 (0.1)		5 (0.6)
Otitis	2 (0.2)			2 (0.2)
Oral pathology		1 (0.1)	1 (0.1)	2 (0.2)
Cardiac pathology	2 (0.2)			2 (0.2)
Ocular pathology	1 (0.1)	1 (0.1)		2 (0.2)
Septicemia			1 (0.1)	1 (0.1)
Total N (%)	362 (42.5)	316 (37.1)	173 (20.3)	851 (100.0)

Figure 2 - Goats 2018 – Number of antibiograms by bacterial group and pathology



Note: only values for pathologies >1% and bacterial groups having more than 30 occurrences are represented. Detailed values are presented in table 2 below.

Table 2 - Goats 2018 – Number of antibiograms by bacterial group and pathology

Bacteria N (%)	Pathology N (%)															Total N (%)
	Respiratory pathology	Mastitis	Digestive pathology	Unspecified	Systemic pathology	Nervous system pathology	Arthritis	Skin and soft tissue infections	Reproductive pathology	Kidney and urinary tract pathology	Otitis	Oral pathology	Cardiac pathology	Ocular pathology	Septicemia	
<i>E. coli</i>	18 (2.1)	27 (3.2)	177 (20.8)	14 (1.6)	19 (2.2)	6 (0.7)	7 (0.8)	1 (0.1)	4 (0.5)	5 (0.6)		1 (0.1)	1 (0.1)		1 (0.1)	281 (33.0)
<i>Pasteurella</i>	191 (22.4)	8 (0.9)	5 (0.6)	8 (0.9)	6 (0.7)	2 (0.2)	1 (0.1)									221 (26.0)
<i>Coagulase-negative Staphylococcus</i>	4 (0.5)	72 (8.5)	1 (0.1)	6 (0.7)			2 (0.2)	2 (0.2)					1 (0.1)	1 (0.1)		89 (10.5)
<i>Coagulase-positive Staphylococcus</i>	6 (0.7)	60 (7.1)	1 (0.1)	7 (0.8)	2 (0.2)	2 (0.2)	1 (0.1)	4 (0.5)			1 (0.1)	1 (0.1)				85 (10.0)
<i>Streptococcus</i>	2 (0.2)	26 (3.1)	3 (0.4)	6 (0.7)	3 (0.4)		5 (0.6)	1 (0.1)								46 (5.4)
<i>Other bacteria < 30 occurrences</i>	24 (2.8)	41 (4.8)	23 (2.7)	19 (2.2)	10 (1.2)	8 (0.9)			2 (0.2)		1 (0.1)			1 (0.1)		129 (15.2)
Total N (%)	245 (28.8)	234 (27.5)	210 (24.7)	60 (7.1)	40 (4.7)	18 (2.1)	16 (1.9)	8 (0.9)	6 (0.7)	5 (0.6)	2 (0.2)	2 (0.2)	2 (0.2)	2 (0.2)	1 (0.1)	851 (100.0)

Table 3 - Goats 2018 – All pathologies and age groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 281)

Antibiotic	Total (N)	% S
Amoxicillin	280	47
Amoxicillin-Clavulanic ac.	281	68
Cephalexin	259	86
Cephalothin	124	83
Cefoxitin	254	95
Cefuroxime	148	95
Cefoperazone	127	97
Ceftiofur	278	97
Cefquinome 30 µg	257	96
Streptomycin 10 UI	206	41
Spectinomycin	143	90
Kanamycin 30 UI	125	80
Gentamicin 10 UI	270	91
Neomycin	190	82
Apramycin	86	98
Tetracycline	268	43
Florfenicol	232	85
Nalidixic ac.	228	84
Flumequine	65	85
Enrofloxacin	258	91
Marbofloxacin	198	94
Danofloxacin	121	95
Sulfonamides	33	39
Trimethoprim	30	77
Trimethoprim-Sulfonamides	280	64

Table 4 - Goats 2018 – All pathologies and age groups included – *Pasteurella*: susceptibility to antibiotics (proportion) (N= 221)

Antibiotic	Total (N)	% S
Amoxicillin	216	90
Amoxicillin-Clavulanic ac.	199	93
Cephalexin	172	96
Cephalothin	76	100
Cefoxitin	92	100
Cefuroxime	73	100
Cefoperazone	74	97
Ceftiofur	210	98
Cefquinome 30 µg	201	95
Streptomycin 10 UI	175	33
Spectinomycin	97	35
Kanamycin 30 UI	83	51
Gentamicin 10 UI	199	92
Neomycin	114	46
Tetracycline	211	84
Doxycycline	36	83
Florfenicol	208	99
Nalidixic ac.	169	85
Oxolinic ac.	31	90
Flumequine	51	80
Enrofloxacin	217	90
Marbofloxacin	173	97
Danofloxacin	102	92
Sulfonamides	31	32
Trimethoprim-Sulfonamides	221	75



Annex 5

Pigs

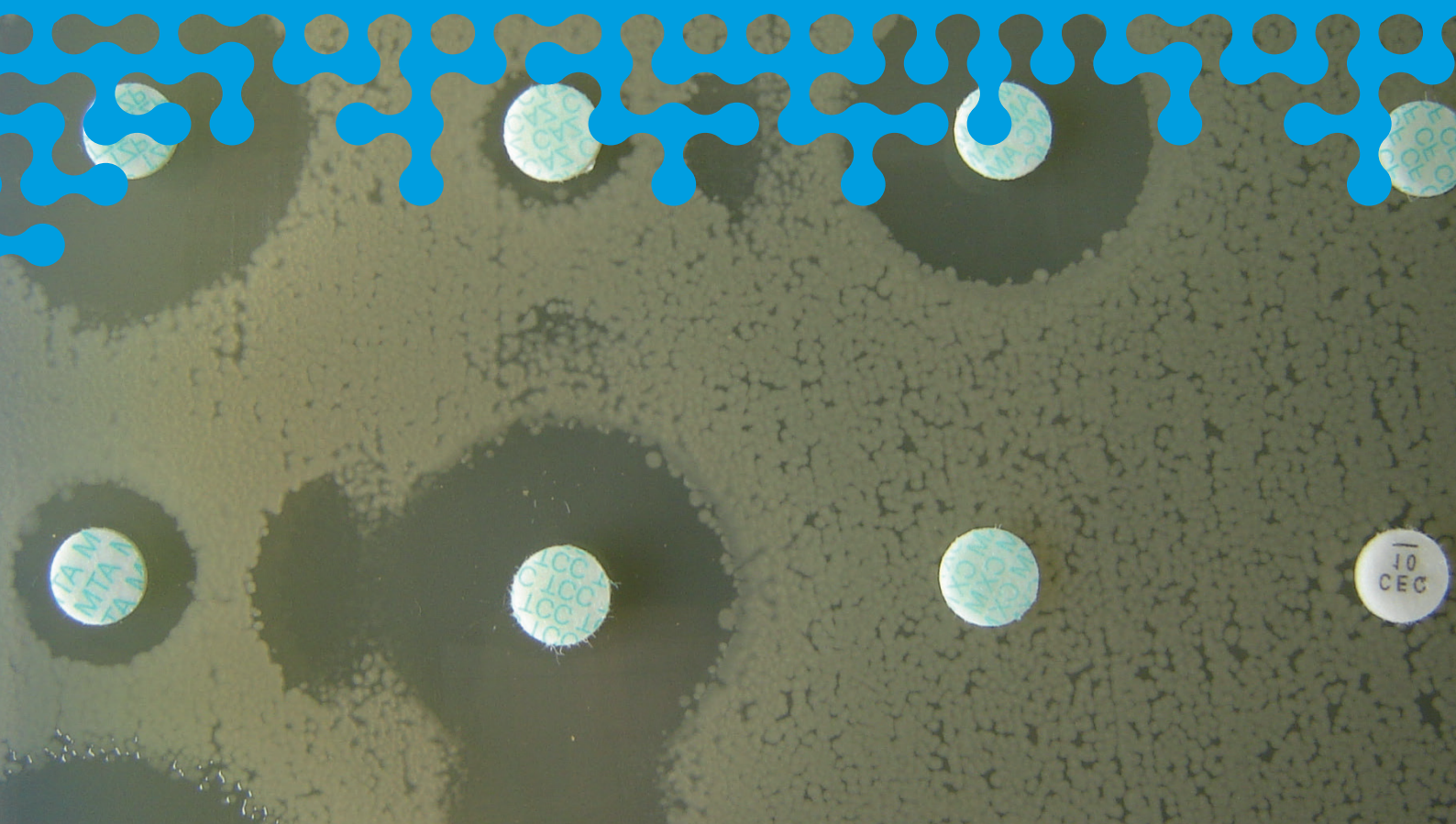


Figure 1 - Pigs 2018 – Antibigram proportions by animal category

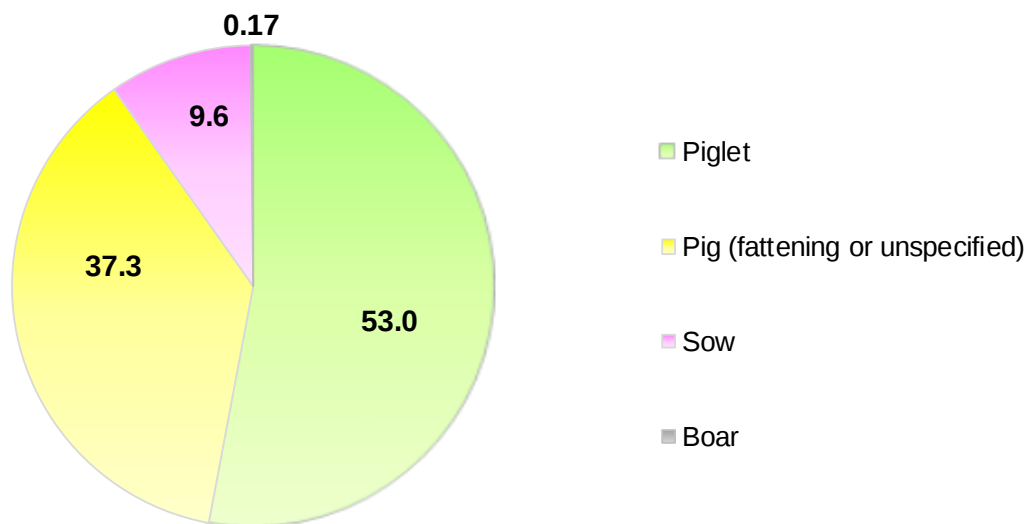
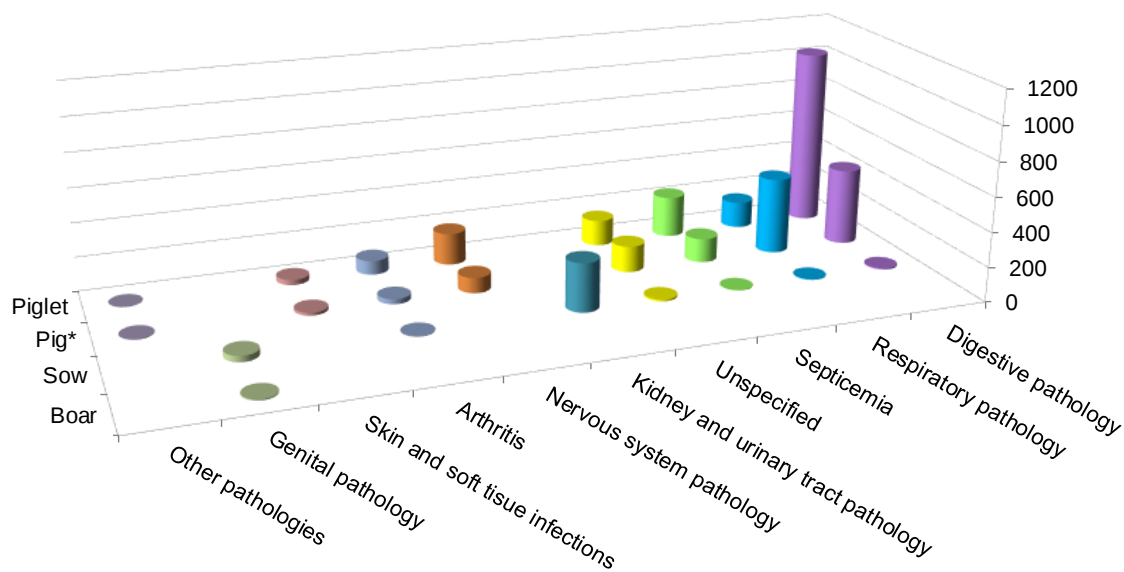


Figure 2 - Pigs 2018 – Number of antibiograms by pathology and animal category

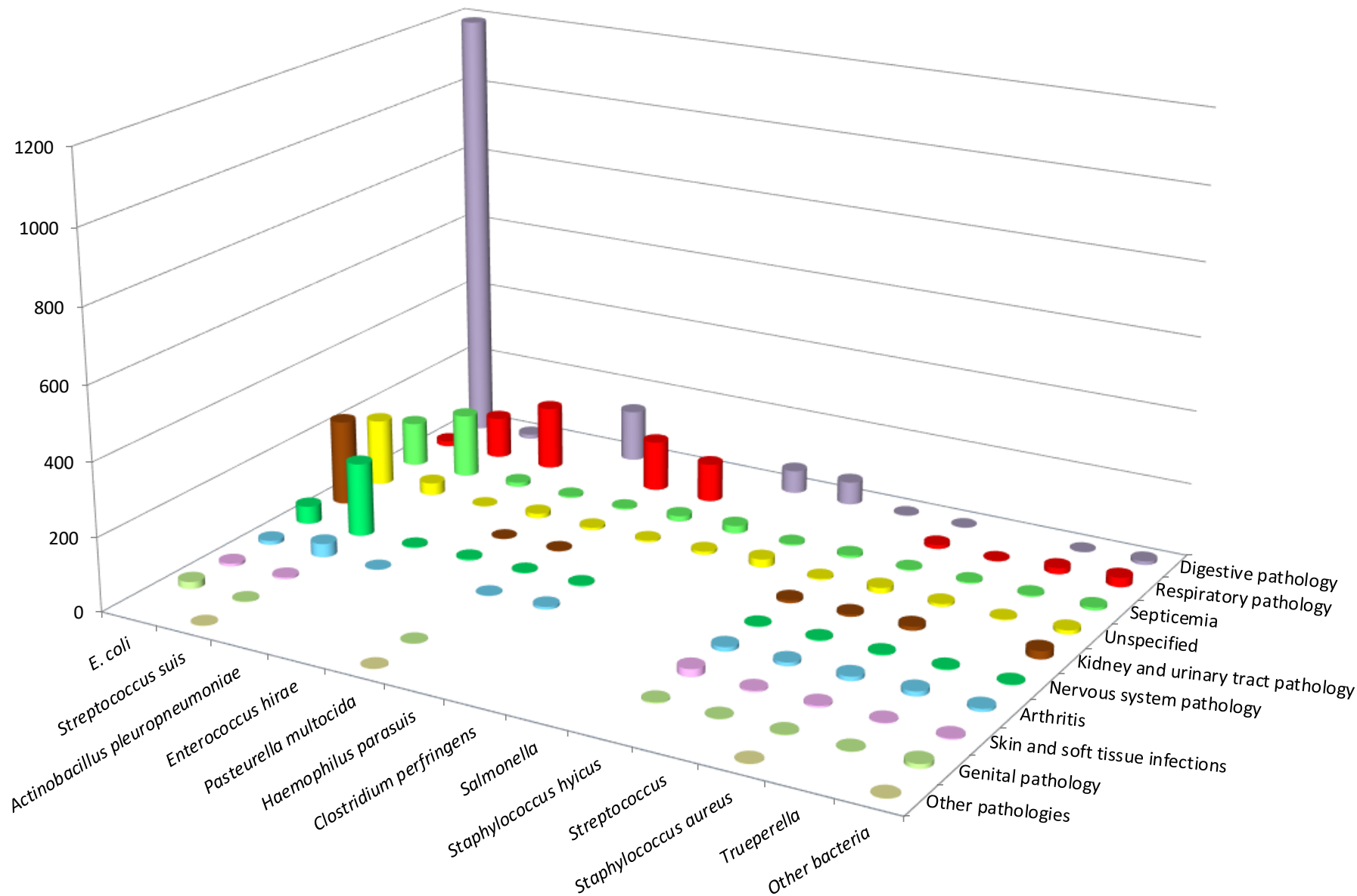


* fattening or unspecified

Table 1 - Pigs 2018 – Number of antibiograms by pathology and animal category

Age group or physiological stage N (%)	Pathology N (%)										Total N (%)
	Digestive pathology	Respiratory pathology	Septicemia	Unspecified	Kidney and urinary tract pathology	Nervous system pathology	Arthritis	Skin and soft tissue infections	Genital pathology	Other	
Piglet	1,034 (29.09)	155 (4.36)	241 (6.78)	152 (4.28)		186 (5.23)	82 (2.31)	31 (0.87)		1 (0.03)	1,882 (52.95)
Porc	447 (12.58)	445 (12.52)	140 (3.94)	153 (4.31)		90 (2.53)	29 (0.82)	17 (0.48)		3 (0.08)	1,324 (37.25)
Sow	7 (0.20)	3 (0.08)	2 (0.06)	10 (0.28)	284 (7.99)		1 (0.03)		35 (0.98)		342 (9.62)
Boar									6 (0.17)		6 (0.17)
Total N (%)	1,488 (41.87)	603 (16.97)	383 (10.78)	315 (8.86)	284 (7.99)	276 (7.77)	112 (3.15)	48 (1.35)	41 (1.15)	4 (0.11)	3,554 (100.00)

Figure 3 - Pigs 2018 – Number of antibiograms by bacteria and pathology



Note: only values for pathologies and bacteria having more than 30 occurrences are represented. Detailed values are presented in table 2 below.

