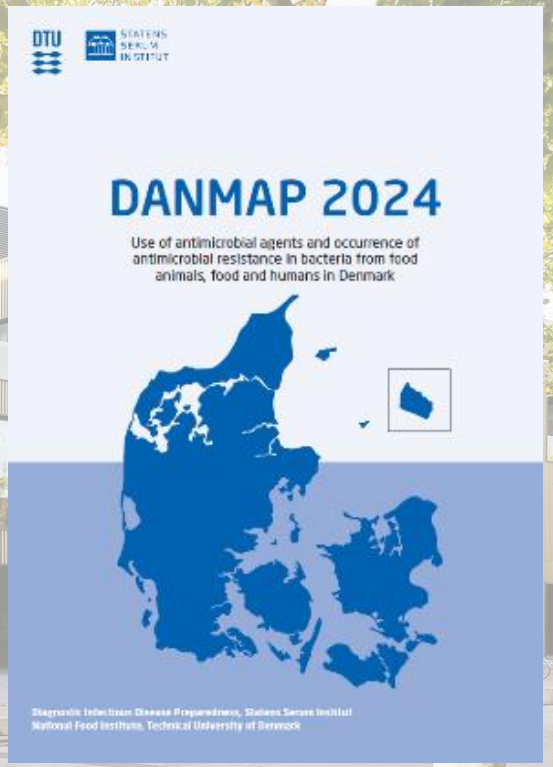
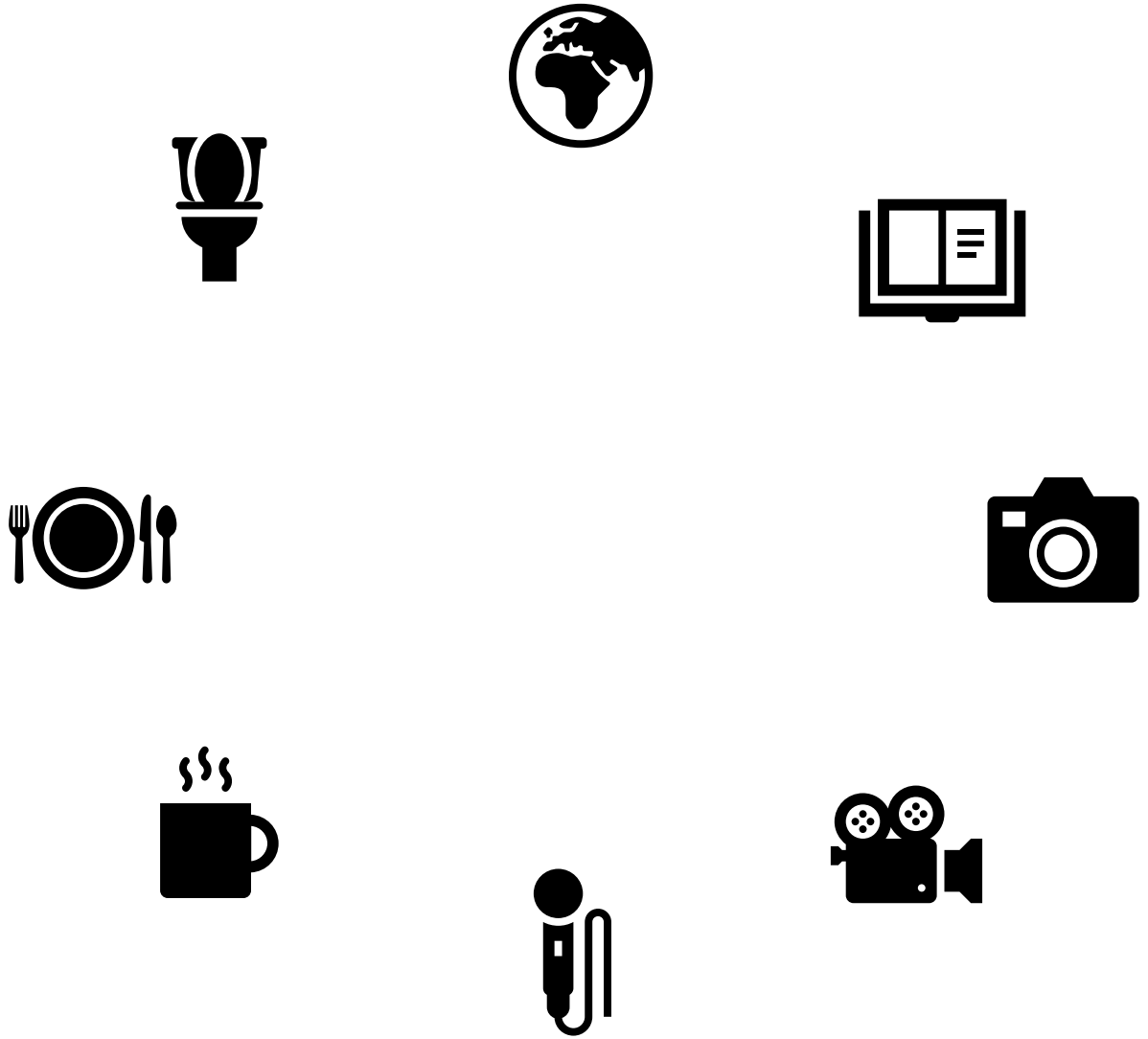
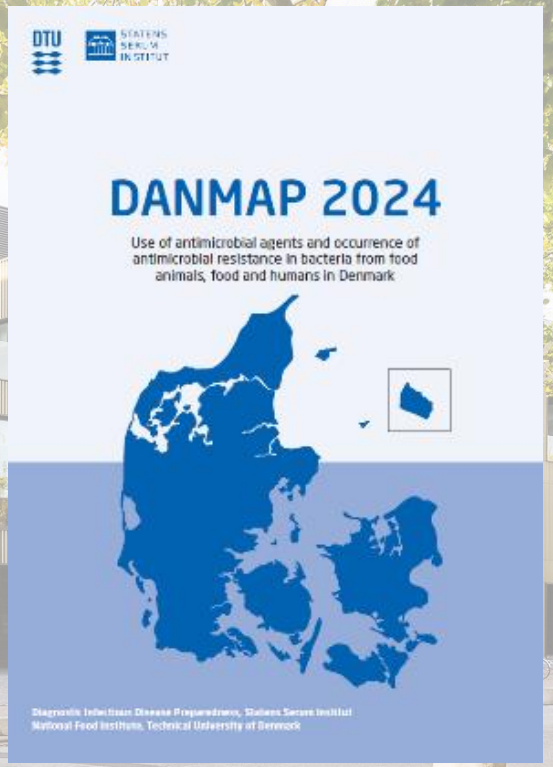
DANMAP Seminar 2025



House keeping



DANMAP Seminar 2025



Welcome by Tine Rask Licht

Program

10.00-10.30	**Registration and coffee**
10.30-10.45	**Welcome by DTU Food Director Tine Rask Licht**
10.45-12.00	**DANMAP-highlights by the editors** • Majda Attauabi, Statens Serum Institut • Mikkel Lindegaard, Statens Serum Institut • Vibe D. Andersen, DTU Food • Ana Sofia R. Duarte, DTU Food • Lina Cavaco, Statens Serum Institut
12.00-12.30	**Lunch break**
12.30-13.20	**New action plans against antimicrobial resistance in the human and veterinary sectors** **Presentation of the national action plans** • Søren Herskind Mortensen, Academic officer, Ministry of the Interior and Health • Pia Holm Jul, Veterinary officer, Danish Veterinary and Food Administration **From action plan on paper to action in practice** • Camilla Holten Møller, Medical doctor and AMR-coordinator, Statens Serum Institut • Hans Henrik Dietz, Chairman, The Veterinary Medical Council
13.20-13.35	**Coffee break**
13.35-14.50	**Panel debate** • Camilla Holten Møller, Medical doctor and AMR-coordinator, Statens Serum Institut • Christian Fink Hansen, Director, Agriculture and Food Council • Christine Nellemann, Chairman, Danish Council on Ethics • Gideon Ertner, Senior Medical Officer, Danish Health Authority • Hans Henrik Dietz, Chairman, Veterinary Medical Council • Pia Holm Jul, Veterinary officer, Danish Veterinary and Food Administration • Trine Christner Månsson, Veterinarian, Danish Veterinary Association • Ulrich Stab Jensen, Chairman, Danish Specialist Scientific Society for Clinical Microbiology
14.50-15.00	**Closing remarks**
	The seminar is facilitated by Senior researcher Ana Sofia R. Duarte, DTU Food

DANMAP Seminar 2025

Antimicrobial consumption in humans

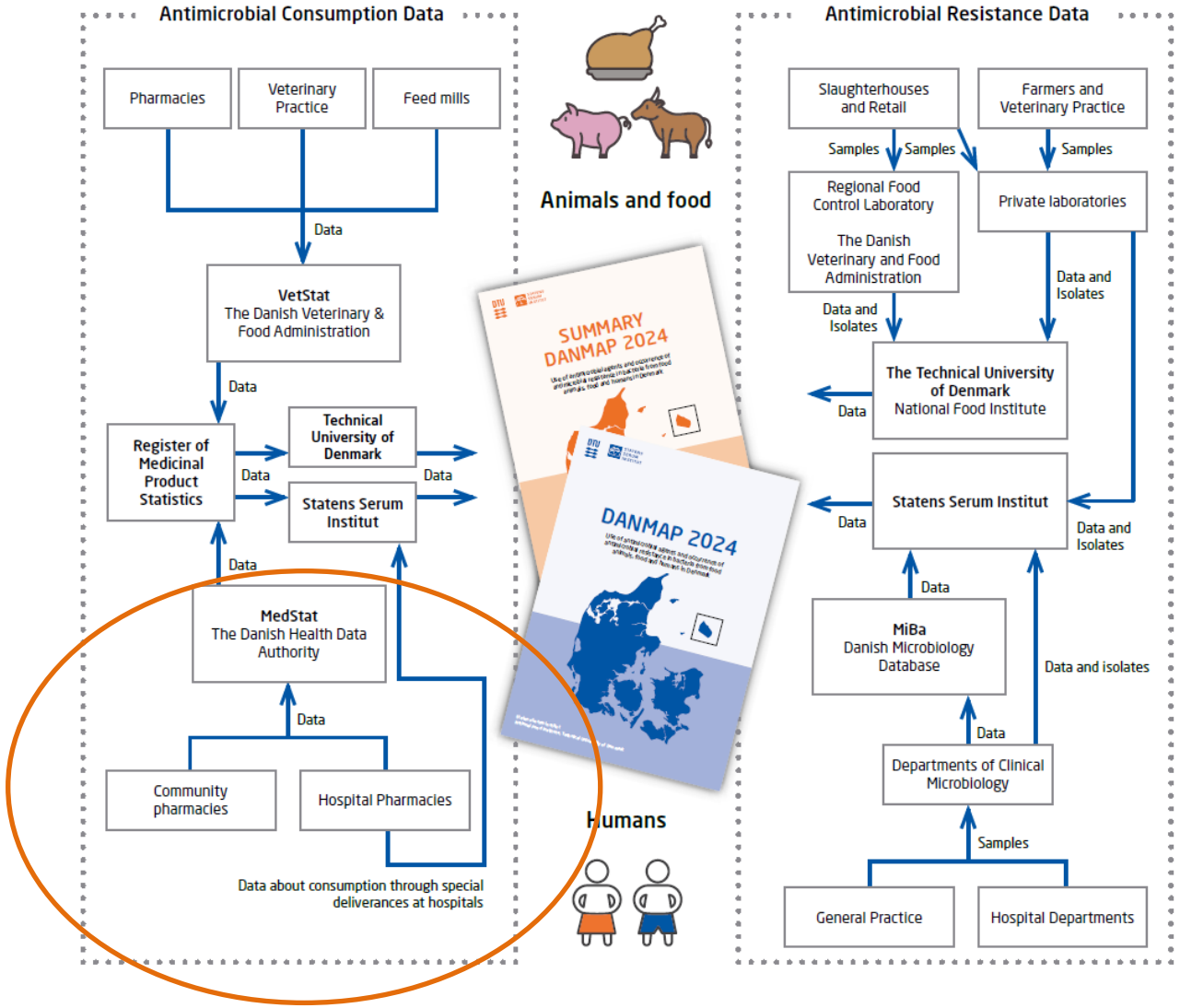
Majda Attauabi
Cand.pharm

Ute Wolff Sönksen
Chief Physician

Statens Serum Institut

DANMAP data flow

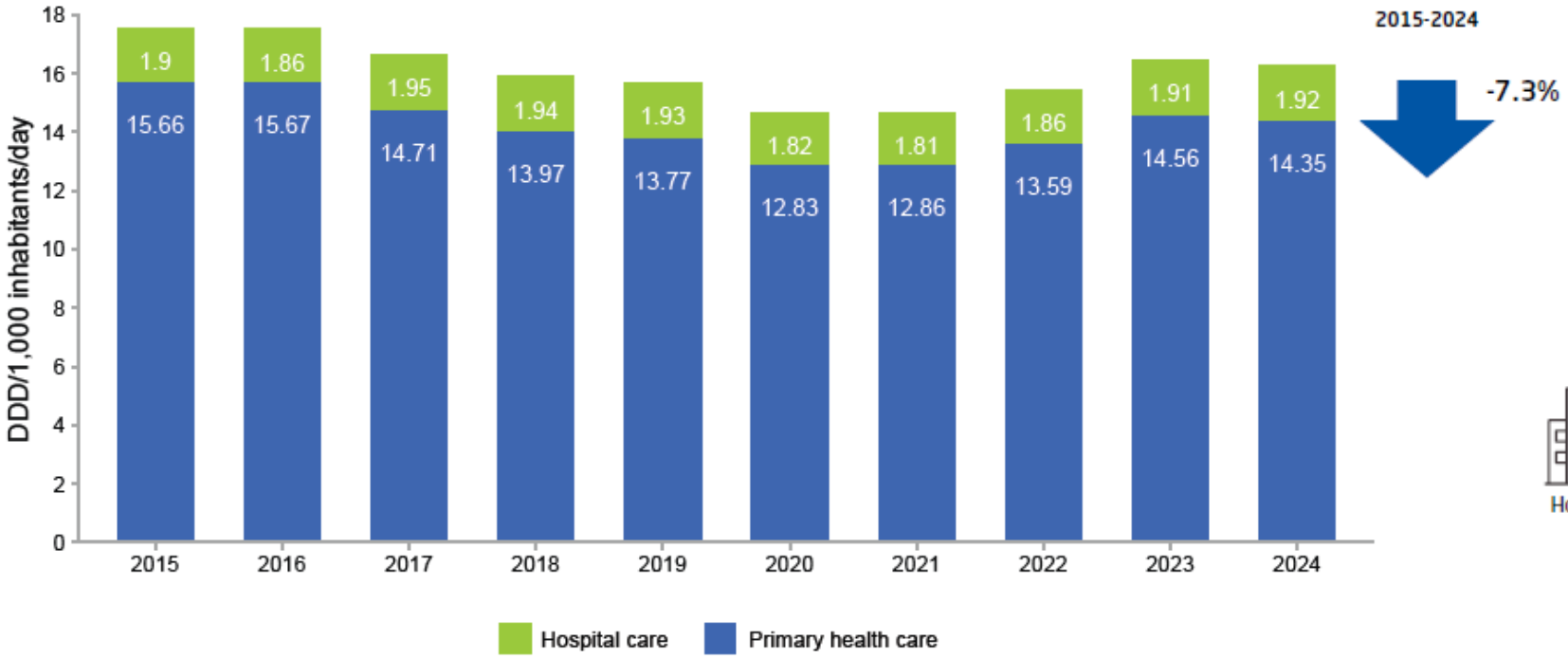
Figure 2.1 Organisation DANMAP regarding data and data flow DANMAP 2024