Table 2 - Pigs 2018 – Number of antibiograms by bacteria and pathology

Bacteria N (%)	Pathology N (%)										Total N (%)
	Digestive pathology	Respiratory pathology	Septicemia	Unspecified	Kidney and urinary tract pathology	Nervous system pathology	Arthritis	Skin and soft tissue infections	Genital pathology	Other	
<i>E. coli</i>	1,194 (33.60)	15 (0.42)	121 (3.40)	183 (5.15)	234 (6.58)	49 (1.38)	11 (0.31)	8 (0.23)	19 (0.53)		1,834 (51.60)
<i>Streptococcus suis</i>	12 (0.34)	114 (3.21)	175 (4.92)	34 (0.96)		202 (5.68)	37 (1.04)	5 (0.14)	2 (0.06)	1 (0.03)	582 (16.38)
<i>Actinobacillus pleuropneumoniae</i>		174 (4.90)	12 (0.34)	1 (0.03)		3 (0.08)	1 (0.03)				191 (5.37)
<i>Enterococcus hirae</i>	142 (4.00)		5 (0.14)	13 (0.37)	1 (0.03)	4 (0.11)					165 (4.64)
<i>Pasteurella multocida</i>		138 (3.88)	4 (0.11)	7 (0.20)	2 (0.06)	2 (0.06)	1 (0.03)		1 (0.03)	1 (0.03)	156 (4.39)
<i>Haemophilus parasuis</i>		106 (2.98)	15 (0.42)	5 (0.14)		3 (0.08)	7 (0.20)				136 (3.83)
<i>Clostridium perfringens</i>	63 (1.77)		21 (0.59)	9 (0.25)							93 (2.62)
<i>Salmonella</i>	63 (1.77)		4 (0.11)	22 (0.62)							89 (2.50)
<i>Staphylococcus hyicus</i>	2 (0.06)		7 (0.20)	4 (0.11)	8 (0.23)	2 (0.06)	12 (0.34)	21 (0.59)	3 (0.08)		59 (1.66)
<i>Streptococcus</i>	1 (0.03)	11 (0.31)	3 (0.08)	15 (0.42)	6 (0.17)	3 (0.08)	10 (0.28)	4 (0.11)	1 (0.03)		54 (1.52)
<i>Staphylococcus aureus</i>		2 (0.06)	4 (0.11)	8 (0.23)	11 (0.31)	3 (0.08)	12 (0.34)	5 (0.14)	2 (0.06)	1 (0.03)	48 (1.35)
<i>Trueperella</i>	1 (0.03)	17 (0.48)	4 (0.11)	3 (0.08)		3 (0.08)	13 (0.37)	2 (0.06)	1 (0.03)		44 (1.24)
<i>Other bacteria</i>	10 (0.28)	26 (0.73)	8 (0.23)	11 (0.31)	22 (0.62)	2 (0.06)	8 (0.23)	3 (0.08)	12 (0.34)	1 (0.03)	103 (2.90)
<i>< 30 occurrences</i>											
Total N (%)	1,488 (41.87)	603 (16.97)	383 (10.78)	315 (8.86)	284 (7.99)	276 (7.77)	112 (3.15)	48 (1.35)	41 (1.15)	4 (0.11)	3,554 (100.00)

Table 3 - Pigs 2018 – All pathologies and age groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 1,834)

Antibiotic	Total (N)	% S
Amoxicillin	1,817	44
Amoxicillin-Clavulanic ac.	1,798	76
Cephalexin	930	91
Cephalothin	451	84
Cefoxitin	1,393	97
Cefuroxime	252	93
Cefoperazone	243	98
Ceftiofur	1,812	98
Cefquinome 30 µg	501	99
Streptomycin 10 UI	200	50
Spectinomycin	1,480	66
Gentamicin 10 UI	1,703	90
Neomycin	1,733	80
Apramycin	1,694	92
Tetracycline	1,529	34
Florfenicol	1,727	88
Nalidixic ac.	987	79
Oxolinic ac.	794	80
Flumequine	784	82
Enrofloxacin	1,755	96
Marbofloxacin	1,365	96
Danofloxacin	242	95
Trimethoprim	435	51
Trimethoprim-Sulfonamides	1,791	51

Table 4 - Pigs 2018 – Digestive pathology – Piglets (post-weaning included) – *E. coli*: susceptibility to antibiotics (proportion) (N= 813)

Antibiotic	Total (N)	% S
Amoxicillin	806	42
Amoxicillin-Clavulanic ac.	809	77
Cephalexin	462	93
Cephalothin	173	88
Cefoxitin	658	97
Ceftiofur	811	98
Cefquinome 30 µg	161	99
Spectinomycin	716	63
Gentamicin 10 UI	786	87
Neomycin	803	75
Apramycin	798	89
Tetracycline	630	32
Florfenicol	760	85
Nalidixic ac.	376	77
Oxolinic ac.	405	82
Flumequine	279	84
Enrofloxacin	807	96
Marbofloxacin	618	96
Trimethoprim	167	57
Trimethoprim-Sulfonamides	783	48

Table 5 - Pigs 2018 – Kidney and urinary tract pathology – Sows – *E. coli*: susceptibility to antibiotics (proportion) (N= 234)

Antibiotic	Total (N)	% S
Amoxicillin	231	53
Amoxicillin-Clavulanic ac.	216	73
Ceftiofur	217	99
Spectinomycin	154	79
Gentamicin 10 UI	184	98
Neomycin	170	94
Apramycin	164	100
Tetracycline	231	34
Florfenicol	231	92
Nalidixic ac.	142	85
Enrofloxacin	172	94
Marbofloxacin	222	95
Trimethoprim-Sulfonamides	233	63

Table 6 - Pigs 2018 – All pathologies included – *Actinobacillus pleuropneumoniae*: susceptibility to antibiotics (proportion) (N= 191)

Antibiotic	Total (N)	% S
Amoxicillin	183	99
Ceftiofur	190	100
Tilmicosin	187	95
Tetracycline	128	90
Doxycycline	153	89
Florfenicol	188	100
Marbofloxacin	157	99
Trimethoprim-Sulfonamides	191	96

Table 7 - Pigs 2018 – All pathologies included – *Pasteurella multocida*: susceptibility to antibiotics (proportion) (N= 156)

Antibiotic	Total (N)	% S
Amoxicillin	142	100
Amoxicillin-Clavulanic ac.	114	99
Ceftiofur	151	99
Tilmicosin	150	97
Tetracycline	133	94
Florfenicol	153	100
Enrofloxacin	114	100
Marbofloxacin	108	100
Trimethoprim-Sulfonamides	155	86

Table 8 - Pigs 2018 – All pathologies included – *Streptococcus suis*: susceptibility to antibiotics (proportion) (N= 582)

Antibiotic	Total (N)	% S
Amoxicillin	549	100
Oxacillin	576	97
Erythromycin	460	37
Tylosin	310	34
Spiramycin	323	37
Lincomycin	449	36
Streptomycin 500 µg	290	95
Kanamycin 1000 µg	216	95
Gentamicin 500 µg	457	99
Tetracycline	325	18
Doxycycline	150	24
Trimethoprim-Sulfonamides	582	79



Annex 6

Poultry

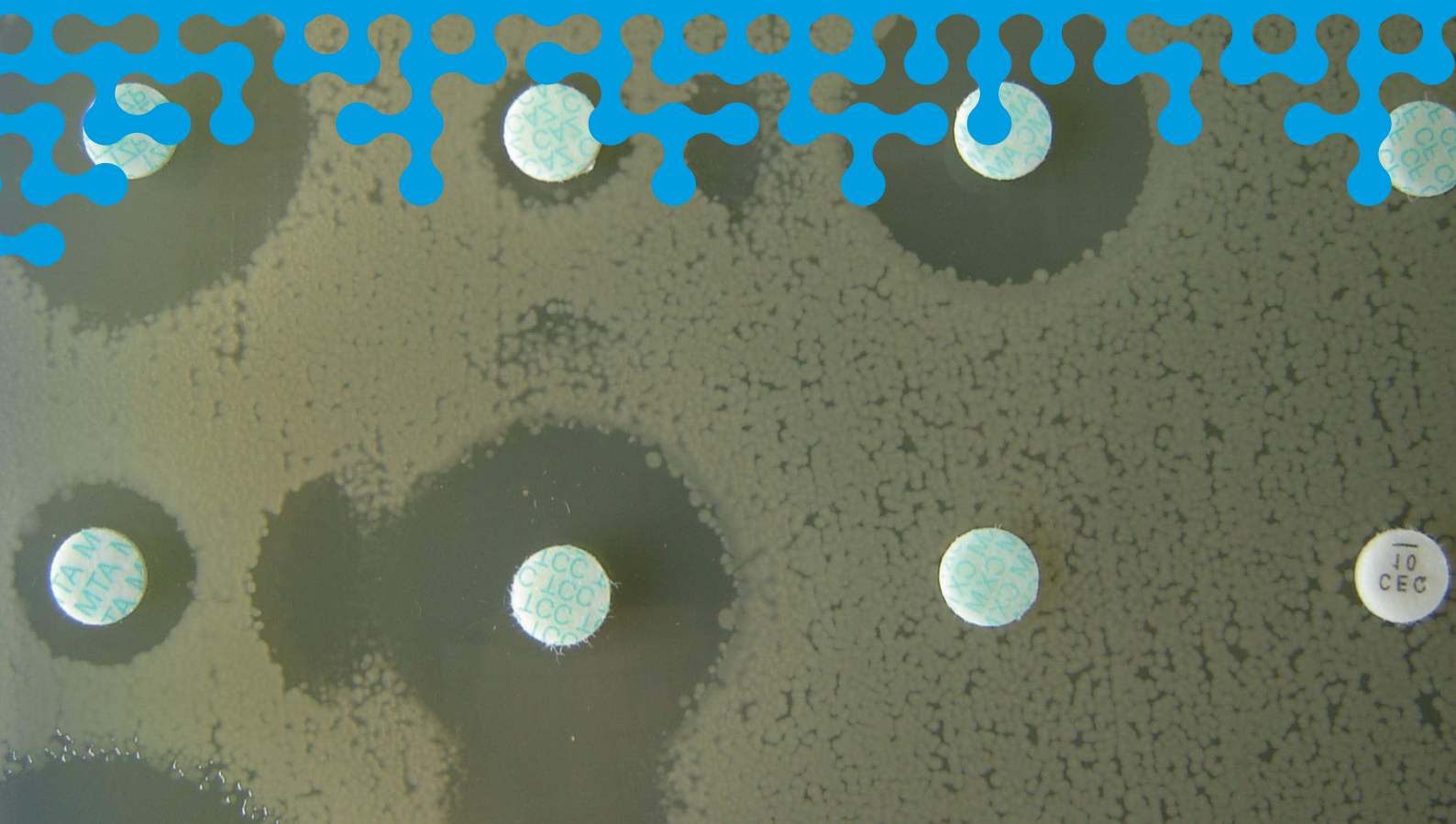
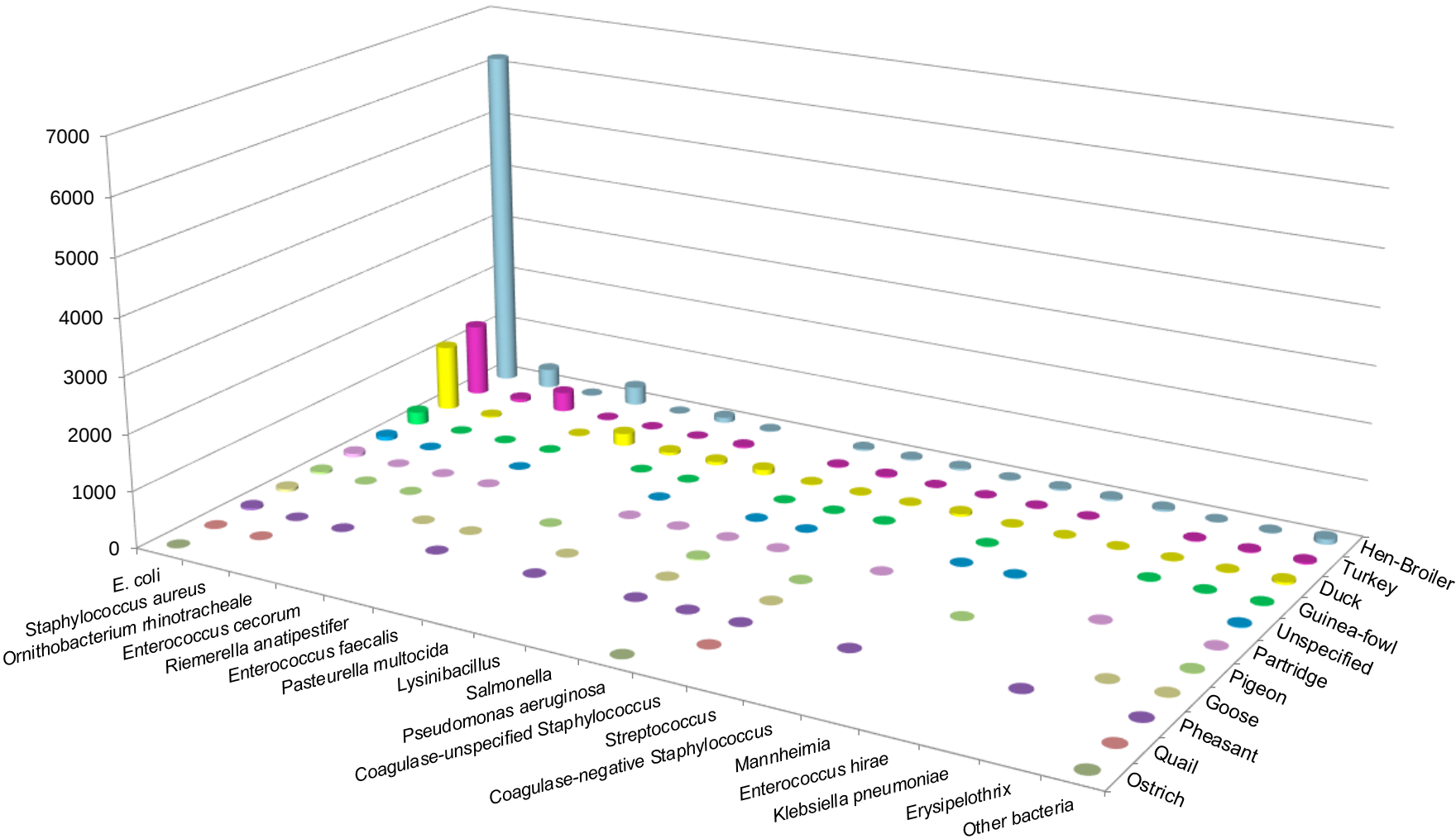


Figure 1 - Poultry 2018 – Number of antibiograms by bacteria and animal



Note: only values for bacterial groups having more than 30 occurrences are represented. Detailed values are presented in table 1 below.