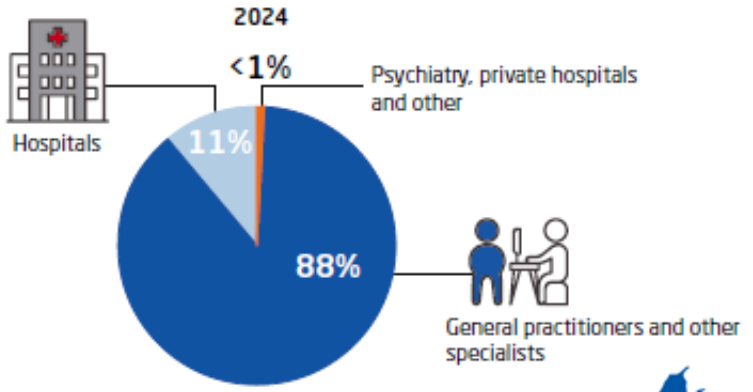
Antibiotic consumption in Denmark

Figure 5.1 Total consumption of systemic antimicrobial agents in humans, DDD per 1,000 inhabitants per day, Denmark, 2015-2024

DANMAP 2024



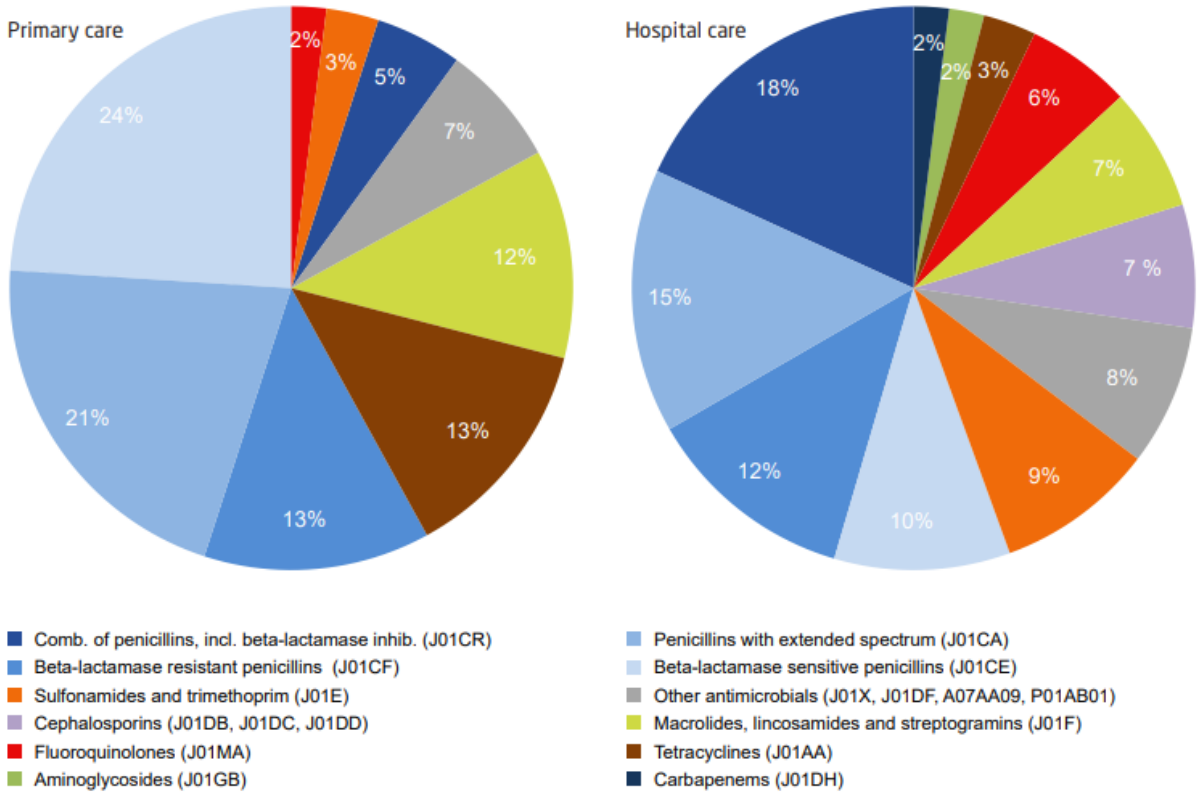
Data: Total sale of antimicrobials in Denmark
Data source: Register of Medicinal Product Statistics and 2025 edition of the Anatomical Therapeutic Chemical (ATC) classification system



Total care

Consumption is characterised by a big share of penicillins

Figure 5.4 Percentage distribution of antimicrobial agents in primary health care and hospital care measured in, DDD, Denmark, 2024
DANMAP 202



Data: Registered sales of antimicrobials to individuals and antimicrobial consumption at somatic hospitals
Data source: Register of Medicinal Product Statistics and the 2025 edition of the Anatomical Therapeutic Chemical (ATC) classification system

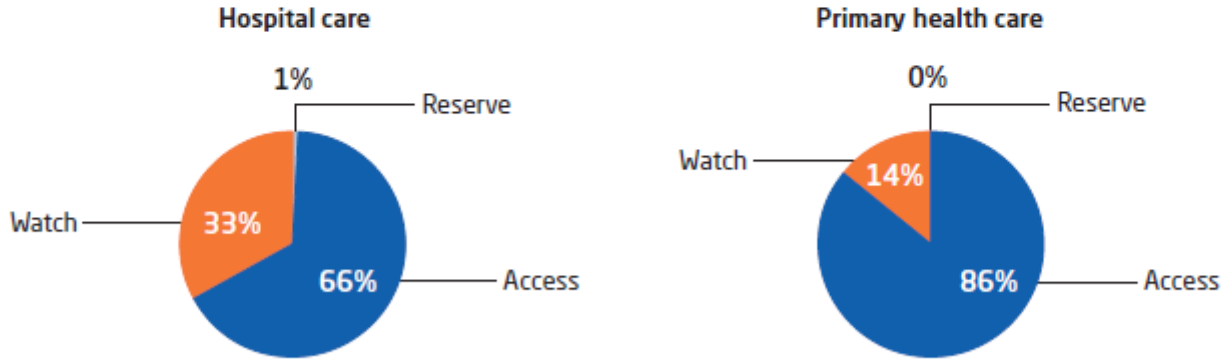
Total care

… and a big share of ”Access” antibiotics

AWaRe classification of antimicrobials in Denmark,

The World Health Organization (WHO) has developed the AWaRe classification system as a tool to assist antibiotic stewardship and to reduce antimicrobial resistance. Antibiotics are classified into three groups to emphasise the importance of their appropriate use:

- **Access:** Antibiotics used to treat common susceptible pathogens with lower resistance potential than antibiotics in the other groups. 60% of total antimicrobial consumption should consist of Access agents.
- **Watch:** Antibiotics that have higher resistance potential, including most of the highest priority agents. These antibiotics should be prioritised as key targets of stewardship programs and monitoring.
- **Reserve:** Antibiotics reserved for treatment of confirmed or suspected infections due to multidrug resistant organisms. These antibiotics should be considered as "last resort" options.

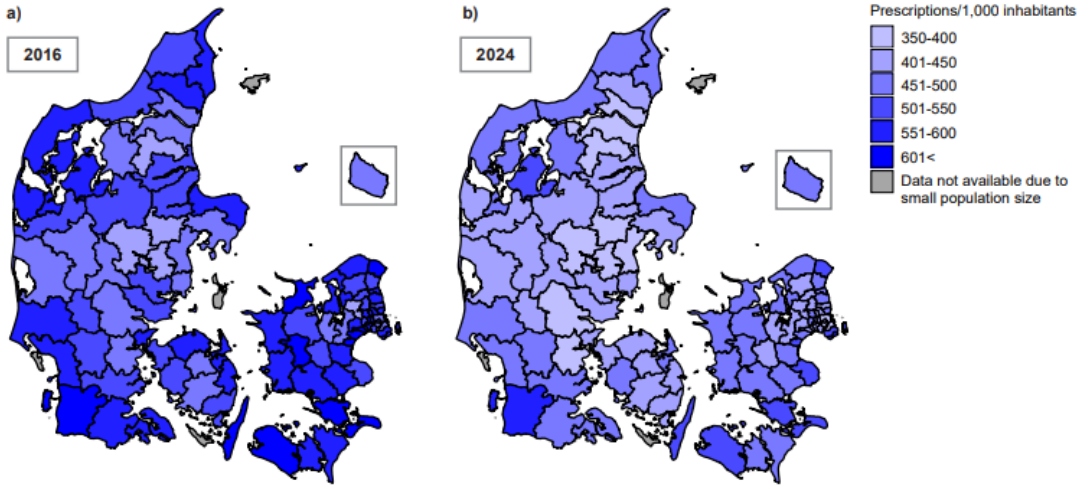


WHO Access, Watch, Reserve (AWaRe) classification of antibiotics for evaluation and monitoring of use, 2017. Geneva: World Health Organization; updated 2023 (WHO-MHP-HPS-EML-2023.04)

Total care

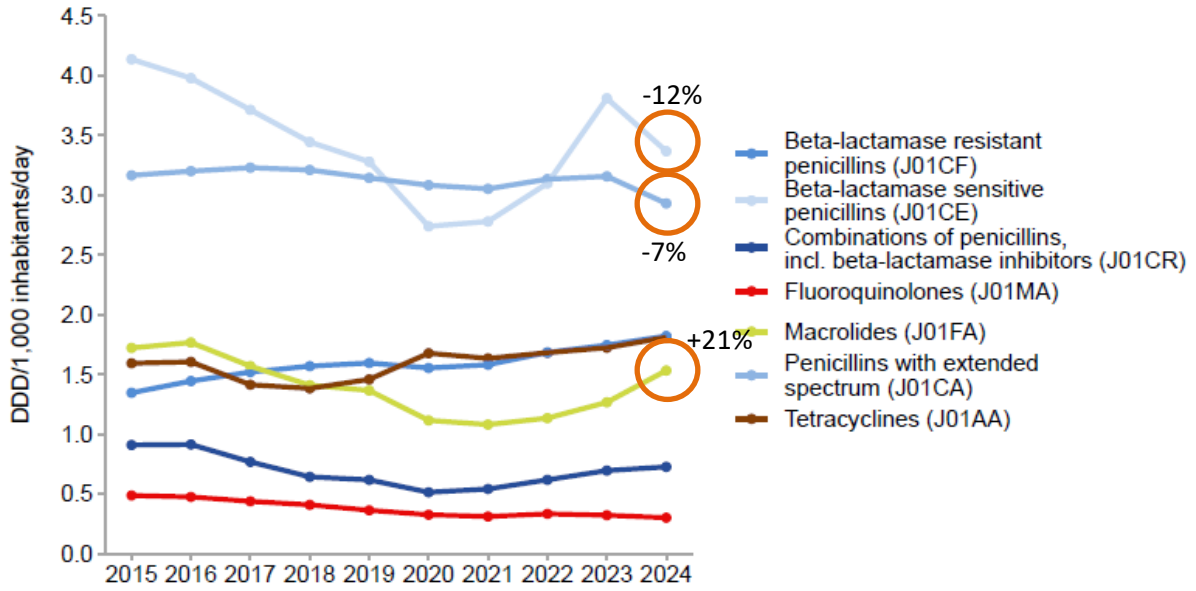
Decreasing trends in primary health care

Figure 5.6 Number of prescriptions in primary health care per 1,000 inhabitants in Danish municipalities in a) 2016 and b) 2024
DANMAP 2024



2016: 522 prescriptions/1,000 inhabitants
2024: 432 prescriptions/1,000 inhabitants
17 % ↓

Figure 5.8 Consumption of leading antimicrobial groups for systemic use in primary health care, DDD per 1,000 inhabitants per day, Denmark, 2015-2024
DANMAP 2024

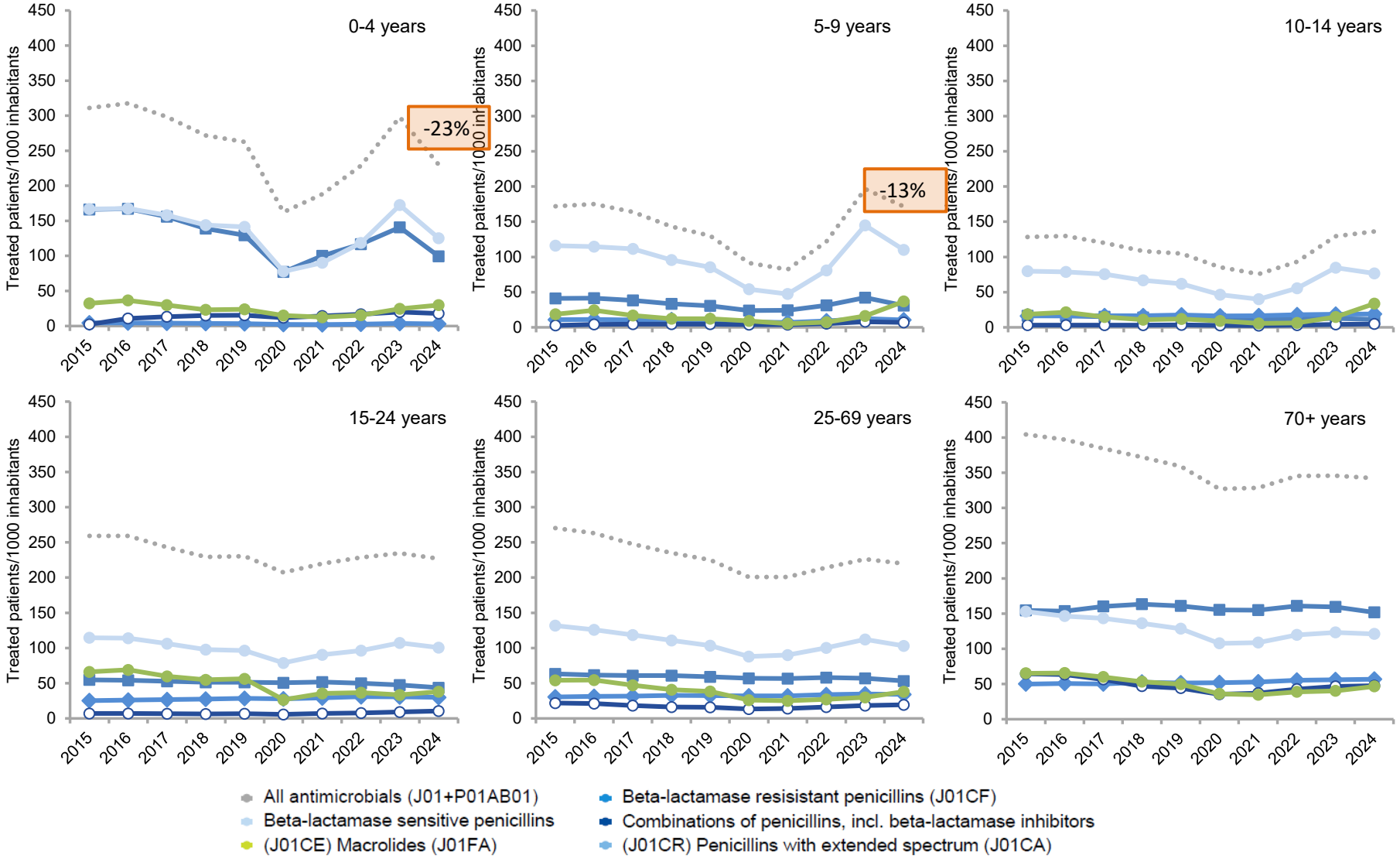


Data: Registered sale of antimicrobials to individuals
Data source: Register of Medicinal Product Statistics and 2025 edition of the Anatomical Therapeutic Chemical (ATC) classificati