Table 1. part 1 - Poultry 2018 – Number of antibiograms by bacteria and animal

Bacteria N (%)	Animal species N (%)											Total N (%)
	Hen-chicken	Turkey	Duck	Guinea-fowl	Poultry	Partridge	Pigeon	Goose	Pheasant	Quail	Ostrich	
<i>E. coli</i>	6,208 (53.10)	1,303 (11.14)	1,185 (10.14)	230 (1.97)	71 (0.61)	65 (0.56)	41 (0.35)	51 (0.44)	39 (0.33)	6 (0.05)	4 (0.03)	9,203 (78.71)
<i>Staphylococcus aureus</i>	342 (2.93)	59 (0.50)	23 (0.20)	4 (0.03)	3 (0.03)	3 (0.03)	3 (0.03)		2 (0.02)	2 (0.02)		441 (3.77)
<i>Ornithobacterium rhinotracheale</i>	8 (0.07)	351 (3.00)		4 (0.03)		5 (0.04)	1 (0.01)		2 (0.02)			371 (3.17)
<i>Enterococcus cecorum</i>	332 (2.84)	9 (0.08)	7 (0.06)	5 (0.04)	1 (0.01)	2 (0.02)		1 (0.01)				357 (3.05)
<i>Riemerella anatipestifer</i>	1 (0.01)	4 (0.03)	223 (1.91)					2 (0.02)	1 (0.01)			231 (1.98)
<i>Enterococcus faecalis</i>	94 (0.80)	3 (0.03)	54 (0.46)	1 (0.01)			2 (0.02)					154 (1.32)
<i>Pasteurella multocida</i>	17 (0.15)	30 (0.26)	60 (0.51)	1 (0.01)	1 (0.01)	1 (0.01)		1 (0.01)	3 (0.03)			114 (0.98)
<i>Lysinibacillus</i>			95 (0.81)			1 (0.01)						96 (0.82)
<i>Salmonella</i>	32 (0.27)	16 (0.14)	10 (0.09)	1 (0.01)	4 (0.03)	2 (0.02)	22 (0.19)	3 (0.03)	3 (0.03)			93 (0.80)
<i>Pseudomonas aeruginosa</i>	27 (0.23)	26 (0.22)	5 (0.04)	2 (0.02)	1 (0.01)	4 (0.03)			2 (0.02)		1 (0.01)	68 (0.58)
<i>Coagulase-unspecified Staphylococcus</i>	38 (0.33)	5 (0.04)	9 (0.08)	6 (0.05)			2 (0.02)	1 (0.01)	1 (0.01)	2 (0.02)		64 (0.55)
<i>Streptococcus</i>	9 (0.08)	5 (0.04)	47 (0.40)			1 (0.01)						62 (0.53)
<i>Coagulase-negative Staphylococcus</i>	32 (0.27)	7 (0.06)	5 (0.04)	6 (0.05)	4 (0.03)				1 (0.01)			55 (0.47)
<i>Mannheimia</i>	37 (0.32)	3 (0.03)	4 (0.03)		6 (0.05)		3 (0.03)					53 (0.45)

Table 1. part 2 - Poultry 2018 – Number of antibiograms by bacteria and animal

Bacteria N (%)	Animal species N (%)											Total N (%)
	Hen-chicken	Turkey	Duck	Guinea-fowl	Poultry	Partridge	Pigeon	Goose	Pheasant	Quail	Ostrich	
<i>Enterococcus hirae</i>	40 (0.34)		2 (0.02)									42 (0.36)
<i>Klebsiella pneumoniae</i>	6 (0.05)	14 (0.12)	4 (0.03)	6 (0.05)		3 (0.03)			6 (0.05)			39 (0.33)
<i>Erysipelothrix</i>	10 (0.09)	17 (0.15)	6 (0.05)	5 (0.04)				1 (0.01)				39 (0.33)
<i>Other bacteria</i> <i>< 30 occurrences</i>	94 (0.80)	27 (0.23)	45 (0.38)	9 (0.08)	15 (0.13)	3 (0.03)	6 (0.05)	5 (0.04)	4 (0.03)	1 (0.01)	1 (0.01)	210 (1.80)
Total N (%)	7,327 (62.67)	1,879 (16.07)	1,784 (15.26)	280 (2.39)	106 (0.91)	90 (0.77)	80 (0.68)	65 (0.56)	64 (0.55)	11 (0.09)	6 (0.05)	11,692 (100.00)

Table 2 - Hens and broilers 2018 – All pathologies included - *E. coli*: susceptibility to antibiotics (proportion) (N=6,208)

Antibiotic	Total (N)	% S
Ampicillin	550	75
Amoxicillin	6,144	71
Amoxicillin-Clavulanic ac.	4,904	88
Cephalexin	2,044	93
Cephalothin	2,806	90
Cefoxitin	4,731	99
Cefuroxime	458	96
Cefoperazone	232	99
Ceftiofur	5,859	99
Cefquinome 30 µg	1,903	99
Spectinomycin	1,968	87
Gentamicin 10 UI	6,043	98
Neomycin	3,538	98
Apramycin	3,422	99
Tetracycline	5,086	62
Doxycycline	1,420	60
Florfenicol	4,707	99
Nalidixic ac.	5,184	61
Oxolinic ac.	1,224	63
Flumequine	4,925	64
Enrofloxacin	6,143	95
Marbofloxacin	434	94
Danofloxacin	243	89
Sulfonamides	222	69
Trimethoprim	2,983	82
Trimethoprim-Sulfonamides	6,144	80

Table 3 – Laying hens (table eggs and hatching eggs) 2018 – All pathologies included - *E. coli*: susceptibility to antibiotics (proportion) (N= 2,055)

Antibiotic	Total (N)	% S
Ampicillin	121	80
Amoxicillin	1,999	79
Amoxicillin-Clavulanic ac.	1,741	91
Cephalexin	437	91
Cephalothin	1,261	92
Cefoxitin	1,624	99
Ceftiofur	1,945	99
Cefquinome 30 µg	436	99
Spectinomycin	436	87
Gentamicin 10 UI	1,992	98
Neomycin	1,370	98
Apramycin	1,310	99
Tetracycline	1,745	71
Florfenicol	1,651	99
Nalidixic ac.	1,861	72
Oxolinic ac.	132	68
Flumequine	1,756	74
Enrofloxacin	1,999	97
Trimethoprim	1,278	91
Trimethoprim-Sulfonamides	1,998	90

Table 4 – Broilers 2018 – All pathologies included - *E. coli*: susceptibility to antibiotics (proportion) (N= 3,726)

Antibiotic	Total (N)	% S
Ampicillin	414	74
Amoxicillin	3,719	66
Amoxicillin-Clavulanic ac.	2,754	86
Cephalexin	1,291	94
Cephalothin	1,462	89
Cefoxitin	2,727	99
Cefuroxime	293	97
Cefoperazone	115	100
Ceftiofur	3,495	99
Cefquinome 30 µg	1,286	99
Spectinomycin	1,267	86
Gentamicin 10 UI	3,629	97
Neomycin	1,787	98
Apramycin	1,768	99.8
Tetracycline	2,960	56
Doxycycline	1,009	59
Florfenicol	2,703	99
Nalidixic ac.	3,165	55
Oxolinic ac.	850	63
Flumequine	2,964	58
Enrofloxacin	3,719	93
Marbofloxacin	137	91
Danofloxacin	121	89
Sulfonamides	180	68
Trimethoprim	1,629	75
Trimethoprim-Sulfonamides	3,719	75

Table 5 - Turkeys 2018 – All pathologies included - *E. coli*: susceptibility to antibiotics (proportion) (N= 1,303)

Antibiotic	Total (N)	% S
Ampicillin	145	48
Amoxicillin	1,303	57
Amoxicillin-Clavulanic ac.	995	83
Cephalexin	585	94
Cephalothin	375	85
Cefoxitin	951	99
Cefuroxime	131	100
Ceftiofur	1,292	99
Cefquinome 30 µg	483	99
Spectinomycin	524	90
Gentamicin 10 UI	1,301	98
Neomycin	527	97
Apramycin	519	100
Tetracycline	996	58
Doxycycline	510	57
Florfenicol	949	99
Nalidixic ac.	1,106	79
Oxolinic ac.	186	70
Flumequine	982	79
Enrofloxacin	1,301	97
Sulfonamides	102	56
Trimethoprim	471	74
Trimethoprim-Sulfonamides	1,302	79

Table 6 - Ducks 2018 – All pathologies included - *E. coli*: susceptibility to antibiotics (proportion) (N= 1,185)

Antibiotic	Total (N)	% S
Amoxicillin	1,179	62
Amoxicillin-Clavulanic ac.	1,135	78
Cephalexin	583	83
Cephalothin	561	70
Cefoxitin	1,114	98
Ceftiofur	1,176	99
Cefquinome 30 µg	579	98
Spectinomycin	564	95
Gentamicin 10 UI	1,153	99
Neomycin	672	97
Apramycin	648	100
Tetracycline	1,130	48
Doxycycline	461	45
Florfenicol	1,124	99
Nalidixic ac.	1,049	71
Oxolinic ac.	189	78
Flumequine	1,118	72
Enrofloxacin	1,179	98
Trimethoprim	640	60
Trimethoprim-Sulfonamides	1,179	63

Table 7 - Guinea-fowls 2018 – All pathologies included - *E. coli*: susceptibility to antibiotics (proportion) (N= 230)

Antibiotic	Total (N)	% S
Amoxicillin	229	59
Amoxicillin-Clavulanic ac.	207	71
Cephalexin	112	90
Cefoxitin	175	98
Ceftiofur	210	99
Cefquinome 30 µg	108	99
Spectinomycin	128	85
Gentamicin 10 UI	224	97
Tetracycline	218	39
Florfenicol	171	97
Nalidixic ac.	168	77
Flumequine	215	76
Enrofloxacin	230	95
Trimethoprim-Sulfonamides	230	71

Table 8 - Hens and broilers 2018 – All pathologies included - *Staphylococcus aureus*: susceptibility to antibiotics (proportion) (N= 342)

Antibiotic	Total (N)	% S
Penicillin G	313	91
Cefoxitin	287	91
Erythromycin	280	96
Tylosin	309	97
Spiramycin	261	96
Lincomycin	334	91
Gentamicin 10 UI	272	99
Neomycin	169	99
Tetracycline	279	93
Doxycycline	144	86
Enrofloxacin	338	99
Trimethoprim-Sulfonamides	340	99

Table 9 - Hens and broilers 2018 – All pathologies included – *Enterococcus cecorum*: susceptibility to antibiotics (proportion) (N= 332)

Antibiotic	Total (N)	% S
Amoxicillin	330	97
Erythromycin	220	68
Tylosin	209	65
Spiramycin	204	47
Lincomycin	319	63
Gentamicin 500 µg	208	98
Tetracycline	220	7
Trimethoprim-Sulfonamides	331	45



Annexe 7

Rabbits

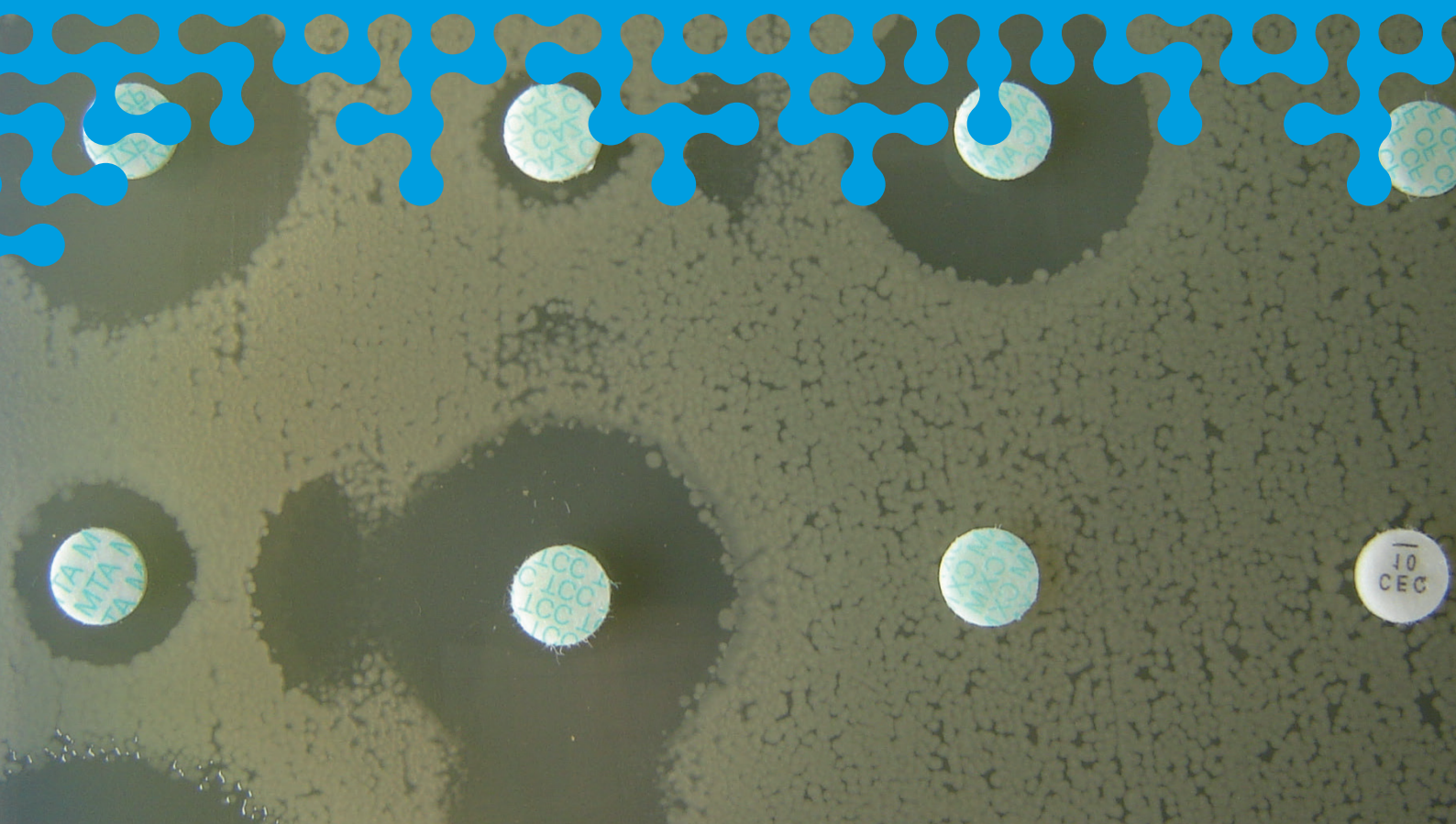
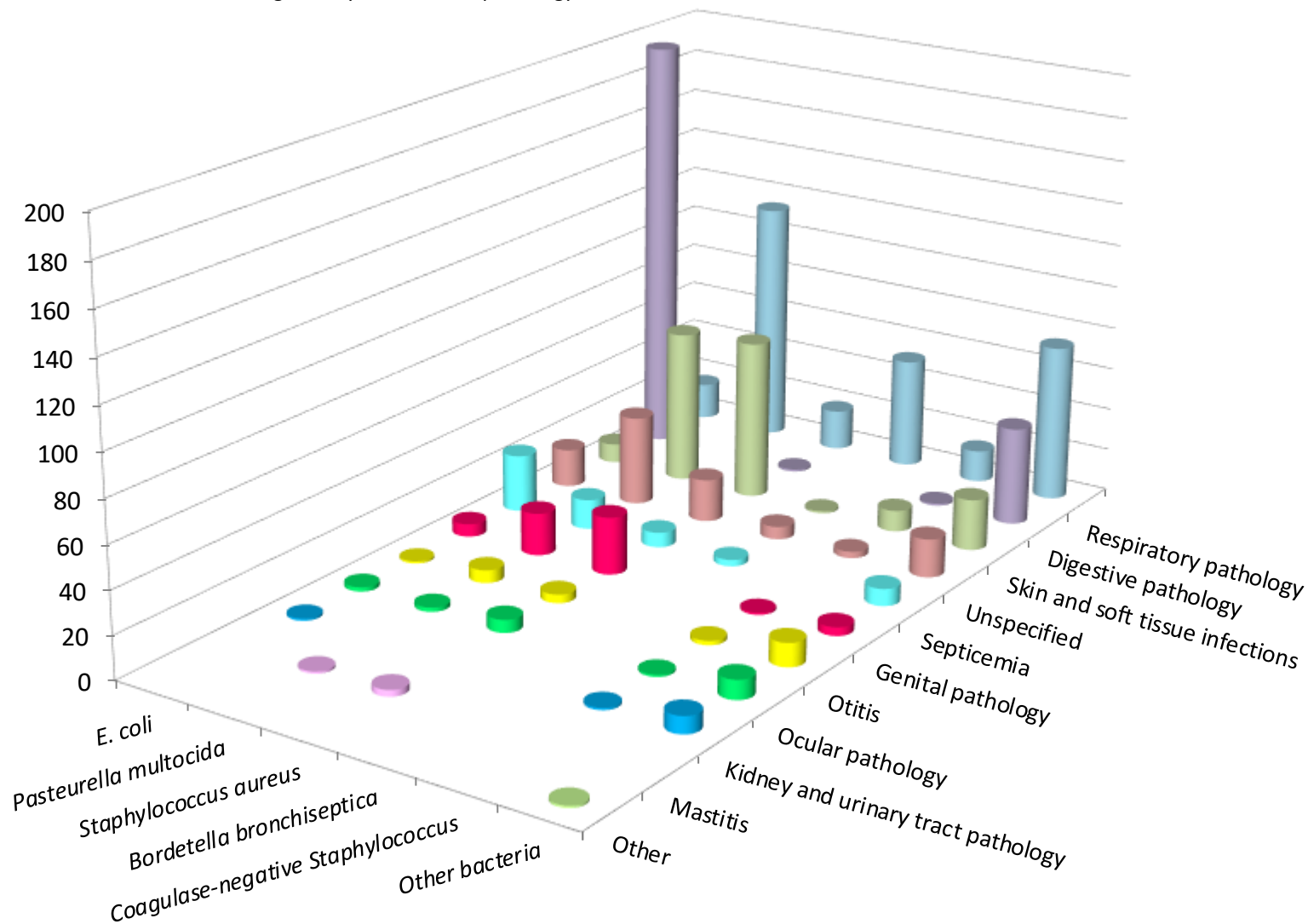


Figure 1 - Rabbits 2018 – Number of antibiograms by bacteria and pathology



Note: only values for bacterial groups having more than 30 occurrences are represented. Detailed values are presented in table 1 below.