Primary care

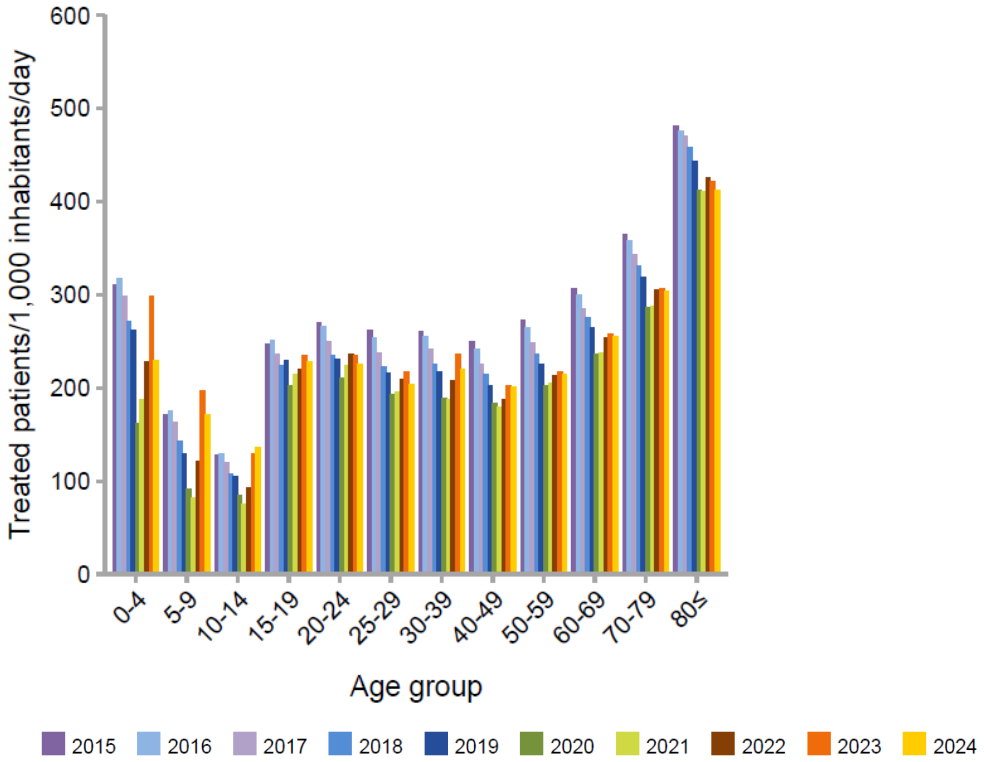
… driven by lower antimicrobial consumption among children

Figure 5.10 Consumption of main antimicrobial agents by age group, treated patients/1,000 inhabitants, Denmark, 2015-2024



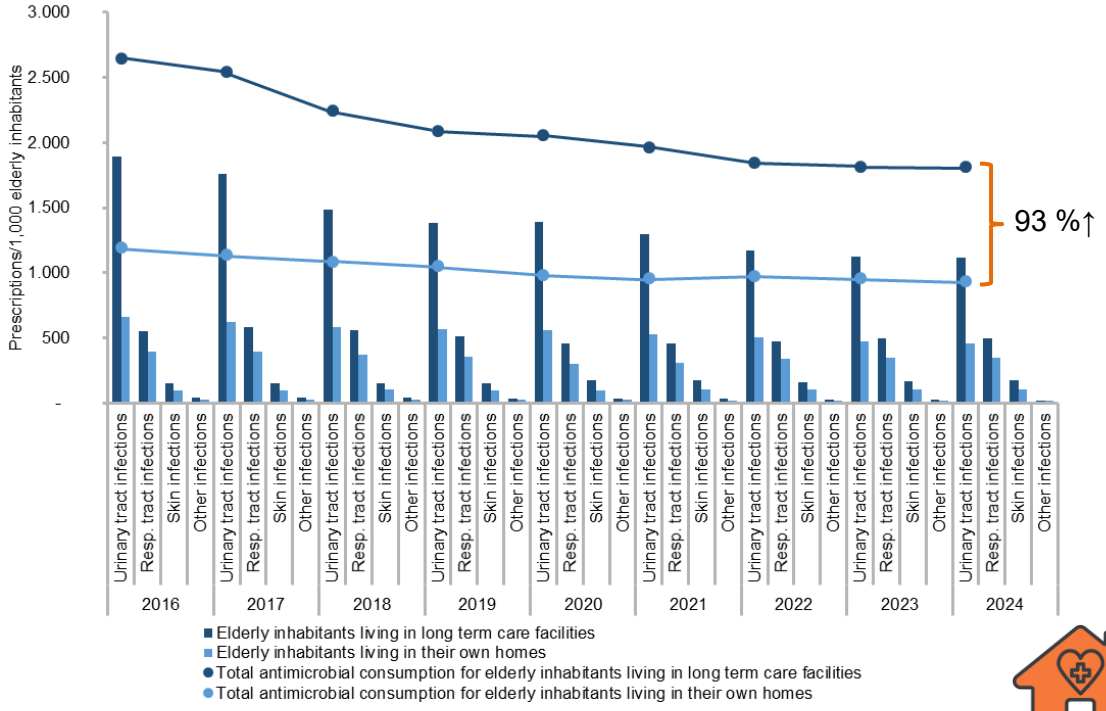
Primary care

Treatment gap persists among elderly depending on residency



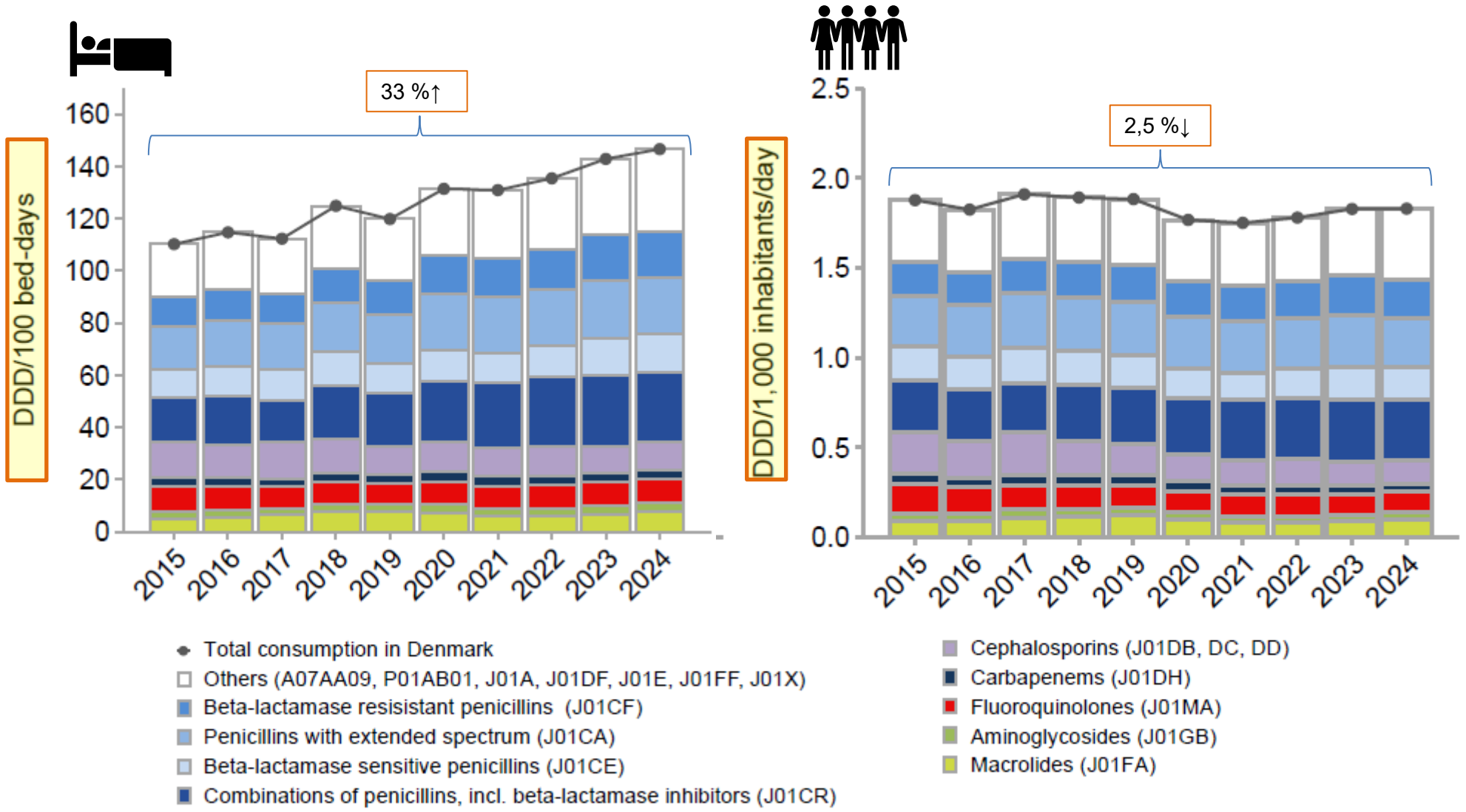
Data: Registered sale of antimicrobials to individuals
Data source: Register of Medicinal Product Statistics, 2025 edition of the Anatomical Therapeutic Chemical (ATC) classification system and Statistics Denmark
Children and adolescents are presented in five-year age groups, while adults are clustered in 10-year age groups

Figure 5.13 Consumption of antimicrobials in primary health care for elderly inhabitants (≥65 years) living in long term care facilities or in their own homes, Denmark, 2016-2024
DANMAP 2024



Primary care

Consumption trends at hospitals highly dependent on the used metrics



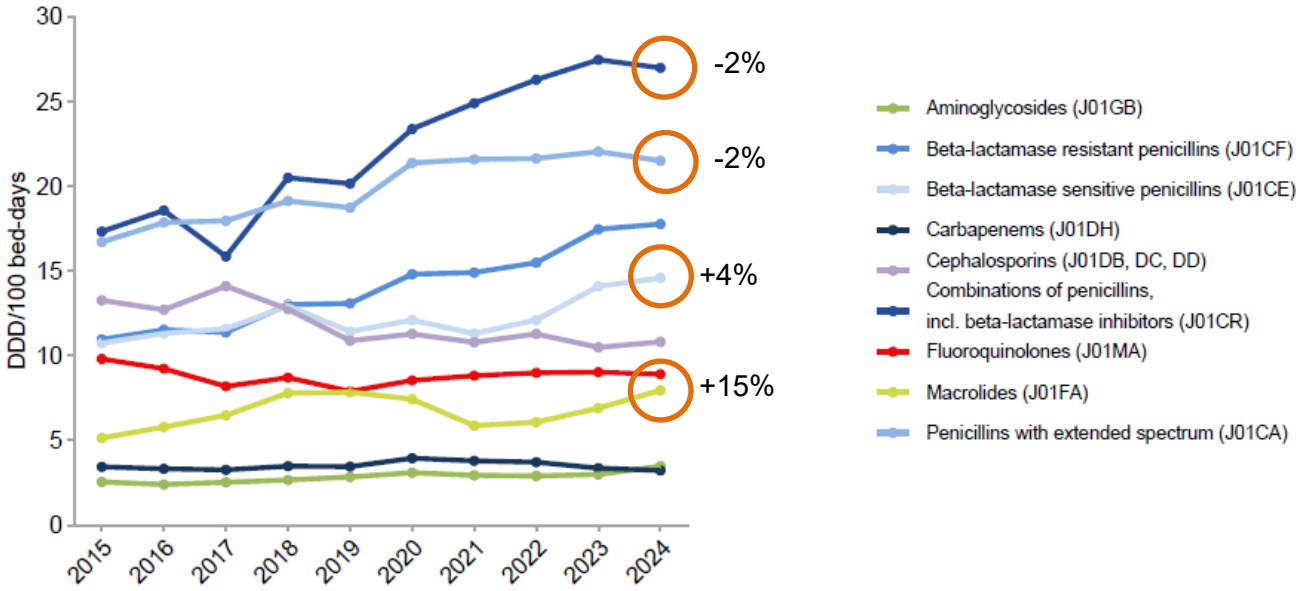
Data: Antimicrobial consumption at somatic hospitals
Data source: Register of Medicinal Product Statistics, 2024 edition of the Anatomical Therapeutic Chemical (ATC) classification system

Hospital care

…. however, key antibiotics are decreasing at hospitals

Figure 5.15 Consumption of leading groups of antimicrobial agents at somatic hospitals, DDD per 100 bed-days, Denmark, 2015-2024

DANMAP 2024



Data: Antimicrobial consumption at somatic hospitals
Data source: Register of Medicinal Product Statistics, 2025 edition of the Anatomical Therapeutic Chemical (ATC) classification system and The National Patient Register

Hospital care

Shortages challenge supply of antimicrobials

Table 5.8 Consumption of selected antimicrobials on special delivery to hospitals, DDD, 2015-2024 DANMAP 2024

Antimicrobial	Year									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
J01MA12 Levofloxacin	7,240	8,080	8,180	6,710	7,360	20,370	44,200	41,530	45,360	41,875
P01AB01 Metronidazole		175	200		8	80	32	94	10	12,833
J01FA09 Clarithromycin	624	414	1,084							3,022
J01GB01 Tobramycin					6,895	6,840	4,790	3,850	2,620	2,780
J01EE01 Sulfamethoxazole and trimethoprim	6,590	6,703.75	8,188	7,596	7,136	3,094	7,985	2,610	3,760	2,502
J01CF05 Flucloxacillin	2,312	2,275	2,200	1,782	1,790	1,665	1,872	2,540	2,232	2,208
J01MA02 Ciprofloxacin	1,155	1,195	690	766	726	1,028	908	935	890	985
J01FG01 Pristinamycin	60	160	160	200	425	390	466	1,067	533	856
J01AA02 Doxycycline	700	801	252	286	312	227	449	444	341	723
J01AA08 Minocycline					125	500	225	325	275	700

Data: Consumption of antimicrobials on special delivery
Data source: Danish Hospital Pharmacies

Hospital care

Topic in focus: Stakeholders suggest solutions to handle shortages

Textbox 5.1

Maintaining access to antimicrobials in a time of increasing product shortages

Access to antimicrobials, especially the narrow spectrum, is crucial to promote rationale use of antimicrobials and thus to combat antimicrobial resistance. In a time of increasing supply issues, antimicrobials risk to disappear from the markets which in turn may push the treatment of infections towards more broad-spectrum antimicrobials.

In Denmark, national stakeholders work to promote and maintain access to antimicrobials in collaboration with national and international experts. We have invited three of them to present their point of views on this matter. Below, you can read the contributions from The Danish Medicines Agency, the pharmaceutical wholesaler Nomeco and the procurement organization for hospital medicines Amgros.

Joint Nordic Initiative to ensure access to critical antibiotics

The consumption of antibiotics in Denmark and other Nordic countries is characterized by a high proportion of older, narrow-spectrum antibiotics[1] - not least due to the focused national efforts in antibiotic stewardship. The national authorities are very aware of the risk of supply failures for these generics and have under the auspices of the Nordic Council of Ministers initiated joint work on the development of common models to ensure access to critical antibiotics to the Nordic countries.

From the Danish side, the initiative is an element of the national action plan for antimicrobial resistance in humans[2], which includes a number of initiatives regarding resistance control with a focus on the use of antibiotics that lead to a lower risk of resistance development, as well as a focus on a more stable and improved supply of antibiotics.

One of the joint Nordic initiatives is to develop and implement a revenue guarantee model for antibiotics in the primary sector. The companies involved will receive a revenue guarantee combined with a fixed participation award, if they commit to having no registered shortages of the product up to a maximum guaranteed package volume.

The model will ideally cover the entire Nordic market for important formulations of narrow-spectrum antibiotics in the primary sector, thereby ensuring larger and more attractive volumes for companies. This may require system and legal changes in all countries, so the initiative starts with a proof of concept (POC) for a single formulation of an antibiotic substance and separate service contracts with the manufacturers for each country. The aim is to test whether a revenue guarantee actually can improve the availability of an important antibiotic and to gain experience on possible adjustments for such a model to possibly be effective.

The proposed antibiotic substance to test in the POC is **phenoxymethylpenicillin 50mg/ml oral suspension**, which is 1st line treatment in most of the Nordic countries primarily for neonates and toddlers. The product is provided to the Nordic market by four companies.

Status: In 2025H2 the medical, legal and commercial challenges and solution options will be identified in each country, along with a preparation of a proposal for a cooperation model and a process plan for implementing the model. This must be approved by the Nordic Council of Ministers in early 2026, after which the POC can be initiated.

[1] The Nordic countries have the highest proportion of narrow-spectrum consumption in Europe. The consumption of narrow spectrum penicillins, cephalosporins and erythromycin in the Nordic countries was 2.5-10 times the consumption of broad-spectrum penicillins, cephalosporins, macrolides (except erythromycin) and fluoroquinolones in 2023. For the EU as a whole the proportion was only around 0,2 times. Source: *Antimicrobial consumption in the EU/EEA (ESAC-Net) - Annual Epidemiological Report for 2023*

[2] Danmark opruster i kampen mod antibiotikaresistens med ny handlingsplan | Indenrigs- og Sundhedsministeriet

By working with this model, Nordic cooperation in this area will be significantly strengthened on several levels. The experience, the structures and the processes that need to be built up to develop and implement the model will strengthen future joint initiatives in this area. Collaboration on reimbursement models also connects to other Nordic collaborations in the area, such as joint purchasing, joint electronic package leaflets, treatment recommendations, and possibly joint stockpiling.

Danish Medicines Agency
For further information: Helle Vibeke Bräuner, helb@dkma.dk

Nomeco's proposed initiatives for an improved robustness of the supply-chain of narrow-spectrum antibiotics

Nomeco is Denmark's largest pharmaceutical wholesaler handling approximately ¼ of all pharmaceuticals in the pharmacy sector and more than half of the pharmaceuticals used in the hospital sector - including antibiotics. Nomeco is a full-line and product neutral wholesaler meaning, that we keep stock of all registered pharmaceuticals, regardless of manufacturer, brand, type, price etc. Nomeco's stock and purchasing profile and algorithms are based on current pharmacy legislation and advanced forecasting - and obviously product availability from our suppliers

With the aim to improve the availability of all critical pharmaceuticals - not least antibiotics, Nomeco has put forward several concrete proposals on how to strengthen the supply security of narrow-spectrum antibiotics in Denmark.

The first set of proposals concerns a *redistribution model* aimed at better utilization of existing stocks. Often back-orders are short and regional or even local. So, to avoid reaching out for the broad-spectrum antibiotics in cases were the narrow-spectrum products are unavailable locally or temporarily, Nomeco suggest looking into alternative and more dynamic distribution models - including elements like consignment stocks at pharmacy level or models enabling redistribution of individual products between pharmacies facilitated by the wholesalers. Financing of the costs resulting from alternative and dynamic distribution models could be made via a tiny fee on all pharmaceuticals going into a fund controlled by the authorities. Such a fund should of course also cover other costs throughout the pharmaceutical supply chain resulting from increasing shortage, instability and risk in general.

The second set of proposals focuses on economic incentives to ensure stable production and attract new manufactures. This includes elements like attractive pricing and a national tender model with at least two winning suppliers and long-term agreements. Other elements to consider include guaranteed minimum purchase volumes etc.

Nomeco is of course fully aware that the above-mentioned initiatives do not solve the underlying problem concerning lack of sufficient supplies of narrow-spectrum antibiotics. Nevertheless, initiatives like these are crucial to ensuring a more stable supply of critical pharmaceuticals and thus also contributing to the fight against antibiotic resistance.

Nomeco, pharmaceutical wholesaler
For further information: Henrik Kaastrup, hka@nomeco.dk

LÆGEMIDDELSTYRELSEN
DANISH MEDICINES AGENCY

AMGROS

Nomeco
a PHOENIX company

continued ... Textbox 5.1

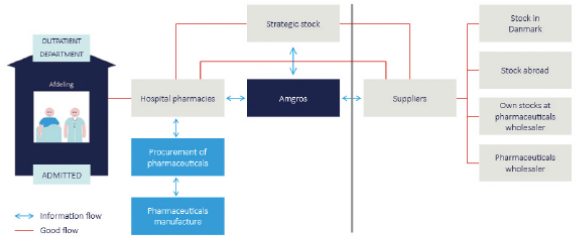
Amgros' Backorder Management of Medicines for Public Hospitals

Amgros is the procurement organization for hospital medicines and hearing aids on behalf of the Danish healthcare regions. Together with the country's hospital pharmacies, Amgros ensures that essential medicines are available to patients in public hospitals - at the right time, in the right place, at the right price - and with environmental considerations in mind. This is achieved through strategic planning and execution of tenders and procurement, ensuring supply security, and systematic follow-up on backorders. In 2024, Amgros achieved savings of DKK 9.9 billion, corresponding to approximately 49% of total expenditure. Around 98% of the medicines used in public hospitals are supplied through Amgros contracts.

National Backorder Management in the Hospital Sector

Amgros and hospital pharmacies continuously monitor orders and registers backorders to manage supply disruptions by standardized escalation model. The model is outlined below.

Figure 1 Amgros': How medicine meets hospital patients in Denmark DANMAP 2024



Escalation Model - Steps 0-5

Step 0: Prevention: In collaboration with hospital pharmacies Amgros is incorporating preventive measures into contracts to ensure supply security

Step 1: Standard Backorder Handling: Amgros' IT system ensures structured and transparent handling of backorders, including registration, monitoring, and coordination with relevant stakeholders. Most backorders are resolved at this stage.

Step 2: Assessment of Compounding: The possibility of in-house compounding at hospital pharmacies is assessed.

Step 3: Procurement of IRS Medicines: Evaluation of the possibility of purchasing alternative medicines without Danish marketing authorization (IRS medicines).

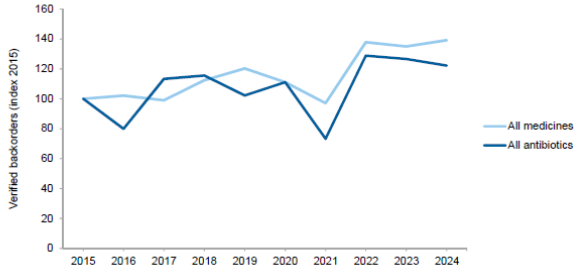
Step 4: Alternative Treatment Regimens: Clinical experts assess analog treatments, patient prioritization, or alternative handling. A cross-regional working group ensures broad implementation of the solution.

Step 5: Initiation of Production: In very rare cases, production is initiated at a hospital pharmacy or an external supplier if APIs, raw materials, and packaging are available.

Supply Situation for Antibiotics in the Hospital Sector

Antibiotics are particularly challenging due to treatment criticality, seasonal variation, and low prices over many years, which have made the market less attractive and reduced the number of suppliers. The backorder index for antibiotics was 120 in 2024 compared to 100 in 2015 meaning a 20% increase in backorders for antibiotics, compared to a 40% increase for all medicines. In almost all cases, alternatives were found based on the backorder management system and flexible procurement options.

Figure 2 Verified backorders of all medicines and of antimicrobials at hospitals, Denmark, 2015-2024 DANMAP 2024



Strategic Measures by Amgros to Improve Supply Security

Creating an Attractive Market: Amgros has a strategic approach to tenders, which includes market analysis, outreach to attract more suppliers to Denmark, and adjustment of tender criteria aimed at supply security.

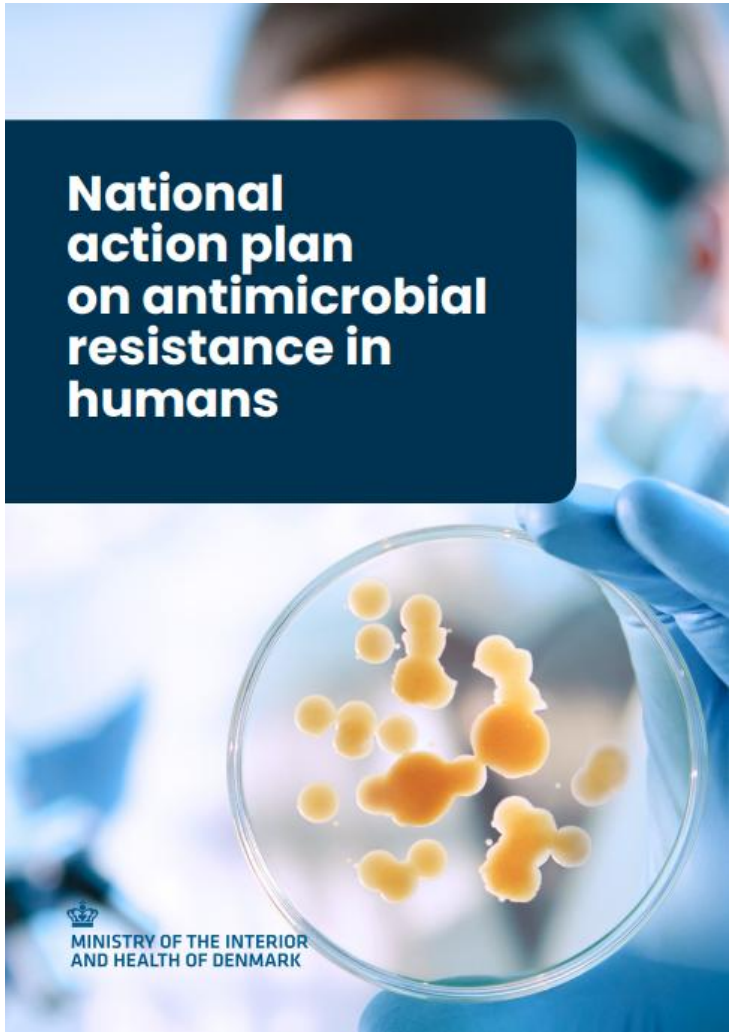
Strategic Medicine Stock: Amgros and hospital pharmacies operate a national stockpile of treatment-critical medicines and medicines with low supply security. This provides a buffer in case of delivery failures and helps prevent disruptions from affecting patients.

Use of Forecasts: Amgros systematically collects consumption data and prepares forecasts as an integral part of the tender process. Once the contract is signed, the expected consumption is shared with the supplier, enabling them to adjust production and logistics to anticipated demand. Suppliers are also informed in case of significant changes during the contract period, allowing them to adjust production.

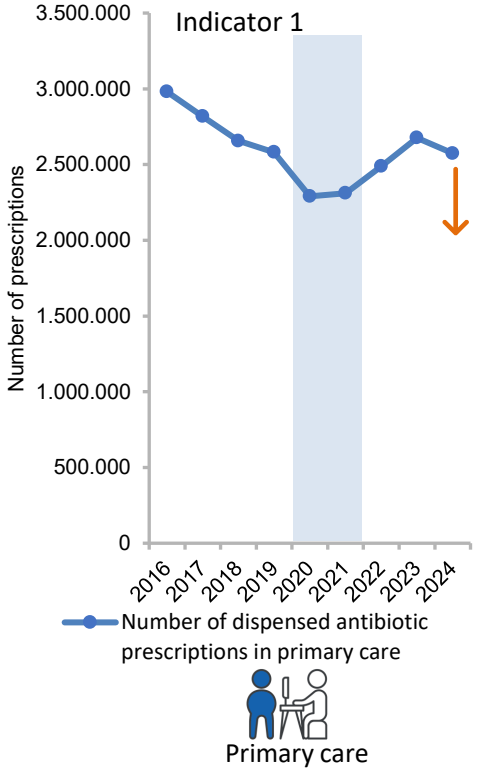
International Cooperation: Amgros participates actively in the Nordic Pharmaceutical Forum working for a more attractive Nordic market. Several joint Nordic tenders, including selected antibiotics, have been carried out by Denmark, Norway, and Iceland. In addition, the Nordic Pharmaceutical Forum collaborate with the Nordic medicines agencies to promote registration of joint Nordic packages.

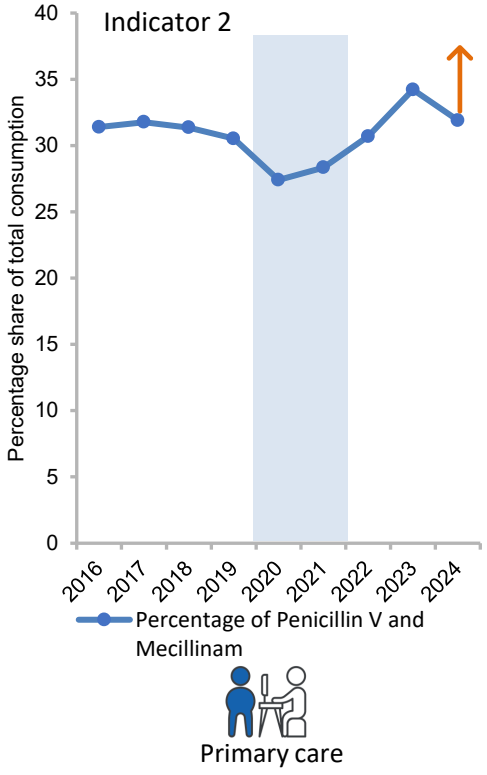
Charlotte Meinicke, Amgros
For further information: Rasmus Syberg Hazelton, rsh@amgros.dk

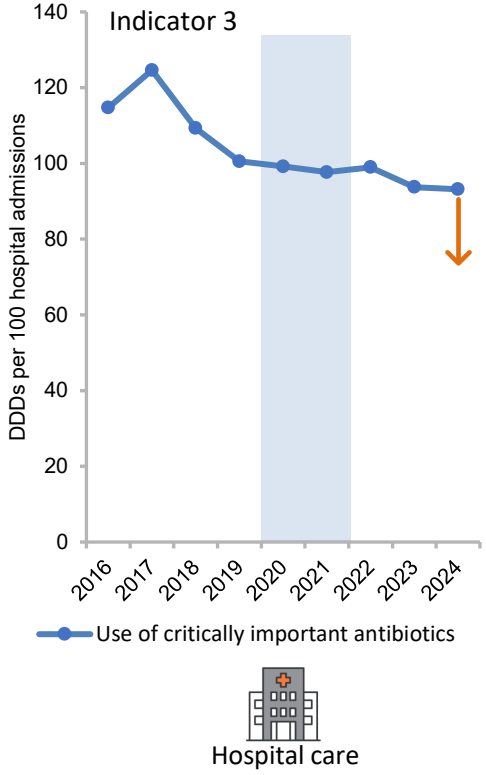
Sneak peak!

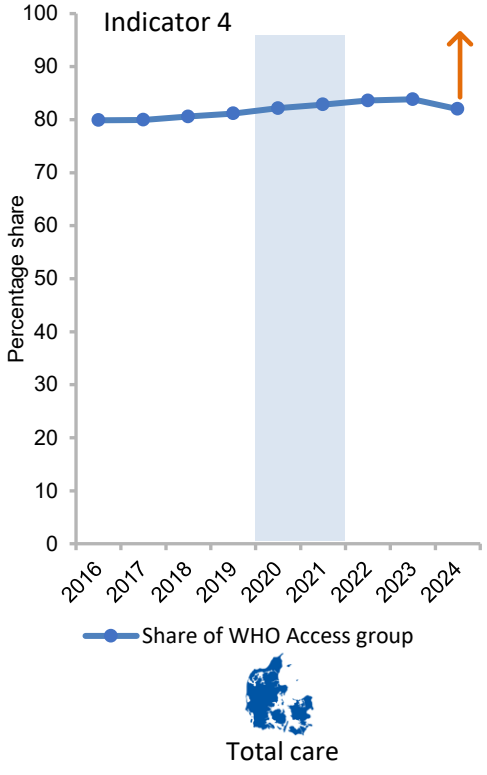

National
action plan
on antimicrobial
resistance in
humans
MINISTRY OF THE INTERIOR
AND HEALTH OF DENMARK

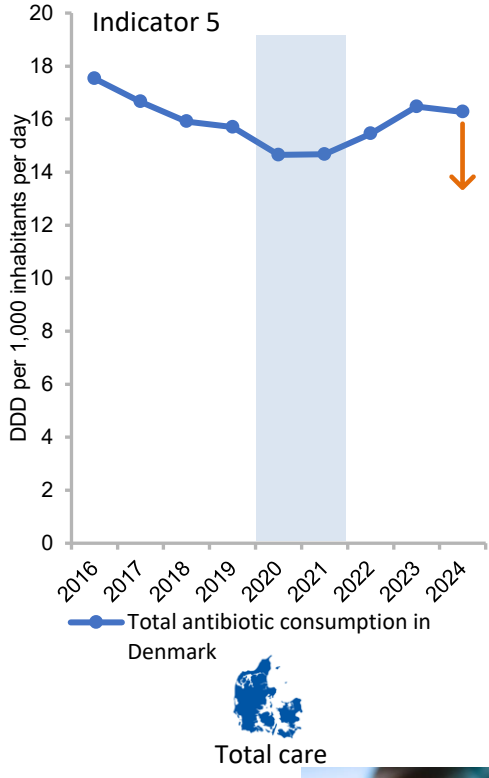
New National action plan on antimicrobial resistance in humans - Baseline