Table 1 - Rabbits 2018 – Number of antibiograms by bacteria and pathology

Bacteria N (%)	Pathology N (%)											Total N (%)
	Respiratory pathology	Digestive pathology	Skin and soft tissue infections	Unspecified	Septicemia	Genital pathology	Otitis	Ocular pathology	Kidney and urinary tract pathology	Mastitis	Other	
E. coli	17 (1.68)	196 (19.43)	9 (0.89)	18 (1.78)	27 (2.68)	6 (0.59)	1 (0.10)	2 (0.20)	1 (0.10)			277 (27.45)
Pasteurella multocida	114 (11.30)		72 (7.14)	42 (4.16)	14 (1.39)	20 (1.98)	6 (0.59)	2 (0.20)		1 (0.10)		271 (26.86)
Staphylococcus aureus	19 (1.88)	1 (0.10)	75 (7.43)	20 (1.98)	7 (0.69)	27 (2.68)	4 (0.40)	6 (0.59)		3 (0.30)		162 (16.06)
Bordetella bronchiseptica	52 (5.15)		1 (0.10)	6 (0.59)	3 (0.30)							62 (6.14)
Coagulase-negative Staphylococcus	15 (1.49)	1 (0.10)	10 (0.99)	3 (0.30)		1 (0.10)	2 (0.20)	1 (0.10)	1 (0.10)			34 (3.37)
Other bacteria < 30 occurrences	74 (7.33)	46 (4.56)	24 (2.38)	18 (1.78)	8 (0.79)	4 (0.40)	11 (1.09)	9 (0.89)	8 (0.79)		1 (0.10)	203 (20.12)
Total N (%)	291 (28.84)	244 (24.18)	191 (18.93)	107 (10.60)	59 (5.85)	58 (5.75)	24 (2.38)	20 (1.98)	10 (0.99)	4 (0.40)	1 (0.10)	1.009 (100.00)

Table 2 - Rabbits 2018 - All pathologies included - *E. coli*: susceptibility to antibiotics (proportion) (N = 277)

Antibiotic	Total (N)	% S
Amoxicillin	222	70
Amoxicillin-Clavulanic ac.	223	83
Cephalexin	200	87
Cefoxitin	212	95
Ceftiofur	246	99
Cefquinome 30 µg	178	100
Streptomycin 10 UI	117	60
Spectinomycin	200	87
Gentamicin 10 UI	277	91
Neomycin	269	82
Apramycin	249	90
Tetracycline	276	20
Florfenicol	137	95
Nalidixic ac.	175	80
Flumequine	125	76
Enrofloxacin	275	97
Marbofloxacin	119	97
Danofloxacin	103	96
Trimethoprim-Sulfonamides	277	34

Table 3 - Rabbits 2018 – All pathologies included - *Pasteurella multocida*: susceptibility to antibiotics (proportion) (N= 271)

Antibiotic	Total (N)	% S
Ceftiofur	137	99
Tilmicosin	223	96
Spectinomycin	133	97
Gentamicin 10 UI	247	98
Tetracycline	261	98
Doxycycline	197	98
Florfenicol	114	99
Nalidixic ac.	202	75
Flumequine	173	95
Enrofloxacin	243	99
Marbofloxacin	107	100
Danofloxacin	136	100
Trimethoprim-Sulfonamides	269	91

Table 4 - Rabbits 2018 – All pathologies included - *Staphylococcus aureus*: susceptibility to antibiotics (proportion) (N= 162)

Antibiotic	Total (N)	% S
Penicillin G	102	87
Cefoxitin	129	96
Erythromycin	147	46
Spiramycin	136	51
Lincomycin	128	46
Gentamicin 10 UI	156	71
Tetracycline	154	49
Doxycycline	136	68
Enrofloxacin	140	94
Trimethoprim-Sulfonamides	162	72



Annex 8

Fish

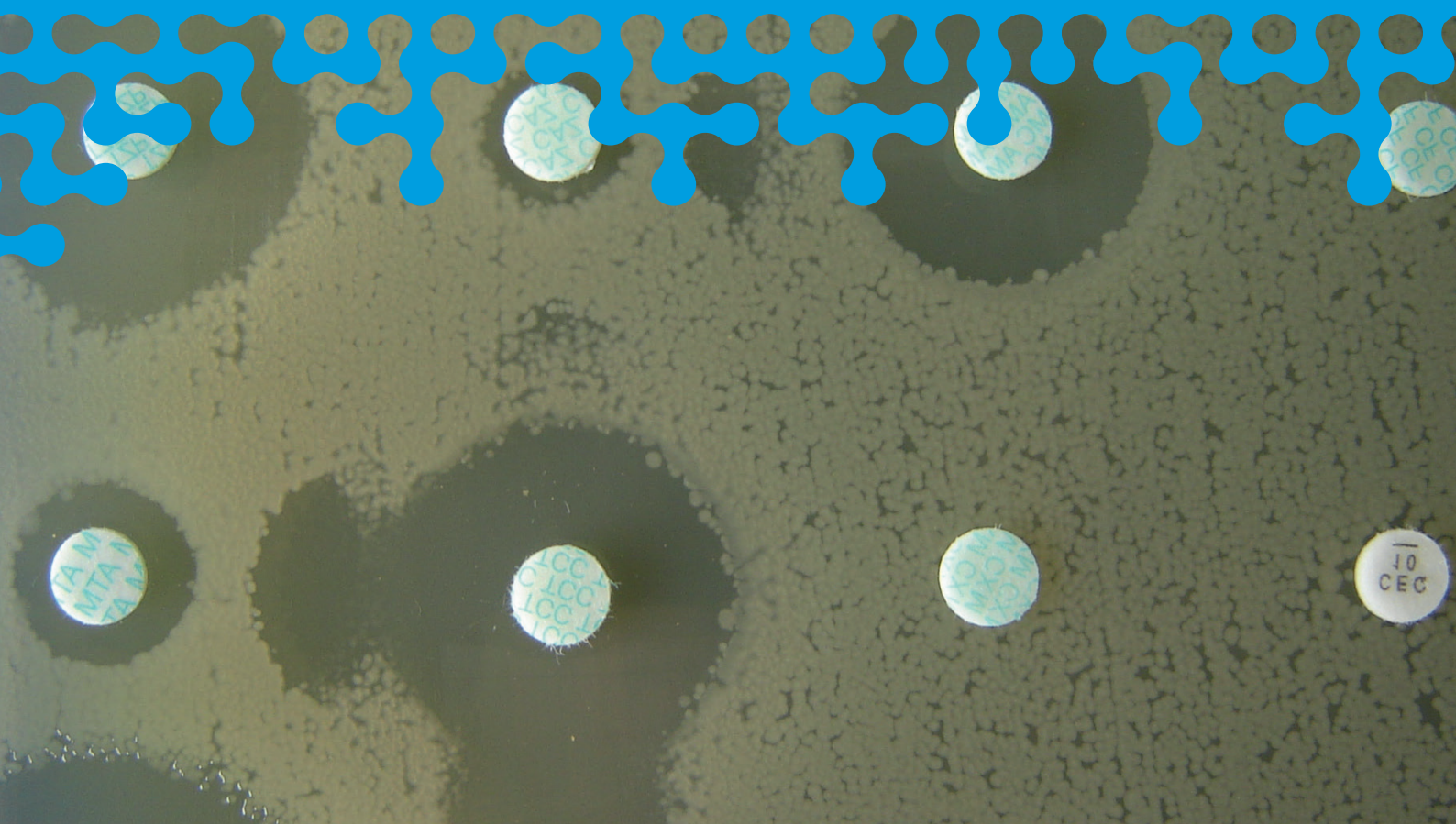


Figure 1 - Fish 2018 – Antibigram proportions by animal species

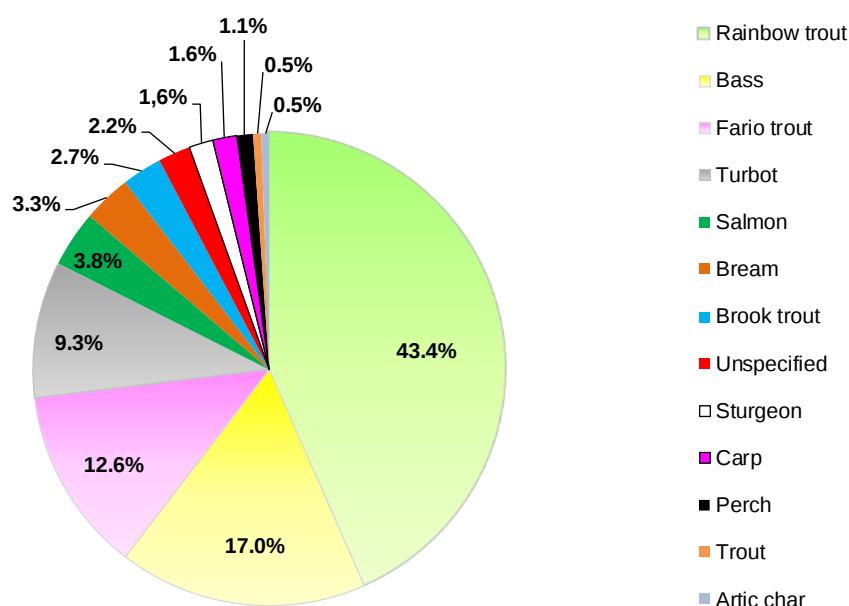


Table 1 - Fish 2018 – Number of antibiograms by bacteria and pathology

Bacteria N (%)	Pathology N (%)				Total N (%)
	Unspecified	Septicemia	Skin and soft tissue infections	Other	
<i>Aeromonas salmonicida</i>	88 (48.35)	17 (9.34)		1 (0.55)	106 (58.24)
<i>Vibrio</i>	20 (10.99)	8 (4.40)	1 (0.55)		29 (15.93)
<i>Yersinia ruckeri</i>	13 (7.14)	6 (3.30)			19 (10.44)
<i>Aeromonas</i>	9 (4.95)		1 (0.55)		10 (5.49)
<i>Carnobacterium</i>	4 (2.20)	1 (0.55)			5 (2.75)
<i>Pseudomonas</i>	2 (1.10)		2 (1.10)		4 (2.20)
<i>Edwardsiella tarda</i>	4 (2.20)				4 (2.20)
<i>Acinetobacter</i>			2 (1.10)		2 (1.10)
<i>E. coli</i>				1 (0.55)	1 (0.55)
<i>Lactococcus</i>		1 (0.55)			1 (0.55)
<i>Chryseobacterium</i>	1 (0.55)				1 (0.55)
Total N (%)	141 (77.47)	33 (18.13)	6 (3.30)	2 (1.10)	182 (100.00)



Annex 9

Horses

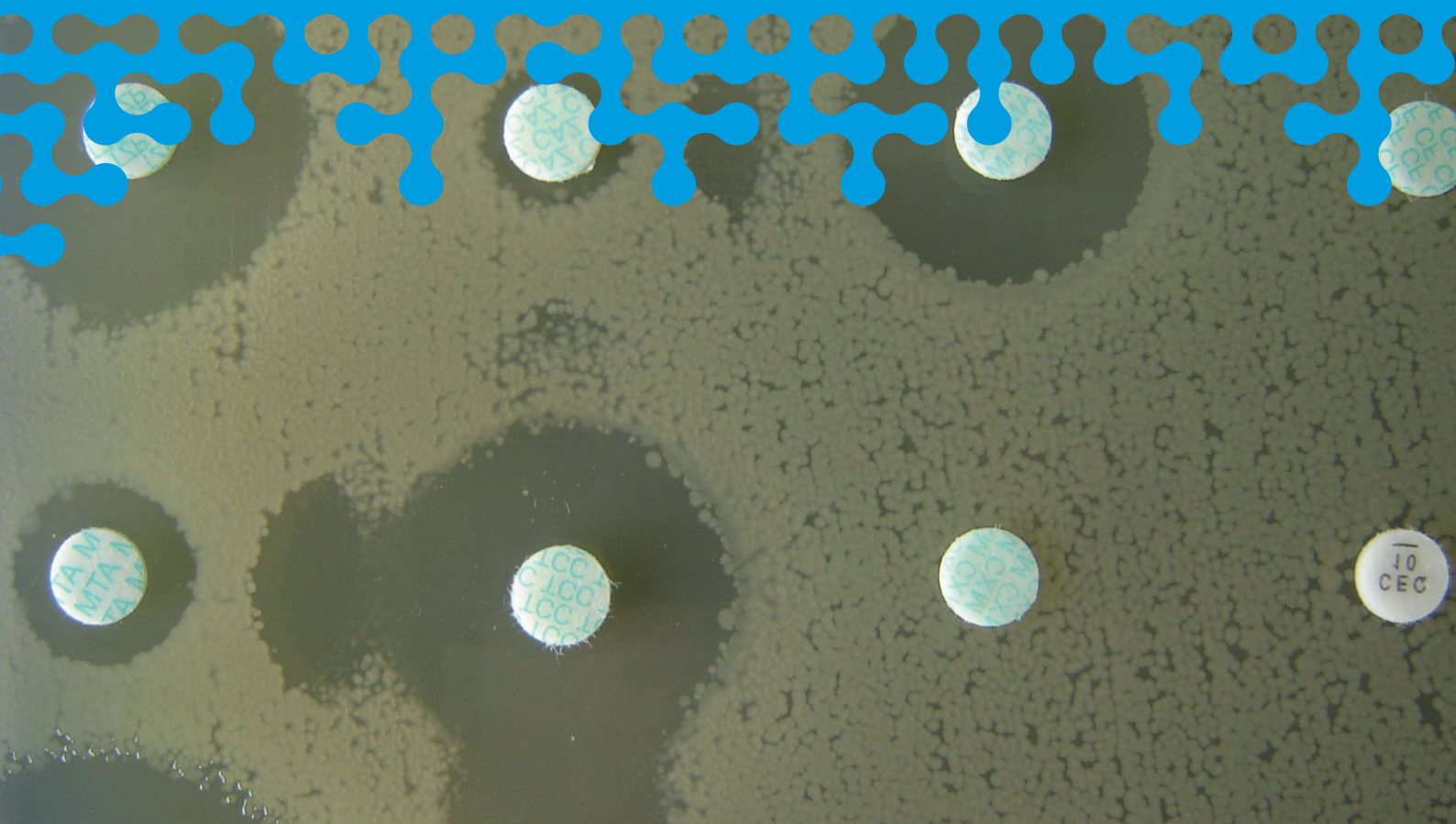
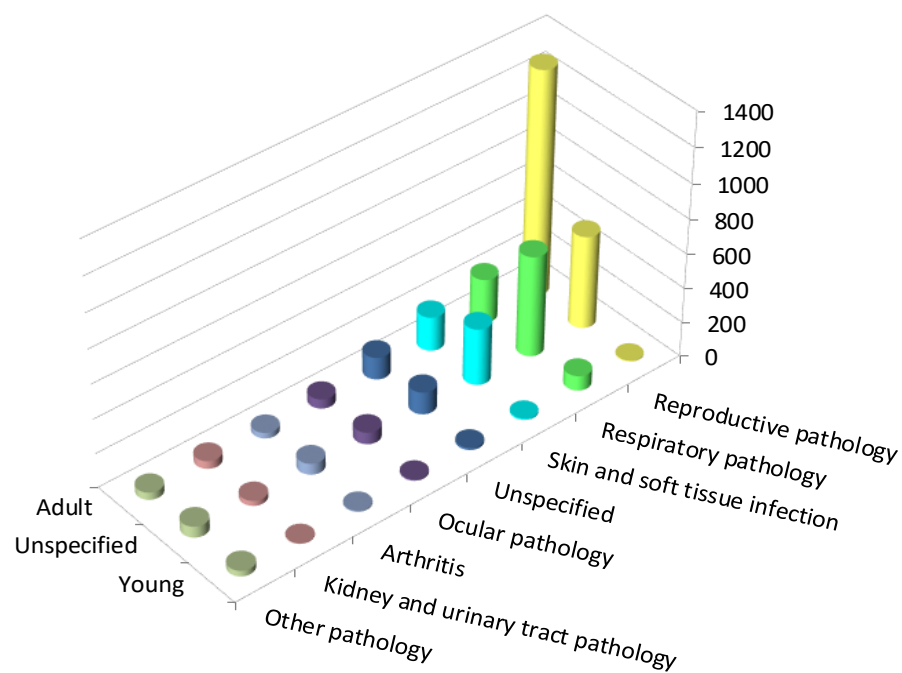