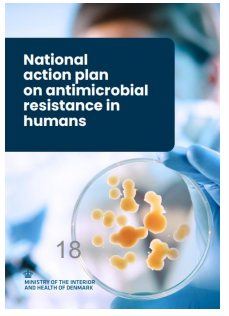








Covid-19

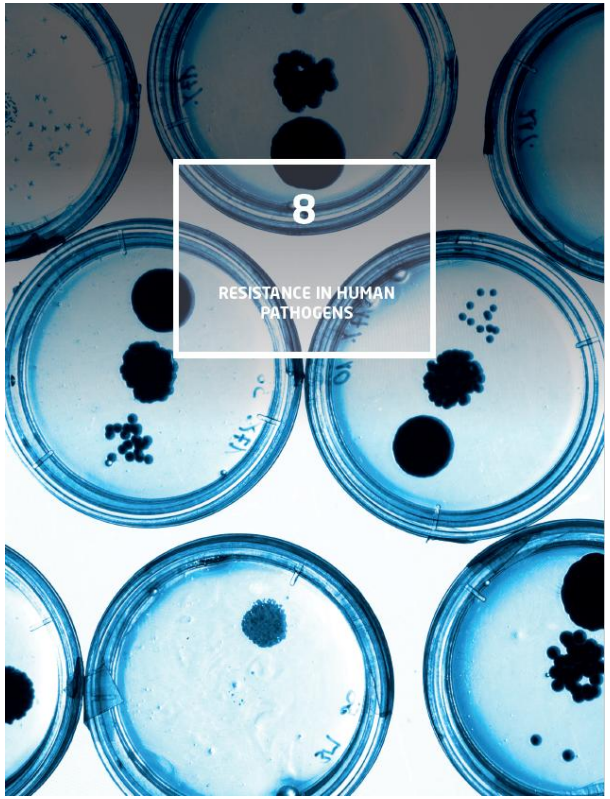


In conclusion…

- Total antimicrobial consumption in Denmark in 2024 was comparable to 2023
- **”Access antibiotics”** and penicillins are used to a large extent in Denmark in both sectors
- Narrow spectrum Penicillin V decreased by 12% from 2023 to 2024 due to fewer prescriptions for **respiratory infections**
- Antimicrobials prescribed to the **0-4 year olds** decreased by 23% and by 13% for the **5-9 year olds**
- Consumption among **elderly** differ significantly based on residency
- Consumption of penicillins combined with beta-lactamase inhibitors at **hospitals** decreased in 2024 for the first time in several years. Consumption of Penicillin V increased simultaneously by 4%

DANMAP Seminar 2025

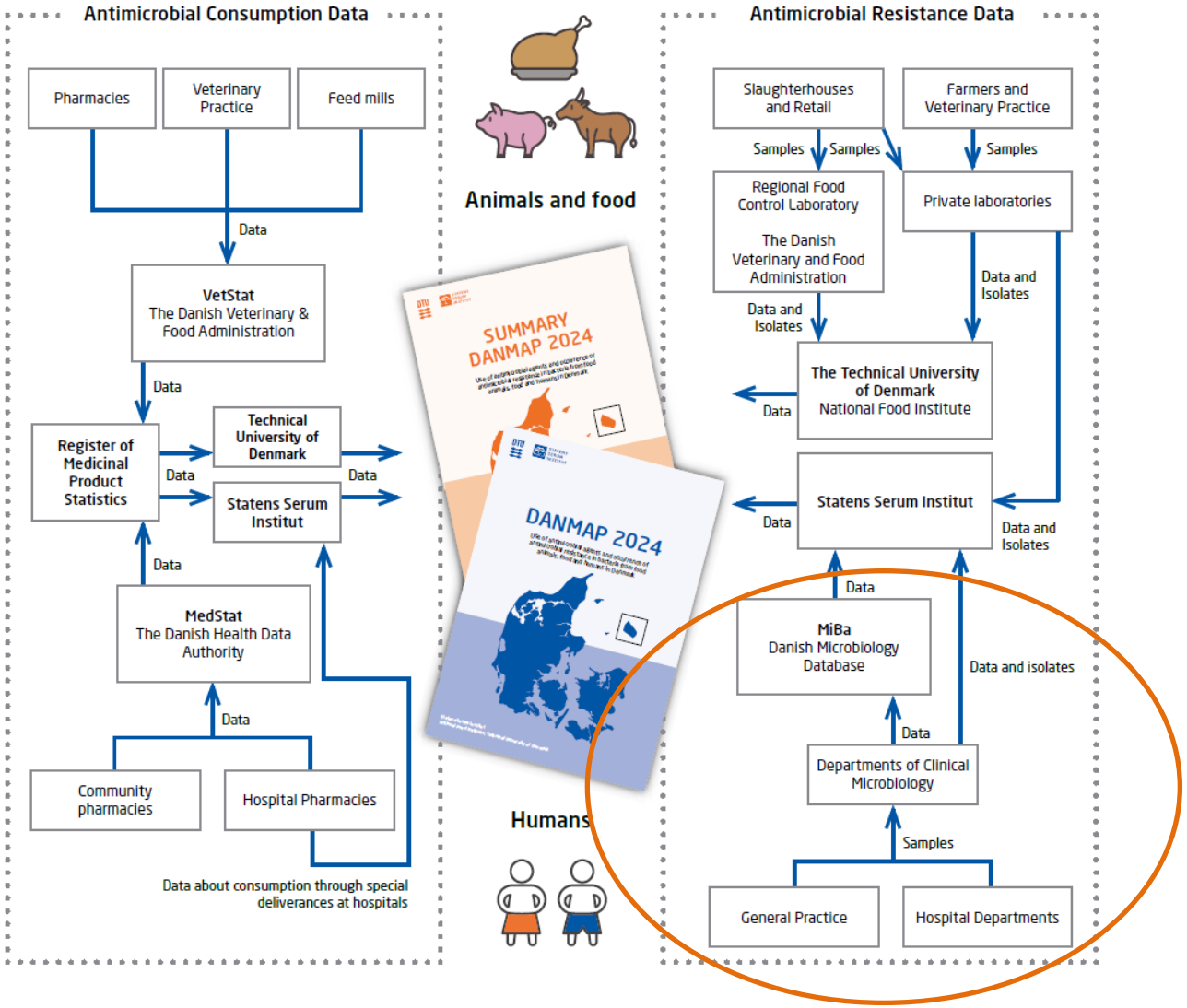
Resistance in human human pathogens



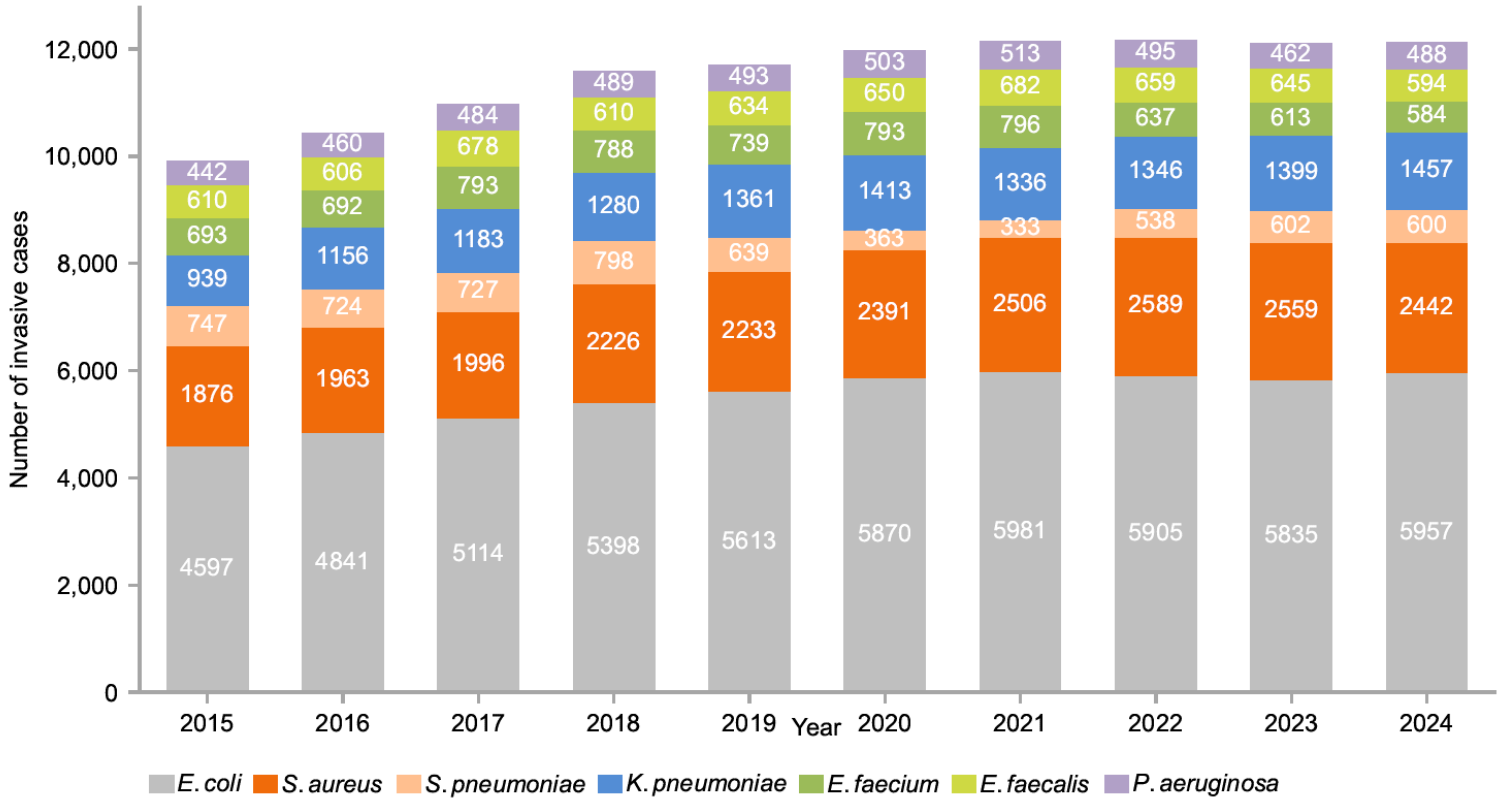
Mikkel Lindegaard
cand.polyt
Referencelaboratoriet for antibiotikaresistens
Statens Serum Institut

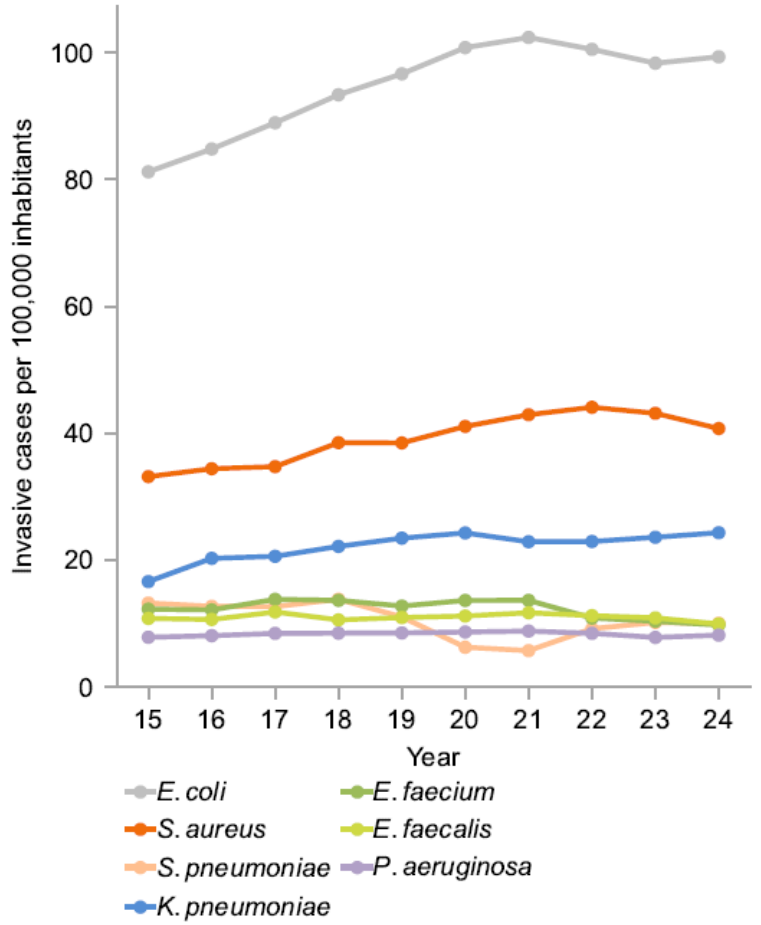
DANMAP data flow

Figure 2.1 Organisation DANMAP regarding data and data flow DANMAP 2024



Monitored invasive infections



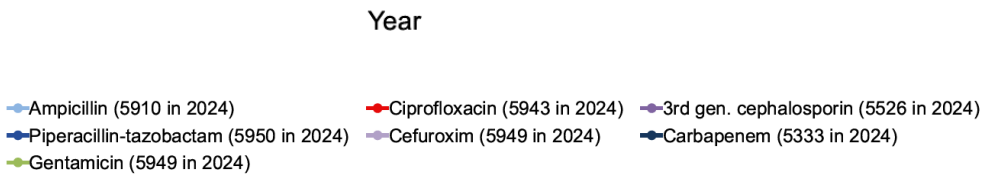


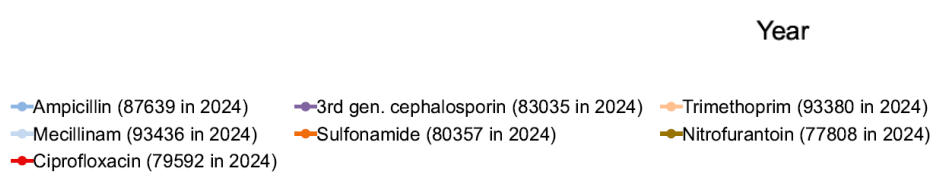
E. coli - invasive infections and urine

Invasive infections

Table 8.4 Invasive *Escherichia coli*. Combined resistance to 1) ampicillin and gentamicin and 2) 3rd generation cephalosporins, ciprofloxacin, and gentamicin (multiresistance) in invasive isolates from humans, Denmark, 2015-2024 DANMAP 2024

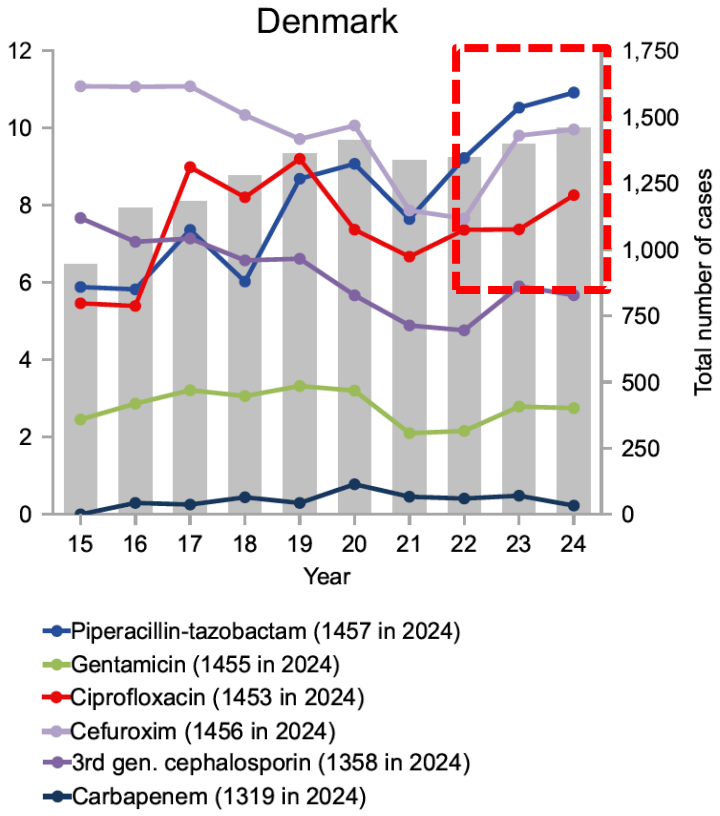
Combination		2015 % (N)	2016 % (N)	2017 % (N)	2018 % (N)	2019 % (N)	2020 % (N)	2021 % (N)	2022 % (N)	2023 % (N)	2024 % (N)
AMP/GEN	Resistance	6.3 (254)	5.8 (278)	5.8 (289)	5.5 (284)	5.2 (275)	5.1 (287)	4.0 (229)	4.1 (233)	4.1 (231)	4.0 (235)
	Percentage (no.) of isolates tested	87 (4,009)	99 (4,816)	98 (5,015)	96 (5,170)	95 (5,308)	95 (5,583)	96 (5,745)	96 (5,679)	96 (5,602)	99 (5,903)
3GC/CIP/ GEN	Resistance	2.3 (93)	1.8 (87)	1.8 (88)	2.0 (100)	1.8 (93)	1.5 (82)	1.1 (60)	1.3 (70)	1.2 (63)	1.0 (54)
	Percentage (no.) of isolates tested	88 (4,071)	98 (4,763)	95 (4,883)	93 (4,997)	94 (5,259)	93 (5,470)	93 (5,564)	93 (5,474)	93 (5,417)	93 (5,515)
	Total number of invasive isolates	4,614	4,841	5,114	5,398	5,613	5,870	5,981	5905	5,835	5,957



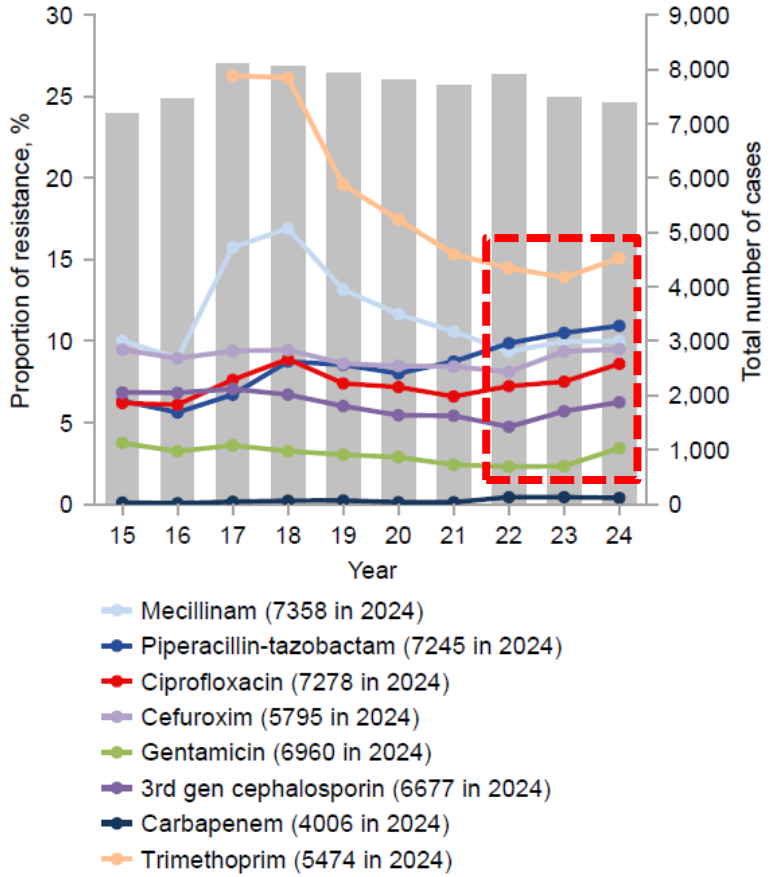


K. pneumoniae – invasive infections and urine

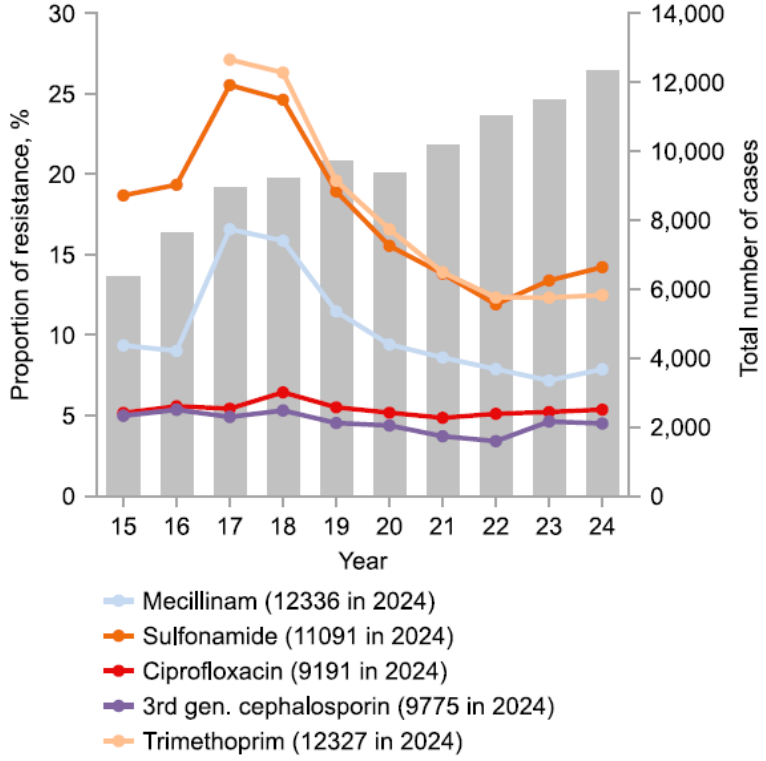
Invasive infections



Hospital urines



Primary healthcare urines



K. pneumoniae – invasive infections

Table 8.8 Invasive *Klebsiella pneumoniae*. Table of resistance percentages, 2015-2024 DANMAP 2024

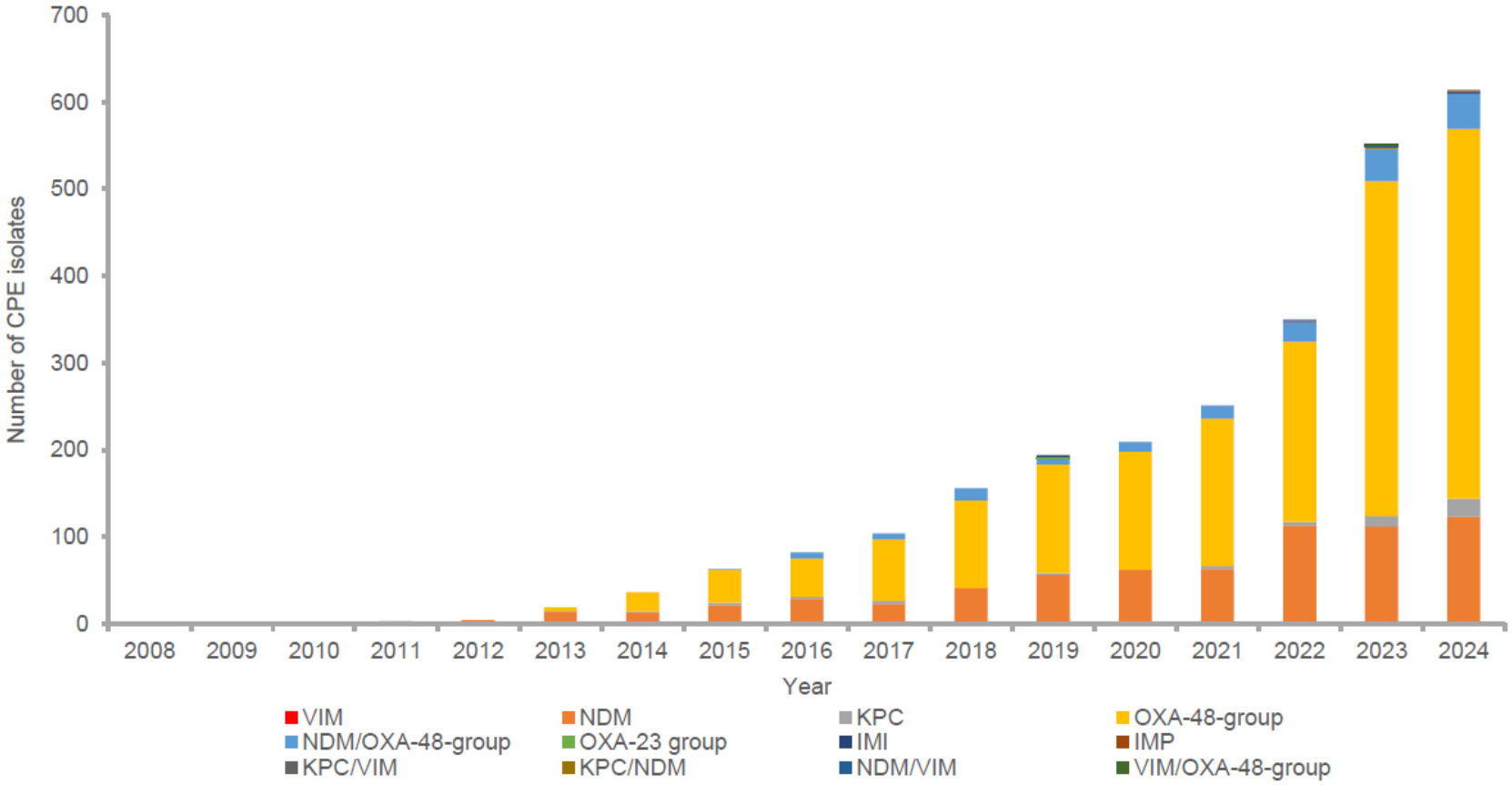
Substance	Percent resistant invasive *K. pneumoniae* isolates									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Piperacillin/tazobactam	5.9	5.8	7.4	6.1	8.7	9.1	7.5	9.2	10.5	10.9
Gentamicin	2.5	2.9	3.2	3.1	3.3	3.2	2.1	2.2	2.8	2.7
Ciprofloxacin	5.5	5.4	9.0	8.1	9.2	7.4	6.7	7.4	7.4	8.3
Cefuroxime	11.1	11.1	11.1	10.3	9.7	10.1	7.9	7.7	9.8	10.0
3rd gen. cephalosporins	7.7	7.3	7.1	6.1	6.6	5.3	4.9	4.8	5.9	5.7
Carbapenem	0.0	0.3	0.3	0.5	0.3	0.8	0.5	0.4	0.5	0.2
Total number of isolates	939	1,156	1,183	1,280	1,361	1,413	1,336	1,346	1,399	1,457

Table 8.9 Invasive *Klebsiella pneumoniae*. Combined resistance to 3rd generation cephalosporins, ciprofloxacin, and gentamicin (multidrug-resistance) in invasive isolates from humans, Denmark, 2015-2024 DANMAP 2024

	2015 % (N)	2016 % (N)	2017 % (N)	2018 % (N)	2019 % (N)	2020 % (N)	2021 % (N)	2022 % (N)	2023 % (N)	2024 % (N)
Resistance	1.1 (9)	1.6 (18)	2.4 (27)	1.7 (20)	2.4 (30)	1.5 (19)	1.0 (13)	1.0 (13)	1.9 (24)	1.4 (19)
Percentage (no.) of isolates tested for combined resistance (multiresistance)	89 (840)	98 (1,131)	95 (1,122)	93 (1,188)	94 (1,275)	93 (1,308)	93 (1,248)	94 (1,259)	92 (1,287)	93 (1,356)
Total number of invasive isolates	943	1,156	1,183	1,280	1,361	1,413	1,336	1,346	1,399	1,457

CPE

Figure 8.14 Numbers of carbapenemase-producing Enterobacterales (CPE), Denmark, 2008-2024 DANMAP 2024

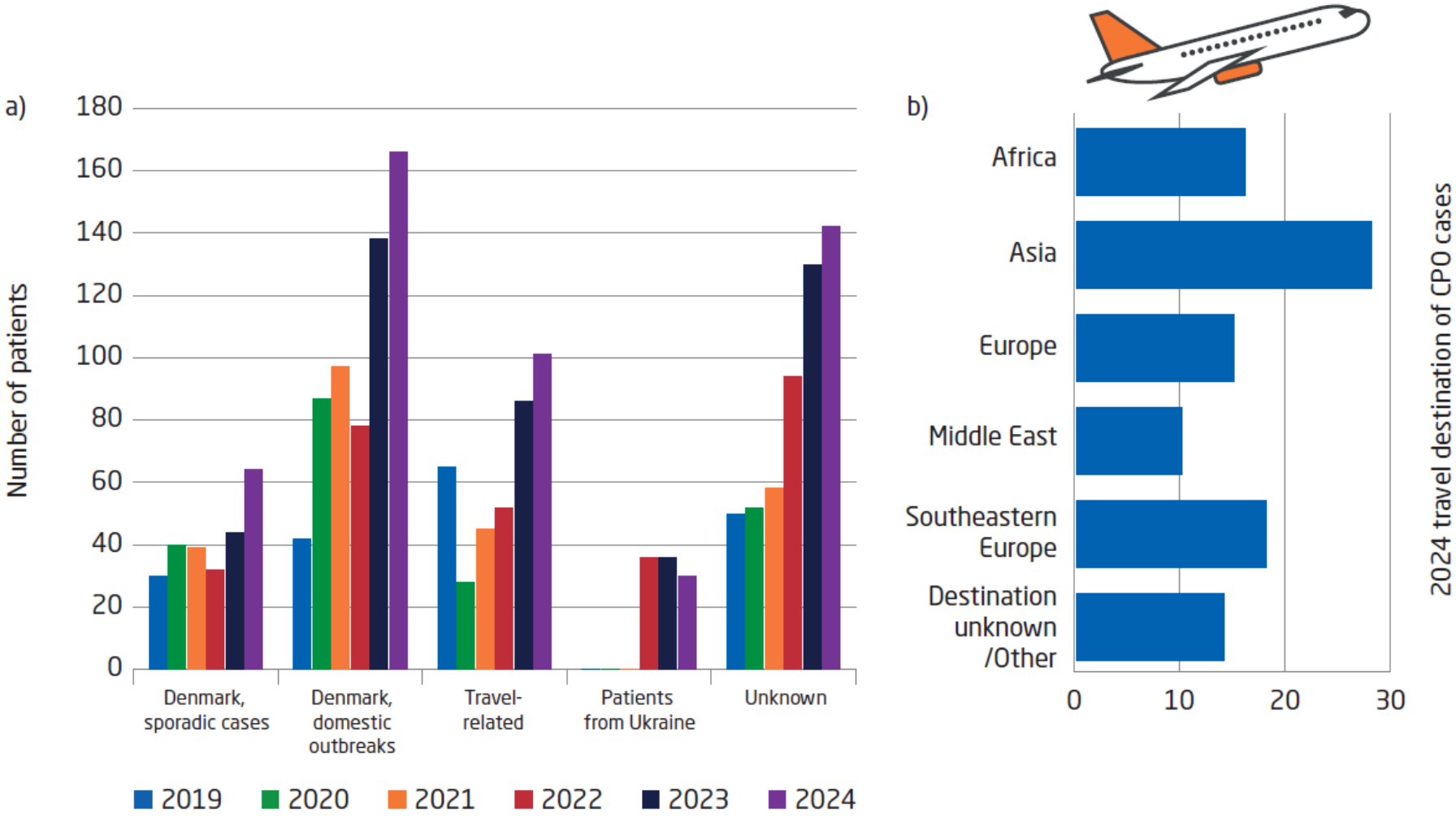


2024: 616 CPE (from 497 patients)

425 isolates with OXA-48
121 isolates with NDM
41 isolates with both OXA-48 and NDM