Figure 1 - Horses 2018 – Number of antibiograms by age group and pathology

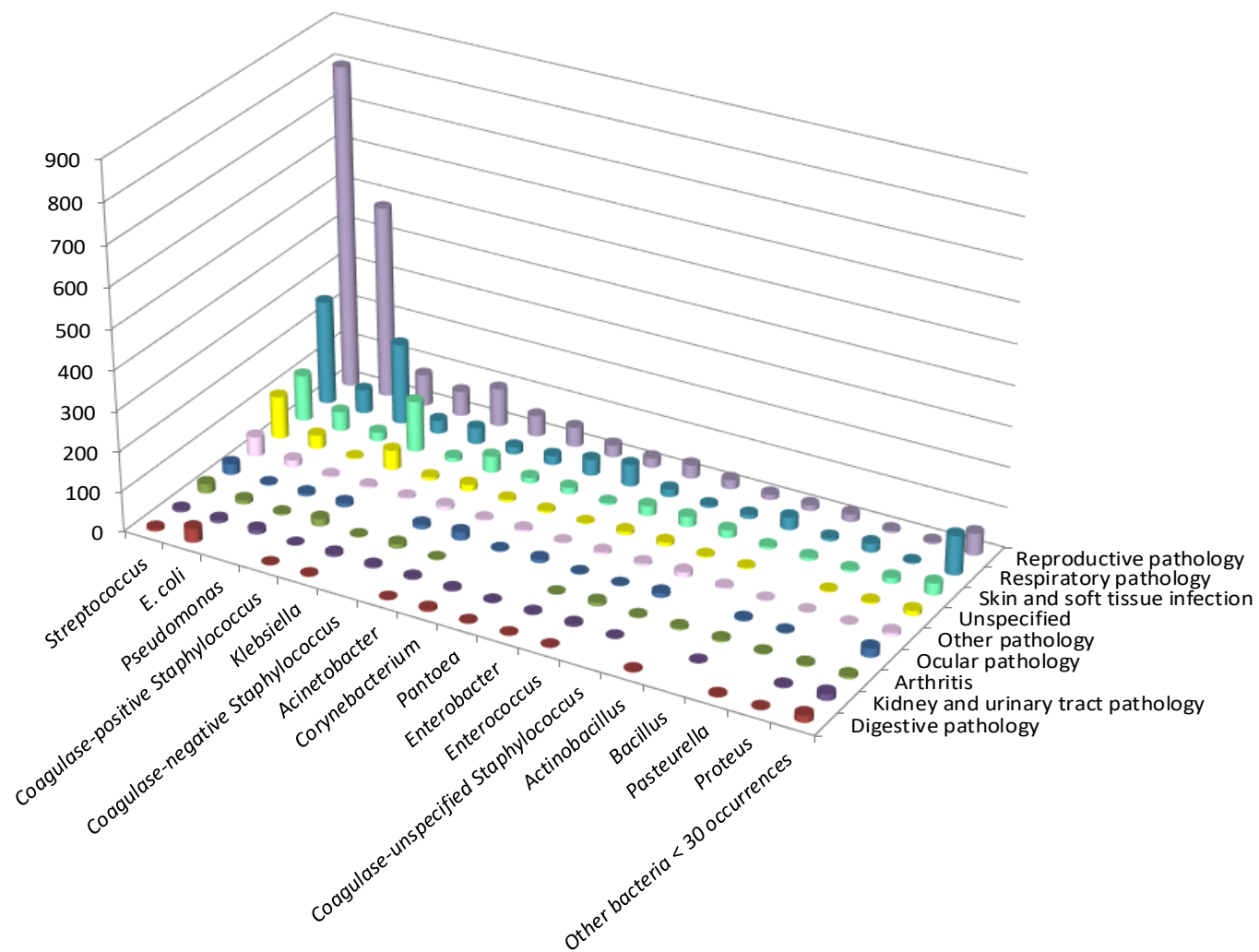


Note: all values are detailed in table 1 (including other pathologies representing less than 1% grouped together)

Table 1 - Horses 2018 – Number of antibiograms by age group and pathology

Pathology N (%)	Age group N (%)			Total N (%)
	Adult	Unspecified	Young	
Reproductive pathology	1,300 (31.65)	539 (13.12)	5 (0.12)	1,844 (44.90)
Respiratory pathology	256 (6.23)	584 (14.22)	86 (2.09)	926 (22.55)
Skin and soft tissue infections	198 (4.82)	329 (8.01)	8 (0.19)	535 (13.03)
Unspecified	129 (3.14)	130 (3.17)	13 (0.32)	272 (6.62)
Ocular pathology	55 (1.34)	69 (1.68)	8 (0.19)	132 (3.21)
Arthritis	33 (0.80)	65 (1.58)	6 (0.15)	104 (2.53)
Kidney and urinary tract pathology	45 (1.10)	30 (0.73)	2 (0.05)	77 (1.87)
Digestive pathology	34 (0.83)	38 (0.93)	4 (0.10)	76 (1.85)
Systemic pathology	11 (0.27)	22 (0.54)	4 (0.10)	37 (0.90)
Bone pathology	7 (0.17)	18 (0.44)	1 (0.02)	26 (0.63)
Omphalitis			24 (0.58)	24 (0.58)
Mastitis	23 (0.56)			23 (0.56)
Cardiovascular disease	1 (0.02)	20 (0.49)		21 (0.51)
Septicemia	1 (0.02)		3 (0.07)	4 (0.10)
Otitis		3 (0.07)		3 (0.07)
Nervous system pathology		1 (0.02)	1 (0.02)	2 (0.05)
Oral pathology		1 (0.02)		1 (0.02)
Total N (%)	2,093 (50.96)	1,849 (45.02)	165 (4.02)	4,107 (100.00)

Figure 2 - Horses 2018 – Number of antibiograms by bacterial group and pathology



Note: only values for pathologies >1% and bacterial groups having more than 30 occurrences are represented. Detailed values are presented in table 2 below.

Table 2. part 1 - Horses 2018 – Number of antibiograms by bacterial group and pathology

[illegible]

Table 2. part 2 - Horses 2018 – Number of antibiograms by bacterial group and pathology

Bacteria N (%)	Pathology N (%)																	Total N (%)
	Reproductive pathology	Respiratory pathology	Skin and soft tissue infections	Unspecified	Ocular pathology	Arthritis	Kidney and urinary tract pathology	Digestive pathology	Systemic pathology	Bone pathology	Omphalitis	Mastitis	Cardiovascular disease	Septicemia	Otitis	Nervous system pathology	Oral pathology	
<i>Pasteurella</i>	6 (0.15)	22 (0.54)	6 (0.15)	2 (0.05)	2 (0.05)	2 (0.05)		2 (0.05)	1 (0.02)									43 (1.05)
<i>Proteus</i>	5 (0.12)	3 (0.07)	14 (0.34)	4 (0.10)		4 (0.10)	3 (0.07)	1 (0.02)										34 (0.83)
<i>Other bacteria < 30 occurrences</i>	55 (1.34)	98 (2.39)	30 (0.73)	12 (0.29)	22 (0.54)	6 (0.15)	16 (0.39)	17 (0.41)	1 (0.02)	1 (0.02)	1 (0.02)	2 (0.05)	3 (0.07)			1 (0.02)		265 (6.45)
Total N (%)	1,844 (44.90)	926 (22.55)	535 (13.03)	272 (6.62)	132 (3.21)	104 (2.53)	77 (1.87)	76 (1.85)	37 (0.90)	26 (0.63)	24 (0.58)	23 (0.56)	21 (0.51)	4 (0.10)	3 (0.07)	2 (0.05)	1 (0.02)	4,107 (100.00)

Table 3 - Horses 2018 – Reproductive pathology – All ages groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 480)

Antibiotic	Total (N)	% S
Amoxicillin	477	75
Amoxicillin-Clavulanic ac.	480	81
Cephalexin	344	88
Cefoxitin	342	97
Cefuroxime	34	88
Cefoperazone	46	93
Ceftiofur	480	96
Cefquinome 30 µg	477	97
Streptomycin 10 UI	337	77
Kanamycin 30 UI	449	93
Gentamicin 10 UI	480	95
Neomycin	209	88
Amikacine	133	100
Apramycin	42	98
Tetracycline	347	81
Florfenicol	314	98
Nalidixic ac.	323	98
Oxolinic ac.	132	97
Flumequine	156	98
Enrofloxacin	460	99
Marbofloxacin	474	99
Danofloxacin	54	98
Trimethoprim-Sulfonamides	480	76

Table 4 - Horses 2018 – Respiratory pathology – All ages groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 59)

Antibiotic	Total (N)	% S
Amoxicillin	59	64
Amoxicillin-Clavulanic ac.	59	80
Cephalexin	57	89
Cefoxitin	58	93
Ceftiofur	59	90
Cefquinome 30 µg	58	91
Streptomycin 10 UI	57	54
Kanamycin 30 UI	57	89
Gentamicin 10 UI	59	83
Tetracycline	56	68
Florfenicol	56	93
Nalidixic ac.	52	83
Enrofloxacin	58	93
Marbofloxacin	57	95
Trimethoprim-Sulfonamides	59	58

Table 5 - Horses 2018 – Skin and soft tissue infections – All ages groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 48)

Antibiotic	Total (N)	% S
Amoxicillin	48	60
Amoxicillin-Clavulanic ac.	48	71
Cephalexin	48	69
Cefoxitin	46	96
Ceftiofur	47	89
Cefquinome 30 µg	45	91
Streptomycin 10 UI	48	71
Kanamycin 30 UI	44	77
Gentamicin 10 UI	48	81
Tetracycline	47	64
Florfenicol	45	98
Nalidixic ac.	47	83
Enrofloxacin	47	94
Marbofloxacin	45	96
Trimethoprim-Sulfonamides	48	71

Table 6 - Horses 2018 – All pathologies and ages groups included – *Klebsiella*: susceptibility to antibiotics (proportion) (N= 169)

Antibiotic	Total (N)	% S
Amoxicillin-Clavulanic ac.	169	81
Cefoxitin	140	94
Ceftiofur	169	93
Cefquinome 30 µg	163	96
Streptomycin 10 UI	137	77
Kanamycin 30 UI	143	91
Gentamicin 10 UI	169	91
Neomycin	66	97
Tetracycline	143	79
Florfenicol	125	95
Nalidixic ac.	134	91
Flumequine	36	83
Enrofloxacin	160	96
Marbofloxacin	160	96
Trimethoprim-Sulfonamides	168	76

Table 7 - Horses 2018 – All pathologies and ages groups included – *Enterobacter*: susceptibility to antibiotics (proportion) (N= 99)

Antibiotic	Total (N)	% S
Amoxicillin-Clavulanic ac.	99	9
Cephalexin	85	13
Cefoxitin	87	8
Ceftiofur	99	75
Cefquinome 30 µg	97	86
Streptomycin 10 UI	83	64
Kanamycin 30 UI	93	72
Gentamicin 10 UI	99	71
Tetracycline	87	66
Florfenicol	80	80
Nalidixic ac.	82	79
Enrofloxacin	99	91
Marbofloxacin	95	93
Trimethoprim-Sulfonamides	99	70

Table 8 - Horses 2018 – Skin and soft tissue infections – All age groups included – *Staphylococcus aureus*: susceptibility to antibiotics (proportion) (N= 101)

Antibiotic	Total (N)	% S
Penicillin G	101	60
Cefoxitin	90	80
Oxacillin	78	86
Erythromycin	98	99
Streptomycin 10 UI	91	96
Kanamycin 30 UI	86	84
Gentamicin 10 UI	101	84
Tetracycline	97	81
Enrofloxacin	89	97
Marbofloxacin	97	98
Trimethoprim-Sulfonamides	97	94
Rifampicin	71	92

Table 9 - Horses 2018 – Reproductive pathology – All age groups included – *Streptococcus groupe C* and *Streptococcus zooepidemicus*: susceptibility to antibiotics (proportion) (N= 486)

Antibiotic	Total (N)	% S
Oxacillin	455	97
Erythromycin	460	97
Tulathromycin	71	79
Tylosin	81	100
Spiramycin	213	98
Lincomycin	137	89
Streptomycin 500 µg	399	99
Kanamycin 1000 µg	360	99
Gentamicin 500 µg	400	99
Tetracycline	391	33
Florfenicol	58	98
Enrofloxacin	484	20
Marbofloxacin	463	70
Trimethoprim-Sulfonamides	417	67
Rifampicin	359	72

Table 10 - Horses 2018 – Respiratory pathology – All age groups included – *Streptococcus*: susceptibility to antibiotics (proportion) (N= 260)

Antibiotic	Total (N)	% S
Oxacillin	258	95
Erythromycin	259	93
Spiramycin	66	97
Lincomycin	113	83
Streptomycin 500 µg	241	99
Kanamycin 1000 µg	231	100
Gentamicin 500 µg	246	99
Tetracycline	234	57
Florfenicol	67	97
Enrofloxacin	258	24
Marbofloxacin	226	66
Trimethoprim-Sulfonamides	259	68
Rifampicin	180	71

Table 11 - Horses 2018 – Skin and soft tissue infections – All age groups included – *Streptococcus*: susceptibility to antibiotics (proportion) (N= 115)

Antibiotic	Total (N)	% S
Oxacillin	115	94
Erythromycin	112	93
Streptomycin 500 µg	106	99
Kanamycin 1000 µg	104	96
Gentamicin 500 µg	112	100
Tetracycline	112	50
Enrofloxacin	113	14
Marbofloxacin	111	59
Trimethoprim-Sulfonamides	112	77
Rifampicin	87	60



Annex 10

Dogs

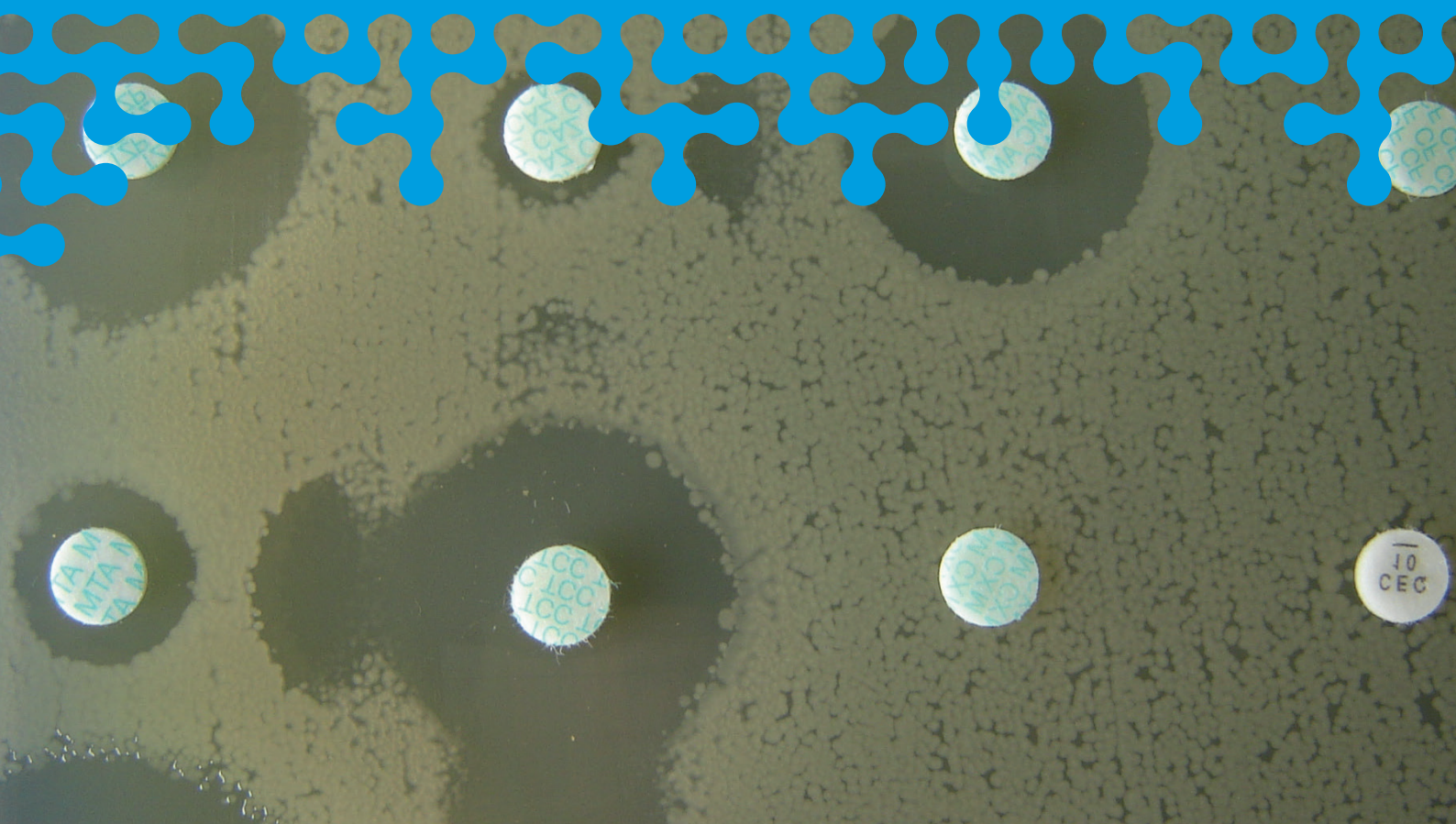
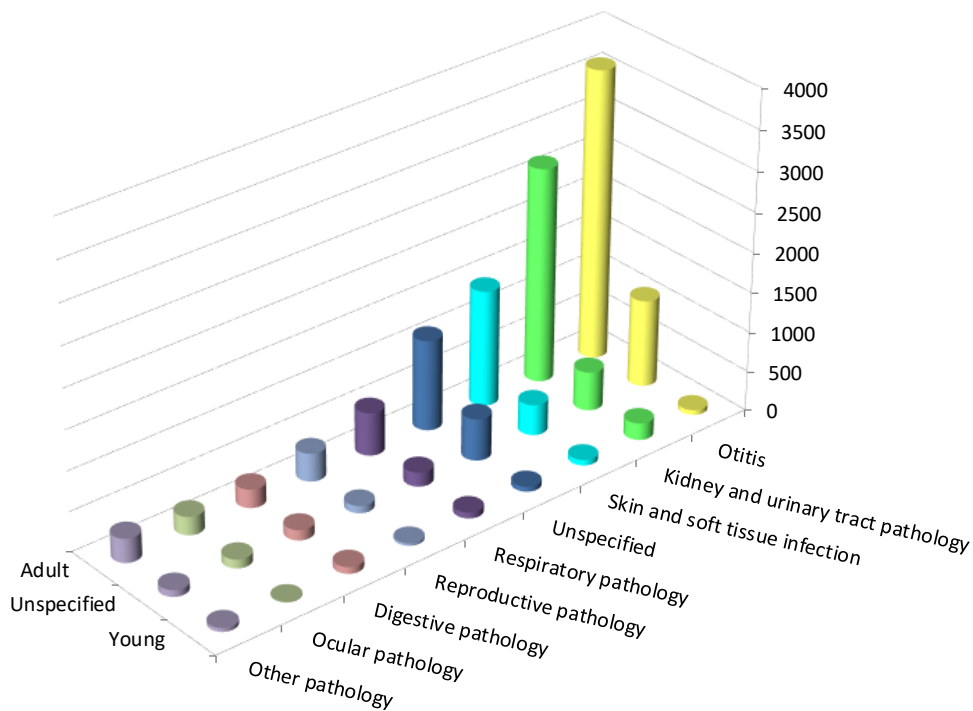


Figure 1 - Dogs 2018 – Number of antibiograms by age group and pathology

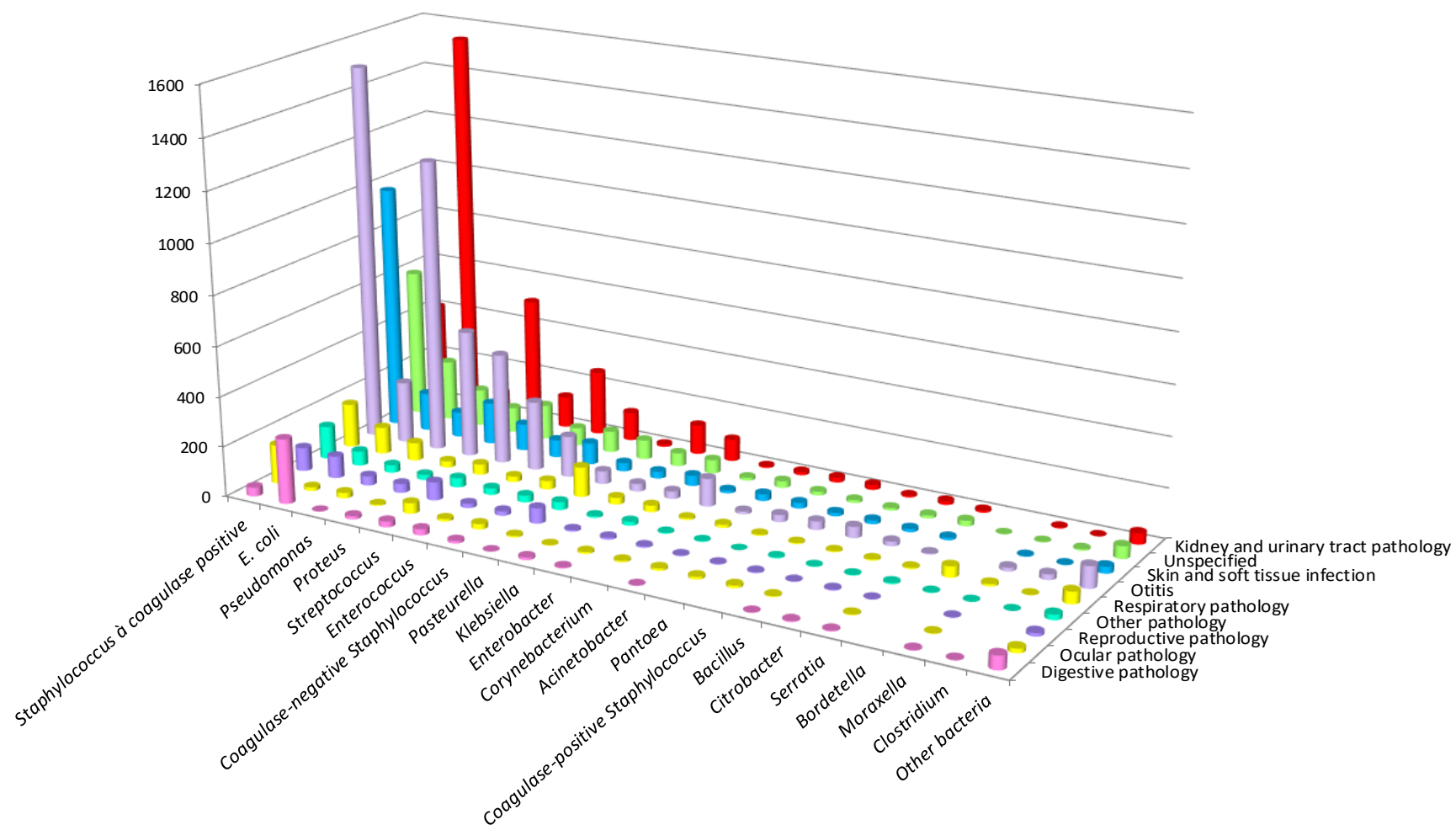


Note: all values are detailed in table 1 (including other pathologies, representing less than 1%, grouped together)

Table 1 - Dogs 2018 – Number of antibiograms by age group and pathology

Pathology N (%)	Age group N (%)			Total N (%)
	Adult	Unspecified	Young	
Otitis	3,642 (25.43)	1,094 (7.64)	61 (0.43)	4,797 (33.49)
Kidney and urinary tract pathology	2,699 (18.84)	487 (3.40)	211 (1.47)	3,397 (23.72)
Skin and soft tissue infections	1,458 (10.18)	383 (2.67)	70 (0.49)	1,911 (13.34)
Unspecified	1 138 (7.94)	526 (3.67)	62 (0.43)	1,726 (12.05)
Respiratory pathology	543 (3.79)	177 (1.24)	74 (0.52)	794 (5.54)
Reproductive pathology	353 (2.46)	92 (0.64)	30 (0.21)	475 (3.32)
Digestive pathology	233 (1.63)	130 (0.91)	84 (0.59)	447 (3.12)
Ocular pathology	229 (1.60)	110 (0.77)	7 (0.05)	346 (2.42)
Arthritis	104 (0.73)	28 (0.20)	6 (0.04)	138 (0.96)
Oral pathology	86 (0.60)	23 (0.16)	5 (0.03)	114 (0.80)
Bone pathology	58 (0.40)	19 (0.13)	11 (0.08)	88 (0.61)
Systemic pathology	18 (0.13)	11 (0.08)	15 (0.10)	44 (0.31)
Mastitis	24 (0.17)			24 (0.17)
Nervous system pathology	6 (0.04)		3 (0.02)	9 (0.06)
Septicemia	1 (0.01)	1 (0.01)	6 (0.04)	8 (0.06)
Muscle pathology	3 (0.02)			3 (0.02)
Cardiac pathology	2 (0.01)	1 (0.01)		3 (0.02)
Total N (%)	10,597 (73.98)	3,082 (21.52)	645 (4.50)	14,324 (100.00)

Figure 2 - Dogs 2018 – Number of antibiograms by bacteria and pathology



Note: only values for pathologies >1% and bacterial groups having more than 30 occurrences are represented. Detailed values are presented in table 2 below.

Table 2, part 1 - Dogs 2018 – Number of antibiograms by bacteria and pathology

Bacteria N (%)	Pathology N (%)																	Total N (%)
	Otitis	Kidney and urinary tract pathology	Skin and soft tissue infections	Unspecified	Respiratory pathology	Reproductive pathology	Digestive pathology	Ocular pathology	Arthritis	Oral pathology	Bone pathology	Systemic pathology	Mastitis	Nervous system pathology	Septicemia	Muscle pathology	Cardiac pathology	
Coagulase-positive Staphylococcus	1,503 (10.49)	409 (2.86)	977 (6.82)	592 (4.13)	176 (1.23)	94 (0.66)	35 (0.24)	156 (1.09)	62 (0.43)	21 (0.15)	33 (0.23)	6 (0.04)	7 (0.05)	3 (0.02)				4,074 (28.44)
E. coli	246 (1.72)	1,539 (10.74)	153 (1.07)	241 (1.68)	107 (0.75)	88 (0.61)	260 (1.82)	14 (0.10)	5 (0.03)	18 (0.13)	4 (0.03)	20 (0.14)	4 (0.03)	1 (0.01)	5 (0.03)	1 (0.01)		2,706 (18.89)
Pseudomonas	1,172 (8.18)	89 (0.62)	101 (0.71)	148 (1.03)	72 (0.50)	37 (0.26)	1 (0.01)	22 (0.15)	10 (0.07)	12 (0.08)	7 (0.05)	2 (0.01)						1,673 (11.68)
Proteus	509 (3.55)	504 (3.52)	167 (1.17)	100 (0.70)	25 (0.17)	36 (0.25)	13 (0.09)	5 (0.03)	3 (0.02)	9 (0.06)	5 (0.03)	2 (0.01)	1 (0.01)			1 (0.01)		1,380 (9.63)
Streptococcus	442 (3.09)	126 (0.88)	107 (0.75)	138 (0.96)	42 (0.29)	73 (0.51)	23 (0.16)	42 (0.29)	14 (0.10)	9 (0.06)	6 (0.04)	3 (0.02)	1 (0.01)	2 (0.01)	1 (0.01)		1 (0.01)	1,030 (7.19)
Enterococcus	276 (1.93)	258 (1.8)	70 (0.49)	71 (0.50)	22 (0.15)	17 (0.12)	24 (0.17)	10 (0.07)	6 (0.04)	5 (0.03)	8 (0.06)	4 (0.03)	2 (0.01)	1 (0.01)				774 (5.40)
Coagulase-negative Staphylococcus	164 (1.14)	115 (0.80)	86 (0.60)	85 (0.59)	34 (0.24)	18 (0.13)	10 (0.07)	21 (0.15)	8 (0.06)	2 (0.01)	10 (0.07)		6 (0.04)	1 (0.01)				560 (3.91)
Pasteurella	51 (0.36)	10 (0.07)	34 (0.24)	77 (0.54)	119 (0.83)	61 (0.43)	1 (0.01)	6 (0.04)	7 (0.05)	21 (0.15)	1 (0.01)	2 (0.01)		1 (0.01)				391 (2.73)
Klebsiella	30 (0.21)	119 (0.83)	28 (0.20)	53 (0.37)	27 (0.19)	6 (0.04)	10 (0.07)	2 (0.01)		2 (0.01)	1 (0.01)	2 (0.01)	1 (0.01)			1 (0.01)		282 (1.97)
Enterobacter	30 (0.21)	88 (0.61)	42 (0.29)	54 (0.38)	26 (0.18)	8 (0.06)	4 (0.03)	7 (0.05)	7 (0.05)	4 (0.03)	4 (0.03)		1 (0.01)					275 (1.92)
Corynebacterium	112 (0.78)	7 (0.05)	12 (0.08)	11 (0.08)	7 (0.05)	6 (0.04)		6 (0.04)	2 (0.01)	2 (0.01)								165 (1.15)
Acinetobacter	11 (0.08)	13 (0.09)	27 (0.19)	27 (0.19)	12 (0.08)	3 (0.02)	1 (0.01)	9 (0.06)	2 (0.01)				1 (0.01)					106 (0.74)
Pantoea	28 (0.20)	19 (0.13)	23 (0.16)	15 (0.10)	5 (0.03)	3 (0.02)		10 (0.07)										103 (0.72)
Coagulase-unspecified Staphylococcus	34 (0.24)	20 (0.14)	14 (0.10)	11 (0.08)	4 (0.03)	4 (0.03)		10 (0.07)	1 (0.01)	1 (0.01)	2 (0.01)							101 (0.71)

Table 2, part 2 - Dogs 2018 – Number of antibiograms by bacteria and pathology

Bacteria N (%)	Pathology N (%)																	Total N (%)
	Otitis	Kidney and urinary tract pathology	Skin and soft tissue infections	Unspecified	Respiratory pathology	Reproductive pathology	Digestive pathology	Ocular pathology	Arthritis	Oral pathology	Bone pathology	Systemic pathology	Mastitis	Nervous system pathology	Septicemia	Muscle pathology	Cardiac pathology	
<i>Bacillus</i>	44 (0.31)	7 (0.05)	15 (0.10)	10 (0.07)	4 (0.03)	2 (0.01)	1 (0.01)	4 (0.03)			2 (0.01)							89 (0.62)
<i>Citrobacter</i>	18 (0.13)	15 (0.10)	13 (0.09)	12 (0.08)	5 (0.03)	4 (0.03)	4 (0.03)		1 (0.01)	1 (0.01)								73 (0.51)
<i>Serratia</i>	4 (0.03)	9 (0.06)	10 (0.07)	22 (0.15)	5 (0.03)	1 (0.01)	3 (0.02)	3 (0.02)	4 (0.03)		1 (0.01)							62 (0.43)
<i>Bordetella</i>				1 (0.01)	44 (0.31)							2 (0.01)						47 (0.33)
<i>Moraxella</i>	14 (0.10)	4 (0.03)	3 (0.02)	2 (0.01)	9 (0.06)	1 (0.01)	2 (0.01)	2 (0.01)		1 (0.01)								38 (0.27)
<i>Clostridium</i>	22 (0.15)	1 (0.01)	2 (0.01)	6 (0.04)	1 (0.01)		1 (0.01)											33 (0.23)
<i>Other bacteria < 30 occurrences</i>	87 (0.61)	45 (0.31)	27 (0.19)	50 (0.35)	48 (0.34)	13 (0.09)	54 (0.38)	17 (0.12)	6 (0.04)	6 (0.04)	4 (0.03)	1 (0.01)			2 (0.01)		2 (0.01)	362 (2.53)
Total N (%)	4,797 (33.49)	3,397 (23.72)	1,911 (13.34)	1,726 (12.05)	794 (5.54)	475 (3.32)	447 (3.12)	346 (2.42)	138 (0.96)	114 (0.80)	88 (0.61)	44 (0.31)	24 (0.17)	9 (0.06)	8 (0.06)	3 (0.02)	3 (0.02)	14,324 (100.00)

Table 3 - Dogs 2018 – Kidney and urinary tract pathology – All age groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 1,539)