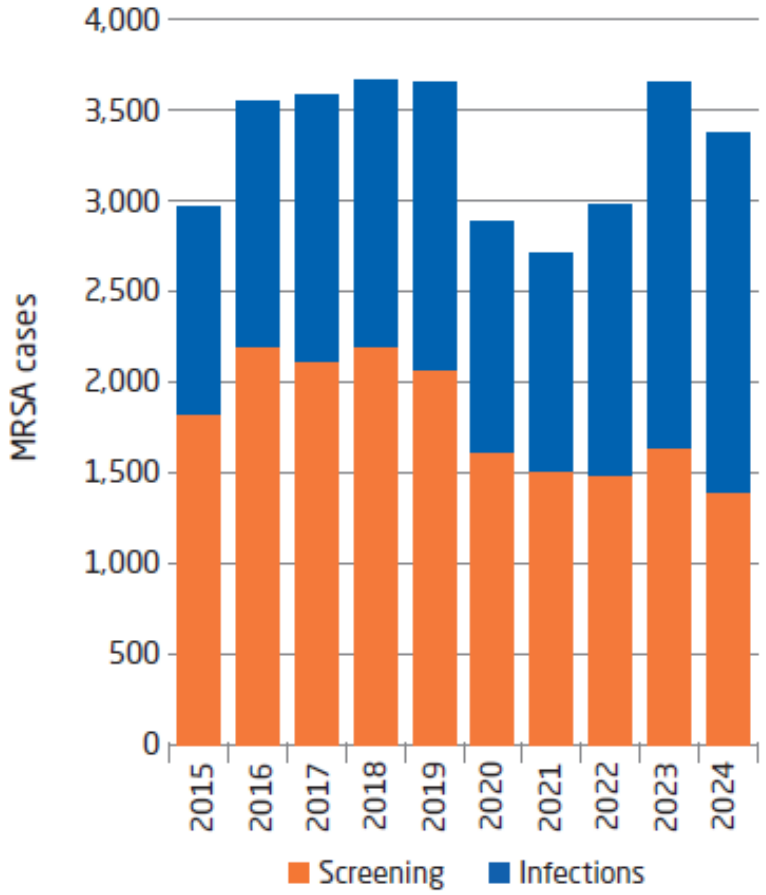
CPE/CPO

Figure 6.4 a) Classification of CPO cases in 2019-2024 b) World regions where patients in 2024 with travel-related cases have travelled



MRSA

Figure 6.5 Number of MRSA under surveillance (screening and infections), and epidemiological classification of infection cases, Denmark, 2015-2024



Main messages

- The incidence of invasive infections appears stable
- After years of decreasing resistance rates, they have now either stabilised or are increasing
  - *K. pneumoniae* resistance towards piperacillin-tazobactam is now at 10.9 %!
- Continued increase in outbreaks of CPO – many with unknown epidemiology
  - 27% of cases have no reported travel information
- After a decrease in the number of MRSA during the pandemic, numbers are increasing again

This year's textboxes

Textbox 8.1

20 years of fungemia surveillance in Denmark (2004-2023)

Karen MT Astvad, Karin M Jørgensen, Nissrine Abou-Chakra, Lise Kristensen, Jan B Gertsen, Valeria Antsupova, Helle K Johansen, Marianne E Clausen, Michael Pedersen, Flemming S Rosenvinge, Sofia Sulim, Lisbeth Lützen, Esad Dzajic, Turid S Søndergaard, Maiken C Arendrup.

Textbox 8.2

Azole resistance in clinical isolates of *A. fumigatus* - the first 5 years of surveillance

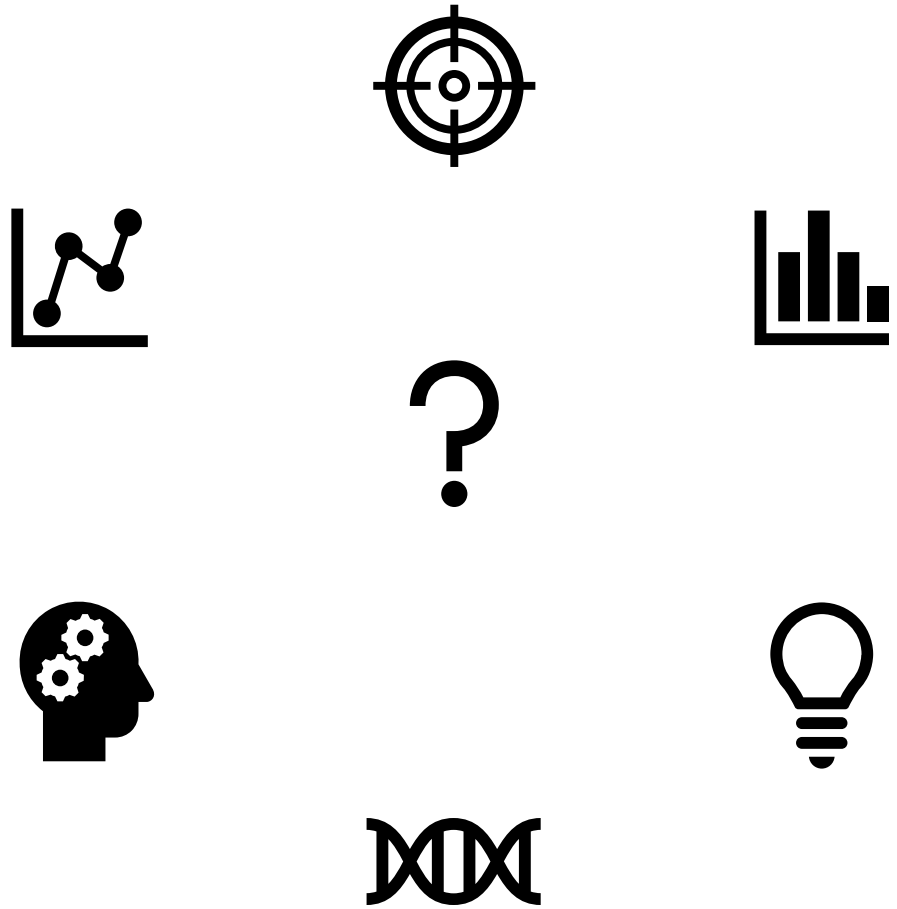
Karen MT Astvad, Karin M Jørgensen, Nissrine Abou-Chakra, Jan B Gertsen, Lise Kristensen, Flemming S Rosenvinge, Lisbeth Lützen, Jette M Bangsborg, Michael Pedersen, Sofia Sulim, Marc TK Nielsen, Turid S Søndergaard, Maiken C Arendrup. Thanks to Bent L Røder for his participation during previous years.

Textbox 8.3

Mycoplasma genitalium

Suhella Tulsiani Drud, Thomas Roland Pedersen and Jørgen Skov Jensen

Questions and comments



DANMAP Seminar 2025

Antimicrobial consumption in animals

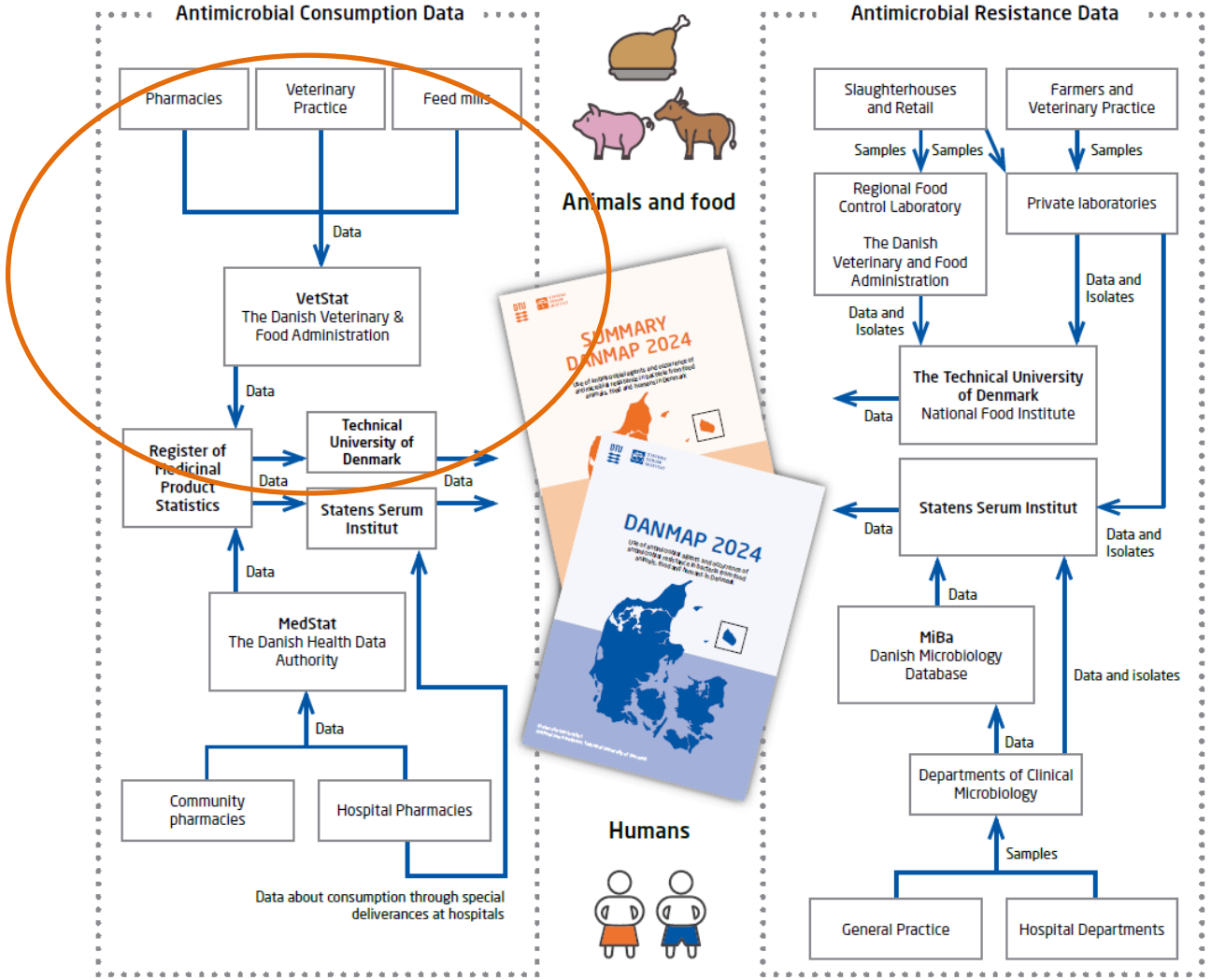
Vibe D. Andersen
Senior Researcher

Marianne Sandberg
Head of Research Group

National Food Institute, DTU

DANMAP data flow

Figure 2.1 Organisation DANMAP regarding data and data flow DANMAP 2024

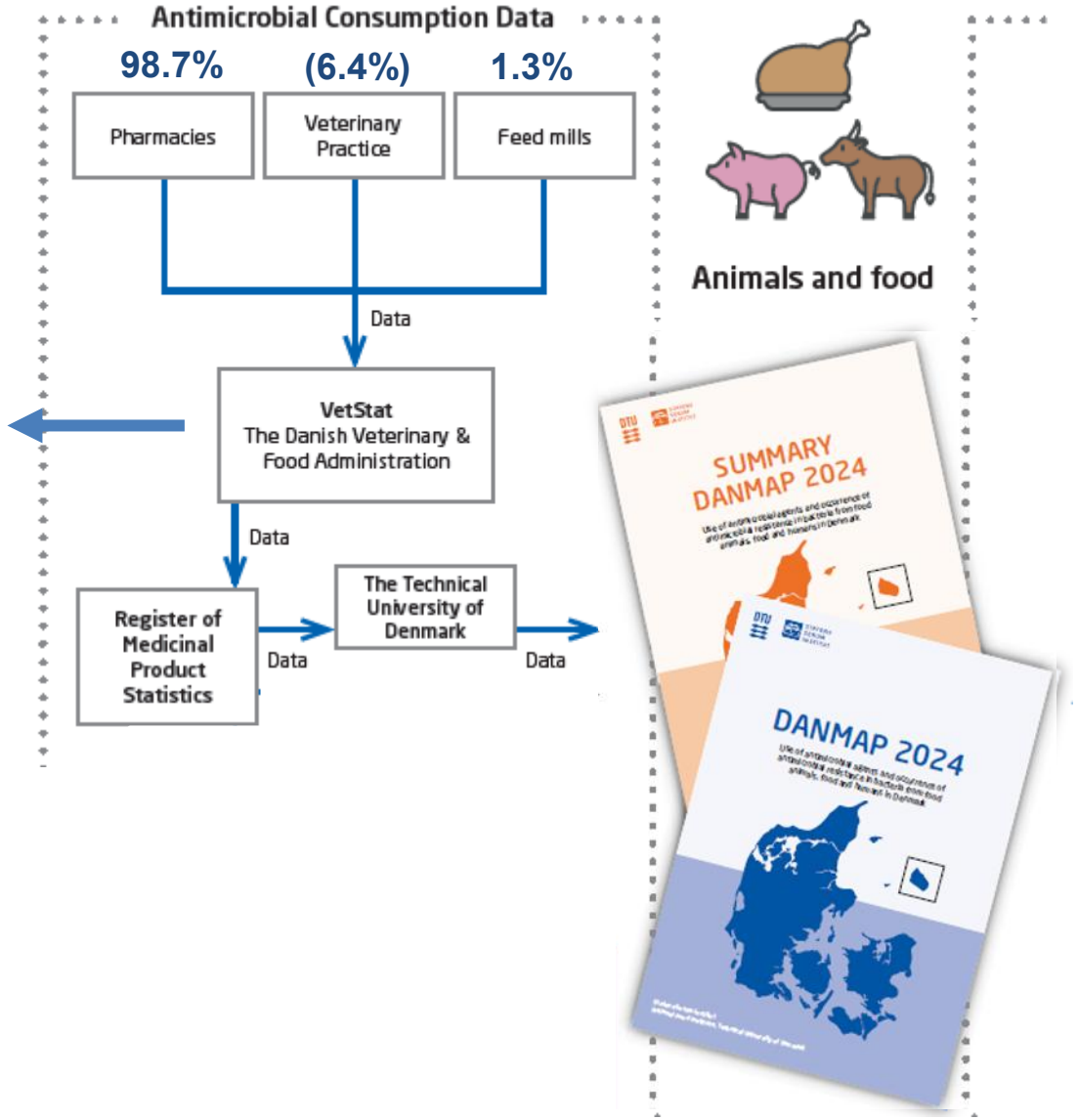


DANMAP data flow

Ministeriet for Fødevarer, Landbrug og Fiskeri
Fødevarestyrelsen

VetStat

https://vetstat.fvst.dk/vetstat/



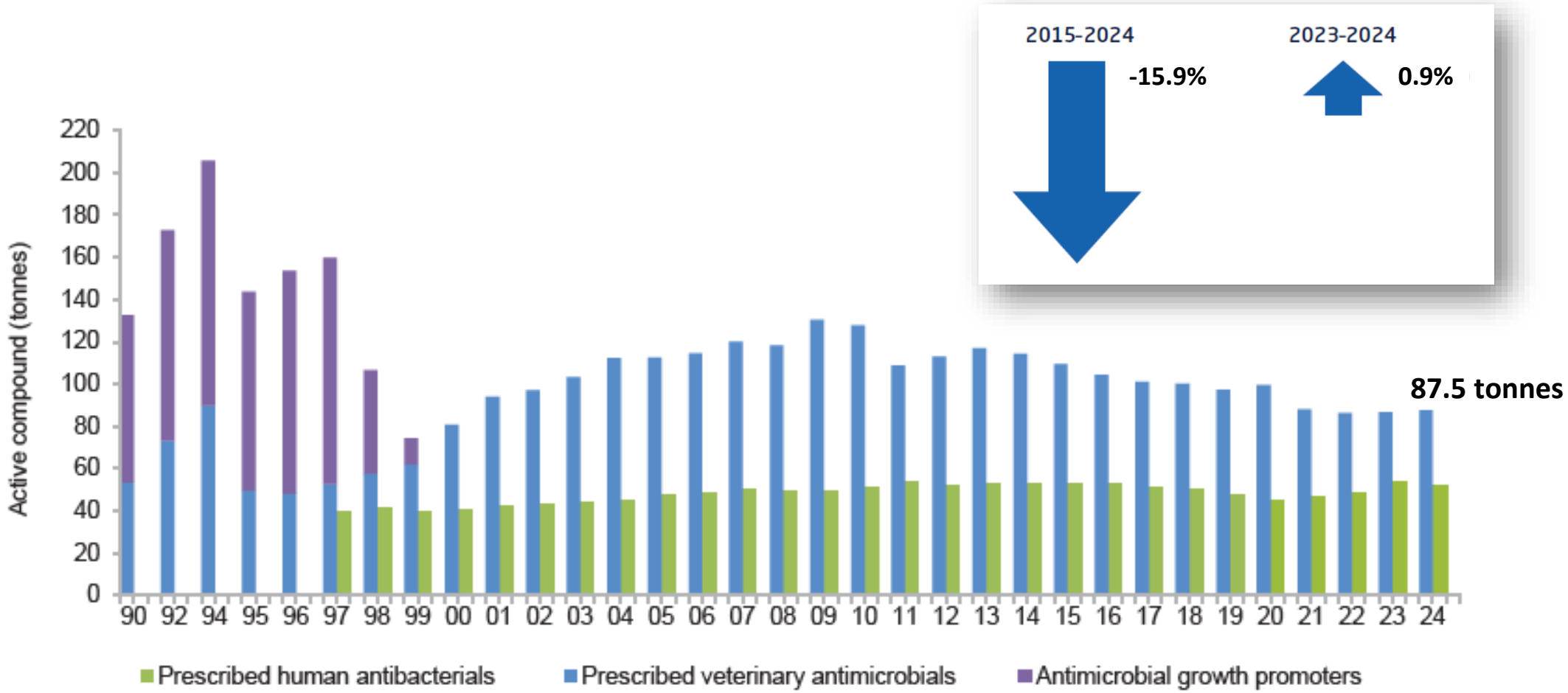
VetStat data is reported in kilograms of active compound