Antibiotic	Total (N)	% S
Amoxicillin	1,535	70
Amoxicillin-Clavulanic ac.	1,539	74
Cephalexin	1,517	71
Cephalothin	69	72
Cefoxitin	631	89
Cefuroxime	110	75
Cefoperazone	83	92
Cefovecin	227	93
Ceftiofur	1,532	96
Cefquinome 30 µg	559	97
Streptomycin 10 UI	700	76
Kanamycin 30 UI	470	92
Tobramycin	746	99
Gentamicin 10 UI	1,537	97
Neomycin	294	93
Apramycin	40	100
Tetracycline	1,442	79
Doxycycline	219	49
Chloramphenicol	903	87
Florfenicol	515	94
Nalidixic ac.	1,265	90
Oxolinic ac.	50	92
Flumequine	215	92
Enrofloxacin	1,426	96
Marbofloxacin	1,363	95
Danofloxacin	71	94
Sulfonamides	33	85
Trimethoprim-Sulfonamides	1,537	90

Table 4 - Dogs 2018 – Skin and soft tissue infections – All age groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 153)

Antibiotic	Total (N)	% S
Amoxicillin	150	61
Amoxicillin-Clavulanic ac.	153	66
Cephalexin	150	68
Cefoxitin	69	81
Cefovecin	32	88
Ceftiofur	152	93
Cefquinome 30 µg	48	92
Streptomycin 10 UI	74	66
Kanamycin 30 UI	38	89
Tobramycin	70	100
Gentamicin 10 UI	152	99
Neomycin	39	82
Tetracycline	146	68
Chloramphenicol	99	82
Florfenicol	48	92
Nalidixic ac.	140	84
Enrofloxacin	144	91
Marbofloxacin	120	93
Trimethoprim-Sulfonamides	152	86

Table 5 - Dogs 2018 – Otitis – All age groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 246)

Antibiotic	Total (N)	% S
Amoxicillin	246	73
Amoxicillin-Clavulanic ac.	246	78
Cephalexin	232	76
Cefoxitin	152	94
Cefovecin	38	95
Ceftiofur	246	98
Cefquinome 30 µg	132	99
Streptomycin 10 UI	122	81
Kanamycin 30 UI	88	97
Tobramycin	83	92
Gentamicin 10 UI	245	97
Neomycin	77	90
Tetracycline	234	79
Doxycycline	32	53
Chloramphenicol	113	87
Florfenicol	126	94
Nalidixic ac.	233	88
Enrofloxacin	242	95
Marbofloxacin	211	95
Trimethoprim-Sulfonamides	241	91

Table 6 - Dogs 2018 – All pathologies and age groups included – *Pasteurella*: susceptibility to antibiotics (proportion) (N= 391)

Antibiotic	Total (N)	% S
Amoxicillin	388	96
Amoxicillin-Clavulanic ac.	388	97
Cephalexin	383	94
Cefoxitin	38	95
Cefovecin	32	88
Ceftiofur	369	96
Cefquinome 30 µg	158	92
Streptomycin 10 UI	200	74
Kanamycin 30 UI	137	87
Tobramycin	159	99
Gentamicin 10 UI	385	98
Neomycin	83	80
Tetracycline	336	97
Doxycycline	73	96
Chloramphenicol	197	95
Florfenicol	166	99
Nalidixic ac.	295	93
Flumequine	52	77
Enrofloxacin	387	98
Marbofloxacin	351	99
Trimethoprim	30	83
Trimethoprim-Sulfonamides	379	90

Table 7 - Dogs 2018 – Otitis – All age groups included – *Staphylococcus pseudintermedius*: susceptibility to antibiotics (proportion) (N= 1,145)

Antibiotic	Total (N)	% S
Penicillin G	1,132	21
Oxacillin	810	95
Cefovecin	657	92
Erythromycin	1,139	73
Tylosin	187	82
Spiramycin	529	74
Lincomycin	1,088	76
Streptomycin 10 UI	717	74
Kanamycin 30 UI	483	76
Gentamicin 10 UI	1,138	90
Neomycin	438	78
Tetracycline	1,118	64
Doxycycline	62	76
Chloramphenicol	525	73
Florfenicol	554	100
Enrofloxacin	809	92
Marbofloxacin	1,016	94
Sulfonamides	100	45
Trimethoprim-Sulfonamides	1,128	88
Fusidic ac.	807	96
Rifampicin	133	97

Table 8 - Dogs 2018 – Skin and soft tissue infections – All age groups included – *Staphylococcus pseudintermedius*: susceptibility to antibiotics (proportion) (N= 802)

Antibiotic	Total (N)	% S
Penicillin G	797	14
Oxacillin	529	87
Cefovecin	605	86
Erythromycin	796	66
Tylosin	119	76
Spiramycin	309	69
Lincomycin	781	72
Streptomycin 10 UI	401	66
Kanamycin 30 UI	277	72
Tobramycin	38	82
Gentamicin 10 UI	800	88
Neomycin	251	73
Tetracycline	743	64
Doxycycline	62	60
Chloramphenicol	484	73
Florfenicol	223	100
Enrofloxacin	654	87
Marbofloxacin	693	87
Sulfonamides	110	45
Trimethoprim-Sulfonamides	790	83
Fusidic ac.	577	97

Table 9 - Dogs 2018 – Kidney and urinary tract pathology – All age groups included – *Staphylococcus pseudintermedius*: susceptibility to antibiotics (proportion) (N= 294)

Antibiotic	Total (N)	% S
Penicillin G	293	17
Oxacillin	227	96
Cefovecin	171	93
Erythromycin	287	74
Spiramycin	68	74
Lincomycin	289	80
Streptomycin 10 UI	156	74
Kanamycin 30 UI	140	73
Gentamicin 10 UI	293	91
Neomycin	56	70
Tetracycline	262	64
Doxycycline	32	59
Chloramphenicol	135	78
Florfenicol	130	98
Enrofloxacin	198	91
Marbofloxacin	276	92
Trimethoprim-Sulfonamides	292	86
Fusidic ac.	218	96

Table 10 - Dogs 2018 – All pathologies and age groups included – All age groups included – *Staphylococcus aureus*: susceptibility to antibiotics (proportion) (N= 489)

Antibiotic	Total (N)	% S
Penicillin G	482	24
Cefoxitin	453	80
Oxacillin	246	90
Erythromycin	484	68
Tylosin	41	90
Spiramycin	207	70
Lincomycin	476	77
Streptomycin 10 UI	239	73
Kanamycin 30 UI	132	87
Gentamicin 10 UI	488	89
Neomycin	154	71
Tetracycline	478	73
Chloramphenicol	313	76
Florfenicol	130	100
Enrofloxacin	408	88
Marbofloxacin	392	89
Sulfonamides	82	33
Trimethoprim-Sulfonamides	486	88
Fusidic ac.	369	95
Rifampicin	30	90

Table 11 - Dogs 2018 – Otitis – All age groups included – *Staphylococcus aureus*: susceptibility to antibiotics (proportion) (N= 137)

Antibiotic	Total (N)	% S
Penicillin G	133	29
Cefoxitin	131	90
Oxacillin	64	94
Erythromycin	134	66
Spiramycin	66	70
Lincomycin	132	74
Streptomycin 10 UI	66	68
Kanamycin 30 UI	34	79
Gentamicin 10 UI	136	86
Neomycin	42	60
Tetracycline	134	66
Chloramphenicol	89	78
Enrofloxacin	121	87
Marbofloxacin	108	87
Trimethoprim-Sulfonamides	136	84
Fusidic ac.	98	96

Table 12 - Dogs 2018 – Skin and soft tissue infections – All age groups included – *Staphylococcus aureus*: susceptibility to antibiotics (proportion) (N= 92)

Antibiotic	Total (N)	% S
Penicillin G	91	30
Cefoxitin	77	83
Oxacillin	47	96
Erythromycin	92	71
Spiramycin	53	72
Lincomycin	90	77
Streptomycin 10 UI	51	71
Gentamicin 10 UI	92	92
Neomycin	41	76
Tetracycline	86	79
Chloramphenicol	66	70
Enrofloxacin	86	88
Marbofloxacin	65	89
Trimethoprim-Sulfonamides	91	90
Fusidic ac.	60	93

Table 13 - Dogs 2018 – Kidney and urinary tract pathology – All age groups included – *Staphylococcus aureus*: susceptibility to antibiotics (proportion) (N=65)

Antibiotic	Total (N)	% S
Penicillin G	65	18
Cefoxitin	64	88
Oxacillin	43	93
Erythromycin	64	61
Lincomycin	64	78
Gentamicin 10 UI	65	91
Tetracycline	64	64
Chloramphenicol	47	70
Enrofloxacin	56	88
Marbofloxacin	60	92
Trimethoprim-Sulfonamides	65	92
Fusidic ac.	57	100

Table 14 - Dogs 2018 – Otitis – All age groups included – *Streptococcus*: susceptibility to antibiotics (proportion) (N= 442)

Antibiotic	Total (N)	% S
Oxacillin	409	88
Cefovecin	67	78
Erythromycin	428	78
Tylosin	93	84
Spiramycin	222	85
Lincomycin	414	81
Streptomycin 500 µg	373	90
Kanamycin 1000 µg	344	99
Gentamicin 500 µg	421	98
Tetracycline	409	33
Doxycycline	33	55
Chloramphenicol	77	44
Florfenicol	282	98
Enrofloxacin	431	55
Marbofloxacin	411	83
Trimethoprim-Sulfonamides	421	63
Rifampicin	44	39

Table 15 - Dogs 2018 – Skin and soft tissue infections – All age groups included – *Streptococcus*: susceptibility to antibiotics (proportion) (N= 107)

Antibiotic	Total (N)	% S
Oxacillin	103	91
Erythromycin	107	78
Spiramycin	57	82
Lincomycin	103	82
Streptomycin 500 µg	96	91
Kanamycin 1000 µg	91	98
Gentamicin 500 µg	106	98
Tetracycline	86	27
Florfenicol	48	96
Enrofloxacin	100	49
Marbofloxacin	96	82
Trimethoprim-Sulfonamides	101	63

Table 16 - Dogs 2018 – All pathologies and age groups included – *Proteus mirabilis*: susceptibility to antibiotics (proportion) (N= 1,273)

Antibiotic	Total (N)	% S
Amoxicillin-Clavulanic ac.	1,271	89
Cephalexin	1,229	79
Cephalothin	77	97
Cefoxitin	472	91
Cefuroxime	86	98
Cefovecin	129	98
Ceftiofur	1,263	99
Cefquinome 30 µg	449	99
Streptomycin 10 UI	472	75
Spectinomycin	32	78
Kanamycin 30 UI	354	88
Tobramycin	704	93
Gentamicin 10 UI	1,273	91
Neomycin	221	88
Apramycin	54	96
Chloramphenicol	792	62
Florfenicol	429	99
Nalidixic ac.	1,119	84
Oxolinic ac.	32	94
Flumequine	134	93
Enrofloxacin	1,211	93
Marbofloxacin	1,167	97
Danofloxacin	70	99
Trimethoprim-Sulfonamides	1,269	79



Annexe11

Cats

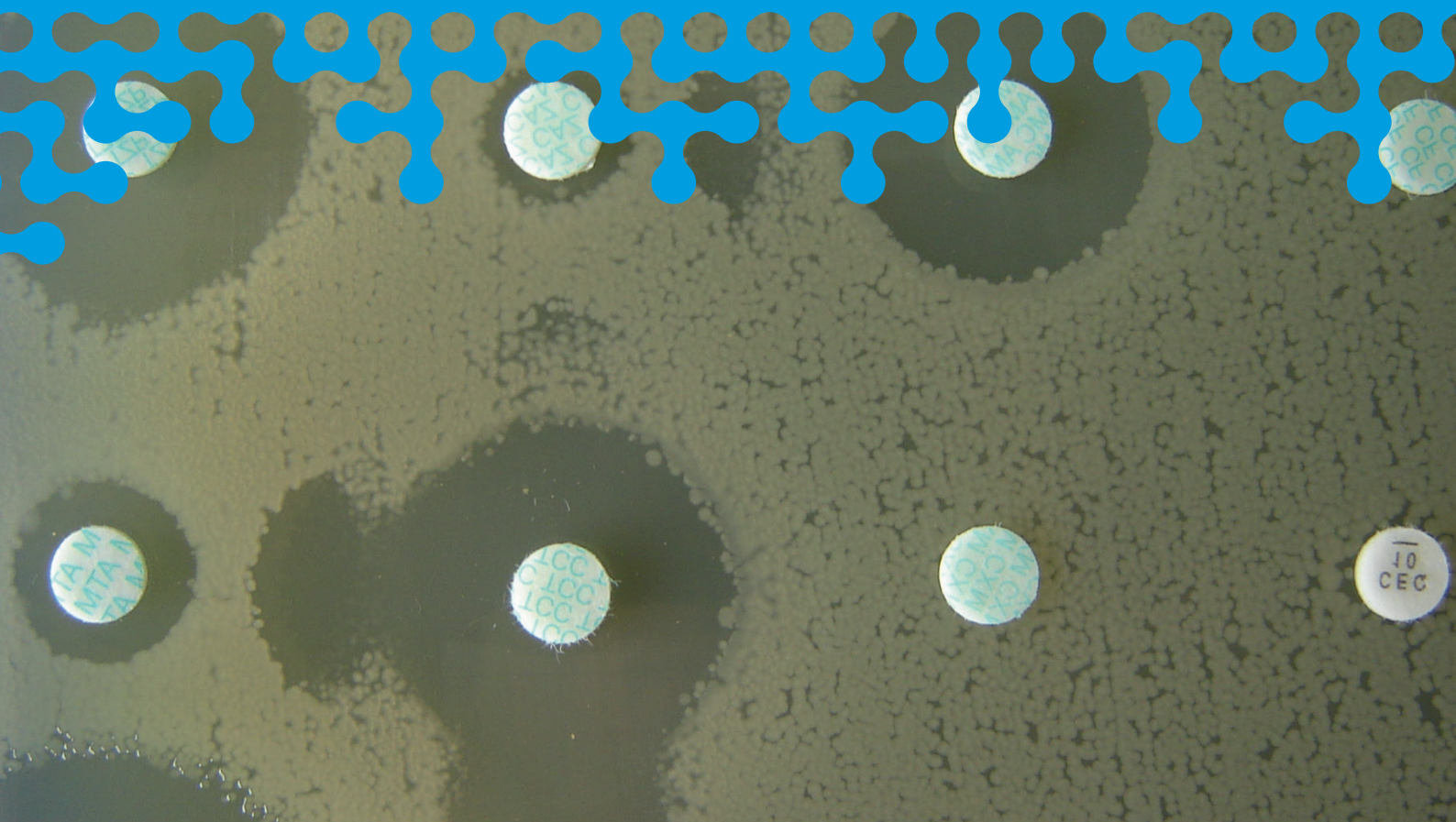
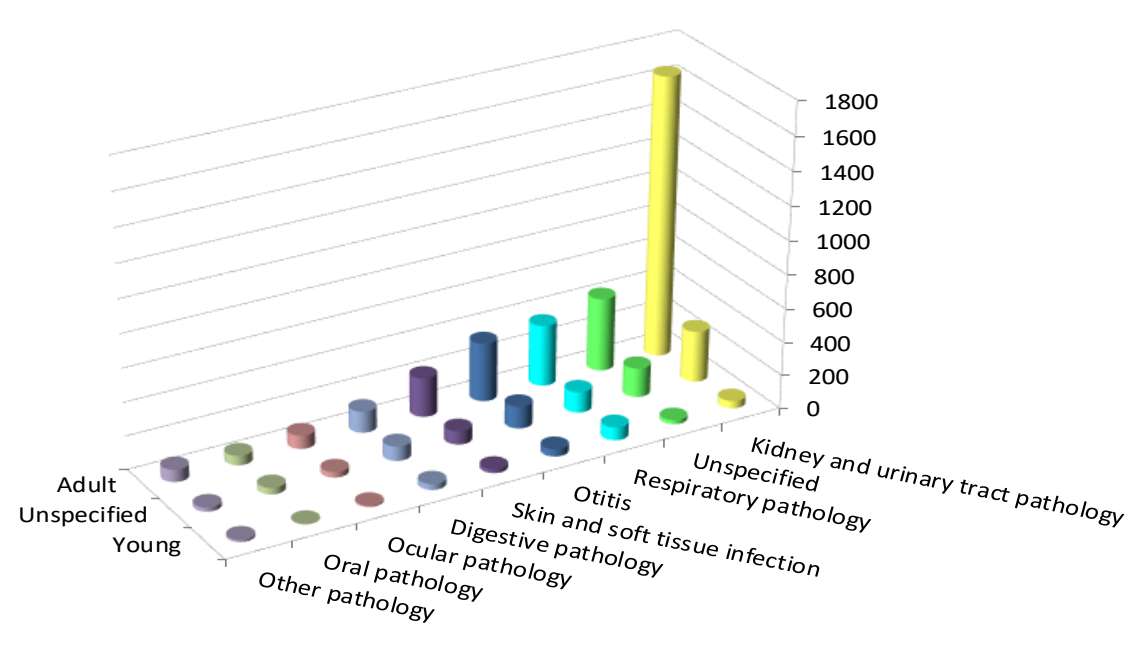


Figure 1 - Cats 2018 – Number of antibiograms by age group and pathology

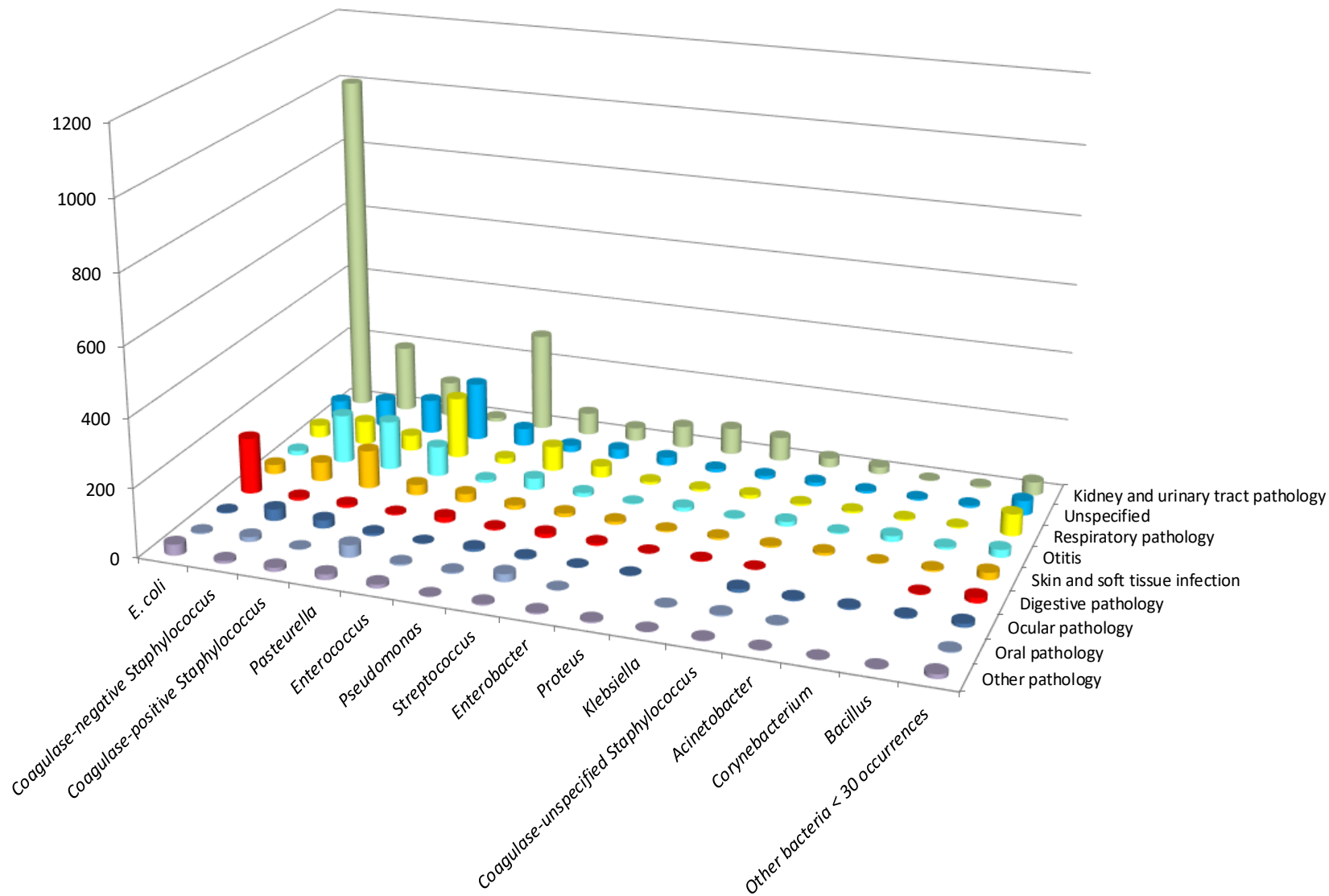


Note: all values are detailed in table 1 (including other pathologies, representing less than 1%, grouped together)

Table 1 - Cats 2018 – Number of antibiograms by age group and pathology

Pathology N (%)	Age group N (%)			Total N (%)
	Adult	Unspecified	Young	
Kidney and urinary tract pathology	1,666 (35.76)	306 (6.57)	45 (0.97)	2,017 (43.29)
Unspecified	438 (9.40)	174 (3.73)	24 (0.52)	636 (13.65)
Respiratory pathology	366 (7.86)	124 (2.66)	78 (1.67)	568 (12.19)
Otitis	350 (7.51)	132 (2.83)	43 (0.92)	525 (11.27)
Skin and soft tissue infections	234 (5.02)	80 (1.72)	22 (0.47)	336 (7.21)
Digestive pathology	128 (2.75)	86 (1.85)	35 (0.75)	249 (5.34)
Ocular pathology	80 (1.72)	33 (0.71)	7 (0.15)	120 (2.58)
Oral pathology	57 (1.22)	39 (0.84)	2 (0.04)	98 (2.10)
Bone pathology	30 (0.64)	9 (0.19)	1 (0.02)	40 (0.86)
Reproductive pathology	13 (0.28)	7 (0.15)		20 (0.43)
Systemic pathology	10 (0.21)	1 (0.02)	5 (0.11)	16 (0.34)
Arthritis	11 (0.24)	3 (0.06)	2 (0.04)	16 (0.34)
Nervous system pathology	4 (0.09)	1 (0.02)	3 (0.06)	8 (0.17)
Septicemia	3 (0.06)	3 (0.06)	1 (0.02)	7 (0.15)
Mastitis	2 (0.04)			2 (0.04)
Cardiac pathology	1 (0.02)			1 (0.02)
Total N (%)	3,393 (72.83)	998 (21.42)	268 (5.75)	4,659 (100.00)

Figure 2 - Cats 2018 – Number of antibiograms by bacteria and pathology



Note: only values for pathologies >1% and bacterial groups having more than 30 occurrences are represented. Detailed values are presented in table 2 below.

Table 2 - Cats 2018 – Number of antibiograms by bacteria and pathology

Bacteria N (%)	Pathology N (%)																Total N (%)
	Kidney and urinary tract pathology	Unspecified	Respiratory pathology	Otitis	Skin and soft tissue infections	Digestive pathology	Ocular pathology	Oral pathology	Bone pathology	Reproductive pathology	Systemic pathology	Arthritis	Nervous system pathology	Septicemia	Mastitis	Cardiac pathology	
<i>E. coli</i>	1,007 (21.61)	60 (1.29)	37 (0.79)	14 (0.30)	28 (0.60)	165 (3.54)	4 (0.09)	4 (0.09)	3 (0.06)	12 (0.26)	10 (0.21)	2 (0.04)	1 (0.02)	3 (0.06)	1 (0.02)		1,351 (29.00)
<i>Coagulase-negative Staphylococcus</i>	196 (4.21)	82 (1.76)	69 (1.48)	143 (3.07)	56 (1.20)	9 (0.19)	34 (0.73)	14 (0.30)	2 (0.04)	1 (0.02)	1 (0.02)	1 (0.02)	3 (0.06)				611 (13.11)
<i>Coagulase-positive Staphylococcus</i>	104 (2.23)	101 (2.17)	46 (0.99)	144 (3.09)	112 (2.4)	9 (0.19)	24 (0.52)	2 (0.04)	8 (0.17)	1 (0.02)		2 (0.04)			1 (0.02)		554 (11.89)
<i>Pasteurella</i>	11 (0.24)	172 (3.69)	181 (3.88)	88 (1.89)	31 (0.67)	4 (0.09)	7 (0.15)	36 (0.77)	8 (0.17)		1 (0.02)	6 (0.13)		1 (0.02)			546 (11.72)
<i>Enterococcus</i>	289 (6.20)	52 (1.12)	17 (0.36)	9 (0.19)	25 (0.54)	16 (0.34)	1 (0.02)	5 (0.11)	6 (0.13)	1 (0.02)	2 (0.04)	1 (0.02)		1 (0.02)			425 (9.12)
<i>Pseudomonas</i>	65 (1.40)	20 (0.43)	73 (1.57)	34 (0.73)	13 (0.28)	5 (0.11)	8 (0.17)	4 (0.09)	1 (0.02)								223 (4.79)
<i>Streptococcus</i>	39 (0.84)	29 (0.62)	34 (0.73)	12 (0.26)	11 (0.24)	12 (0.26)	5 (0.11)	23 (0.49)		1 (0.02)	1 (0.02)	2 (0.04)					169 (3.63)
<i>Enterobacter</i>	64 (1.37)	25 (0.54)	8 (0.17)	2 (0.04)	9 (0.19)	6 (0.13)	1 (0.02)	1 (0.02)	3 (0.06)					1 (0.02)			120 (2.58)
<i>Proteus</i>	78 (1.67)	10 (0.21)	7 (0.15)	12 (0.26)	4 (0.09)	1 (0.02)	1 (0.02)			3 (0.06)	1 (0.02)						117 (2.51)
<i>Klebsiella</i>	70 (1.50)	11 (0.24)	11 (0.24)	2 (0.04)	6 (0.13)	3 (0.06)		1 (0.02)	1 (0.02)								105 (2.25)
<i>Coagulase-unspecified Staphylococcus</i>	27 (0.58)	12 (0.26)	6 (0.13)	14 (0.30)	5 (0.11)	1 (0.02)	10 (0.21)	4 (0.09)					1 (0.02)			1 (0.02)	81 (1.74)
<i>Acinetobacter</i>	21 (0.45)	7 (0.15)	6 (0.13)	4 (0.09)	8 (0.17)		5 (0.11)	1 (0.02)					1 (0.02)				53 (1.14)
<i>Corynebacterium</i>	2 (0.04)	5 (0.11)	5 (0.11)	17 (0.36)	2 (0.04)		5 (0.11)										36 (0.77)
<i>Bacillus</i>	5 (0.11)	7 (0.15)	4 (0.09)	7 (0.15)	5 (0.11)	2 (0.04)	4 (0.09)		1 (0.02)								35 (0.75)
<i>Other bacteria < 30 occurrences</i>	39 (0.84)	43 (0.92)	64 (1.37)	23 (0.49)	21 (0.45)	16 (0.34)	11 (0.24)	3 (0.06)	7 (0.15)	1 (0.02)		2 (0.04)	2 (0.04)	1 (0.02)			233 (5.00)
Total N (%)	2,017 (43.29)	636 (13.65)	568 (12.19)	525 (11.27)	336 (7.21)	249 (5.34)	120 (2.58)	98 (2.10)	40 (0.86)	20 (0.43)	16 (0.34)	16 (0.34)	8 (0.17)	7 (0.15)	2 (0.04)	1 (0.02)	4,659 (100.00)

Table 3 - Cats 2018 – All pathologies and age groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 1,351)

Antibiotic	Total (N)	% S
Amoxicillin	1,344	70
Amoxicillin-Clavulanic ac.	1,350	74
Cephalexin	1327	78
Cephalothin	57	79
Cefoxitin	546	93
Cefuroxime	129	85
Cefoperazone	85	99
Cefovecin	155	93
Ceftiofur	1,343	96
Cefquinome 30 µg	525	98
Streptomycin 10 UI	568	76
Spectinomycin	37	95
Kanamycin 30 UI	391	93
Tobramycin	668	98
Gentamicin 10 UI	1,348	98
Neomycin	268	91
Apramycin	74	100
Tetracycline	1,268	81
Doxycycline	143	52
Chloramphenicol	759	91
Florfenicol	460	95
Nalidixic ac.	1,128	87
Oxolinic ac.	42	90
Flumequine	164	88
Enrofloxacin	1,266	93
Marbofloxacin	1,195	93
Danofloxacin	78	100
Trimethoprim-Sulfonamides	1,348	90

Table 4 - Cats 2018 – Kidney and urinary tract pathology – All age groups included – *E. coli*: susceptibility to antibiotics (proportion) (N= 1,007)

Antibiotic	Total (N)	% S
Amoxicillin	1,003	71
Amoxicillin-Clavulanic ac.	1,006	75
Cephalexin	989	76
Cephalothin	38	82
Cefoxitin	348	94
Cefuroxime	55	80
Cefoperazone	43	100
Cefovecin	112	92
Ceftiofur	1,001	95
Cefquinome 30 µg	325	98
Streptomycin 10 UI	400	79
Kanamycin 30 UI	285	93
Tobramycin	561	98
Gentamicin 10 UI	1,004	98
Neomycin	157	93
Tetracycline	944	82
Doxycycline	117	50
Chloramphenicol	632	91
Florfenicol	297	96
Nalidixic ac.	853	87
Flumequine	107	93
Enrofloxacin	949	93
Marbofloxacin	913	92
Danofloxacin	36	100
Trimethoprim-Sulfonamides	1,004	91

Table 5 - Cats 2018 – Respiratory pathology – All age groups included – *Pasteurella*: susceptibility to antibiotics (proportion) (N= 181)

Antibiotic	Total (N)	% S
Amoxicillin	177	93
Amoxicillin-Clavulanic ac.	181	92
Cephalexin	177	94
Ceftiofur	167	97
Cefquinome 30 µg	69	91
Streptomycin 10 UI	75	47
Kanamycin 30 UI	51	61
Tobramycin	92	100
Gentamicin 10 UI	179	93
Neomycin	35	74
Tetracycline	179	96
Chloramphenicol	106	98
Florfenicol	74	100
Nalidixic ac.	157	94
Enrofloxacin	181	97
Marbofloxacin	176	99
Trimethoprim-Sulfonamides	181	82

Table 6 - Cats 2018 – All pathologies and age groups included – Coagulase-positive *Staphylococcus*: susceptibility to antibiotics (proportion) (N= 554)

Antibiotic	Total (N)	% S
Penicillin G	548	40
Cefoxitin	408	81
Oxacillin	326	88
Cefovecin	294	88
Erythromycin	550	72
Tylosin	86	84
Spiramycin	229	82
Lincomycin	547	82
Streptomycin 10 UI	346	86
Kanamycin 30 UI	271	87
Gentamicin 10 UI	551	91
Neomycin	167	90
Tetracycline	530	82
Chloramphenicol	220	86
Florfenicol	251	99
Enrofloxacin	376	89
Marbofloxacin	506	89
Sulfonamides	37	76
Trimethoprim-Sulfonamides	548	88
Fusidic ac.	367	97
Rifampicin	65	98

Tableau 7 - Cats 2018 – Otitis – All pathologies and age groups included – Coagulase-positive *Staphylococcus*: susceptibility to antibiotics (proportion) (N= 144)

Antibiotic	Total (N)	% S
Penicillin G	143	60
Cefoxitin	97	93
Oxacillin	89	98
Cefovecin	71	94
Erythromycin	143	80
Spiramycin	63	86
Lincomycin	141	86
Streptomycin 10 UI	95	93
Kanamycin 30 UI	78	92
Gentamicin 10 UI	143	94
Neomycin	48	94
Tetracycline	140	89
Chloramphenicol	49	86
Florfenicol	70	100
Enrofloxacin	91	97
Marbofloxacin	135	96
Trimethoprim-Sulfonamides	143	92
Fusidic ac.	95	97

Tableau 8 - Cats 2018 – Skin and soft tissue infections – All pathologies and age groups included – Coagulase-positive *Staphylococcus*: susceptibility to antibiotics (proportion) (N= 112)

Antibiotic	Total (N)	% S
Penicillin G	112	39
Cefoxitin	88	76
Oxacillin	57	91
Cefovecin	64	92
Erythromycin	112	73
Spiramycin	51	84
Lincomycin	111	86
Streptomycin 10 UI	74	88
Kanamycin 30 UI	47	81
Gentamicin 10 UI	111	93
Neomycin	38	95
Tetracycline	108	90
Chloramphenicol	48	85
Florfenicol	42	98
Enrofloxacin	85	92
Marbofloxacin	102	91
Trimethoprim-Sulfonamides	108	92
Fusidic ac.	70	94

Tableau 9 - Cats 2018 – Kidney and urinary tract pathology – All pathologies and age groups included – Coagulase-positive *Staphylococcus*: susceptibility to antibiotics (proportion) (N= 104)

Antibiotic	Total (N)	% S
Penicillin G	102	38
Cefoxitin	66	89
Oxacillin	71	83
Cefovecin	55	89
Erythromycin	103	73
Spiramycin	34	79
Lincomycin	103	79
Streptomycin 10 UI	69	86
Kanamycin 30 UI	57	84
Gentamicin 10 UI	103	88
Tetracycline	96	76
Chloramphenicol	37	89
Florfenicol	49	98
Enrofloxacin	62	81
Marbofloxacin	102	80
Trimethoprim-Sulfonamides	104	84
Fusidic ac.	68	100



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