Defined Animal Daily Dose (DADD)
Determined by strength specification

Live biomass
Statistikbanken
https://www.statistikbanken.dk/

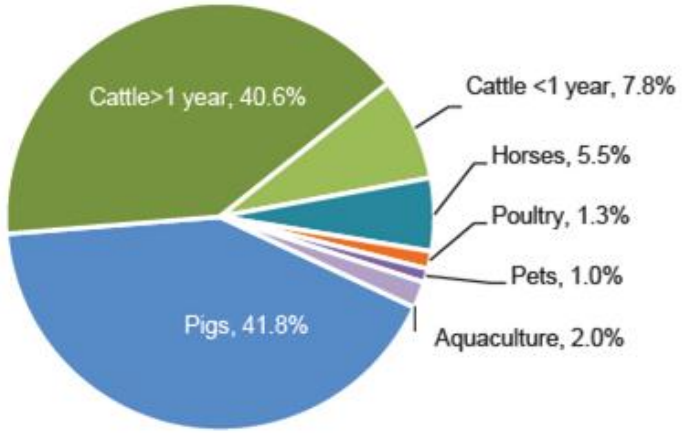
Treatment proportion (DAPD)

Antimicrobial consumption in animals and humans – a historical overview

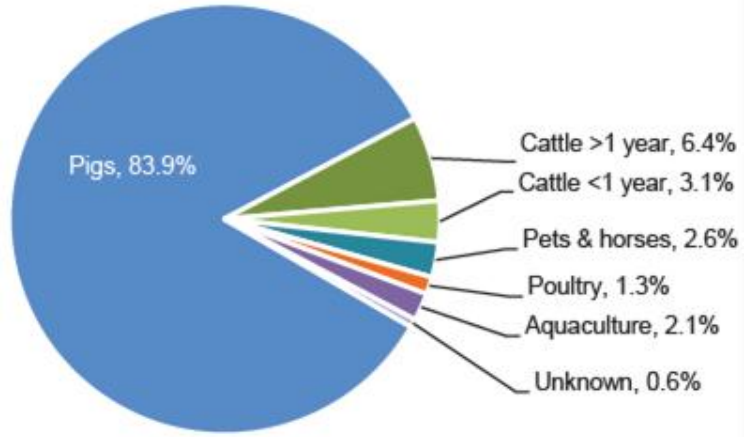


Antimicrobial consumption

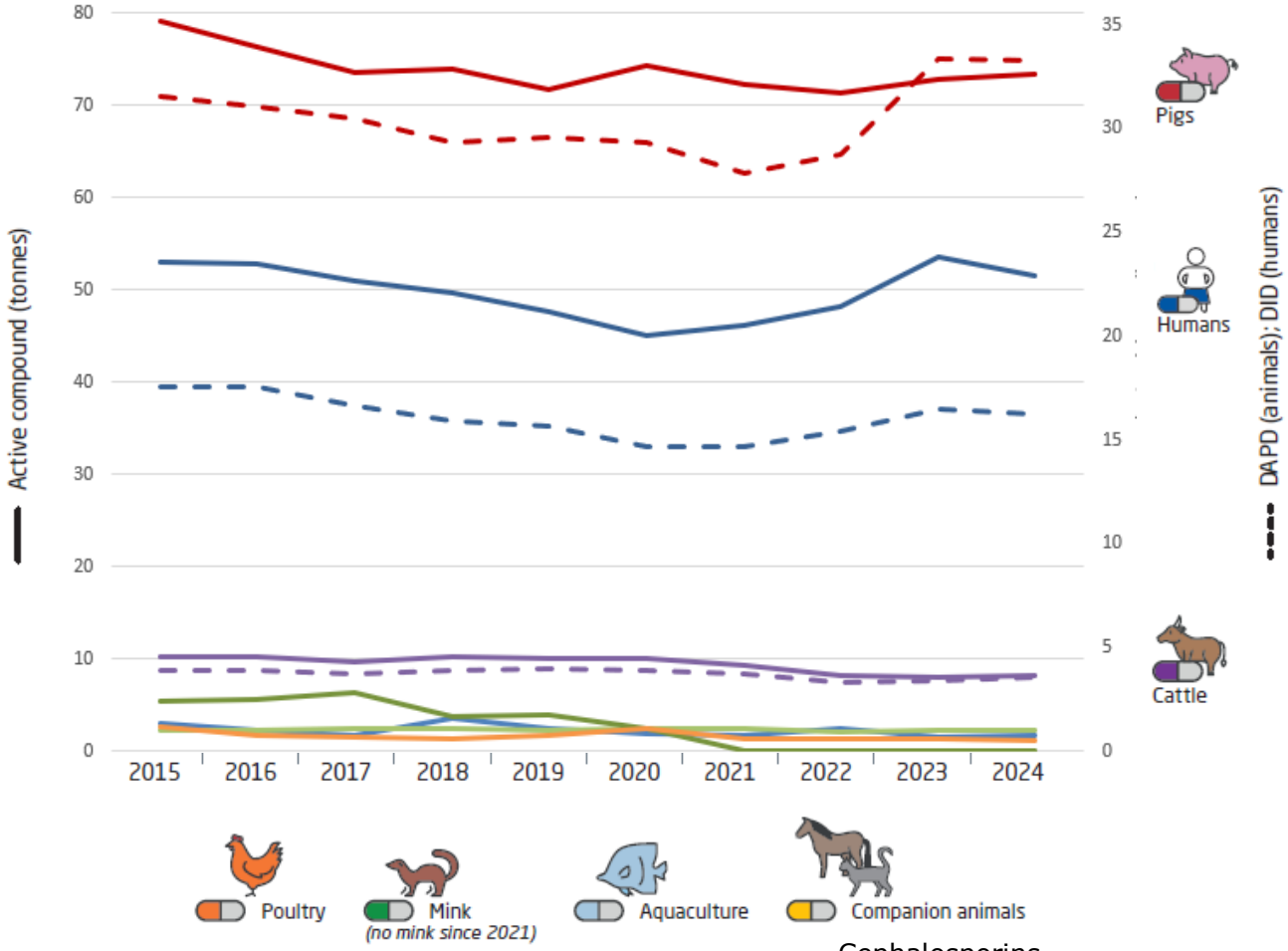
Distribution



Live biomass

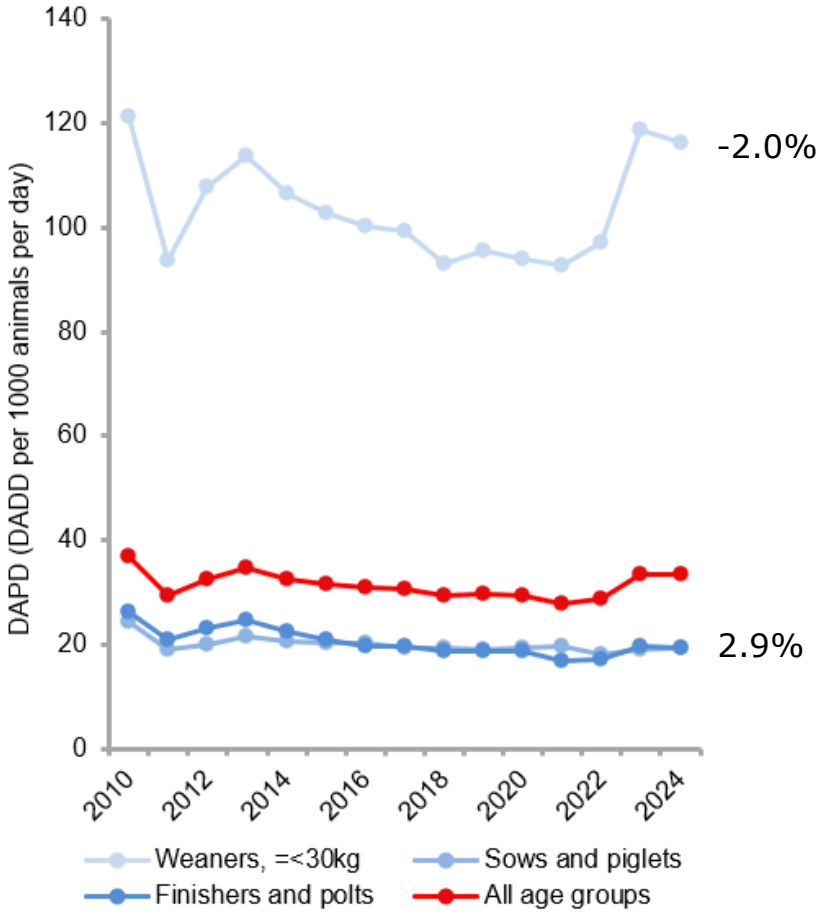


Active compund (tonnes)

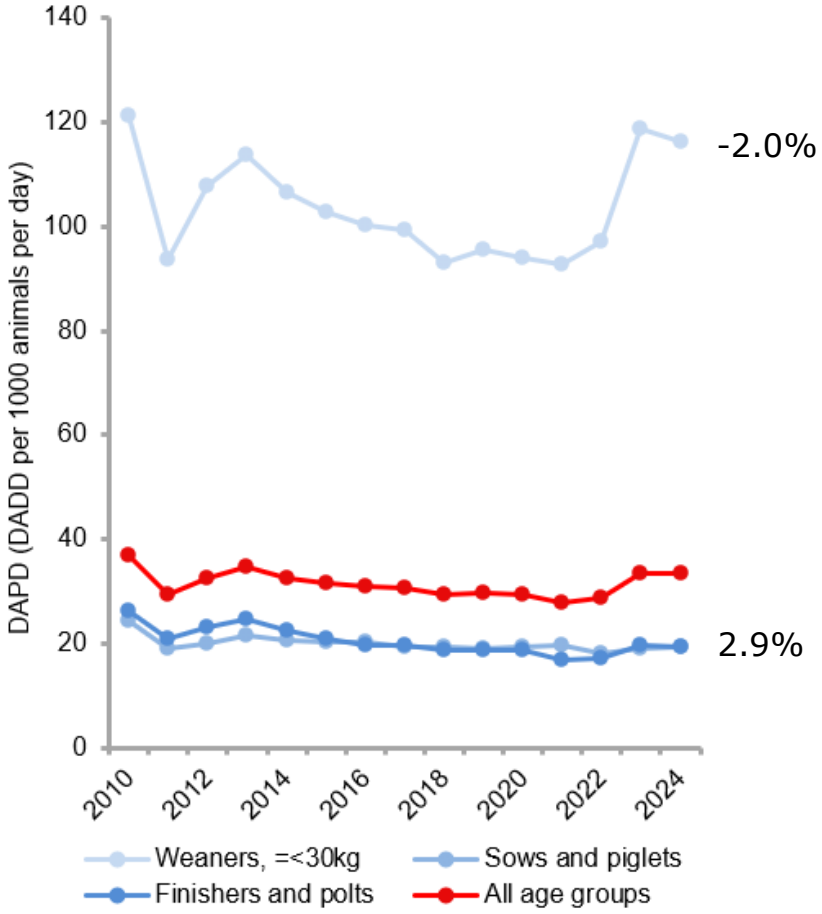


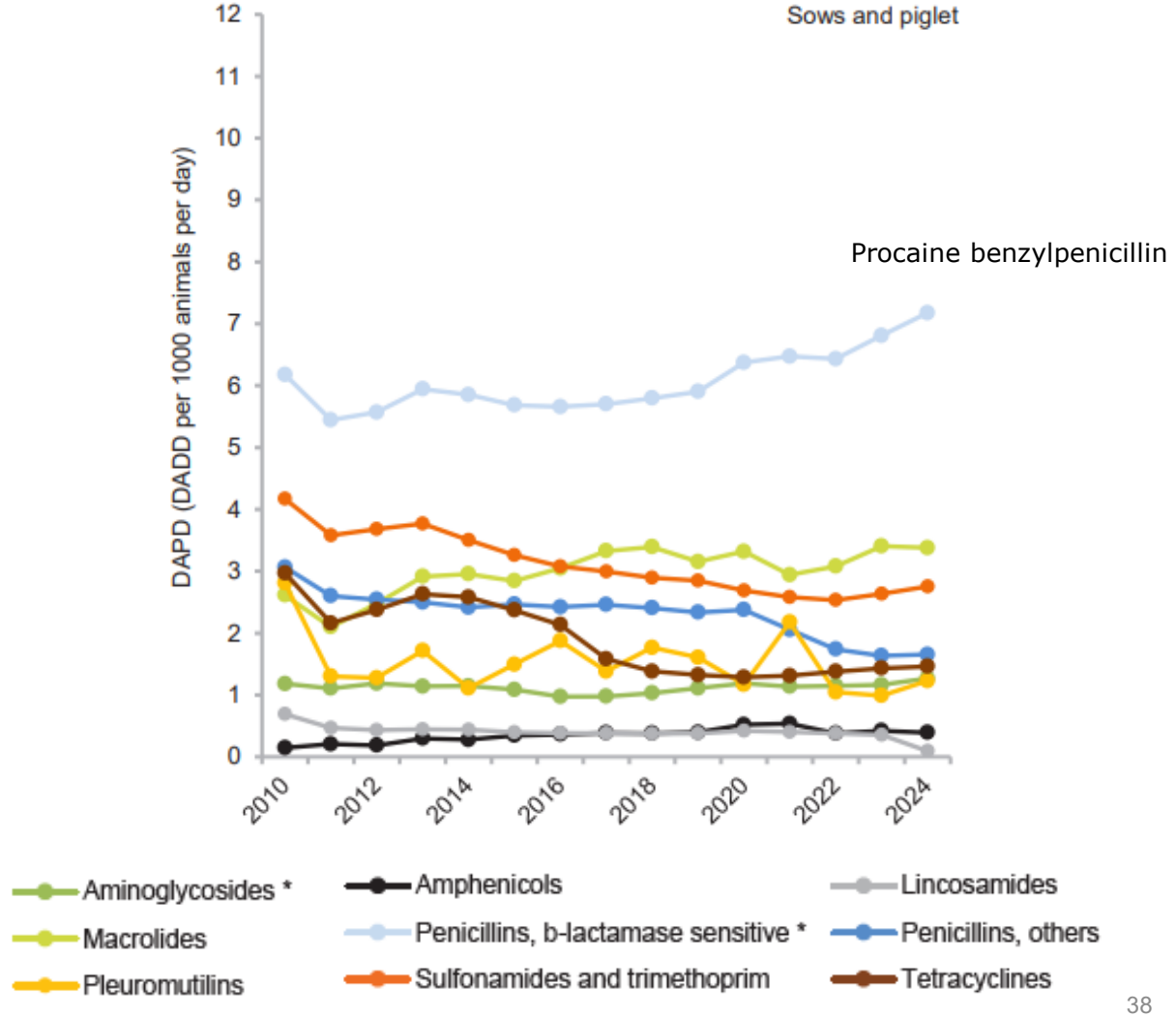
Cephalosporins
Fluoroquinolons

Antimicrobial consumption in pigs

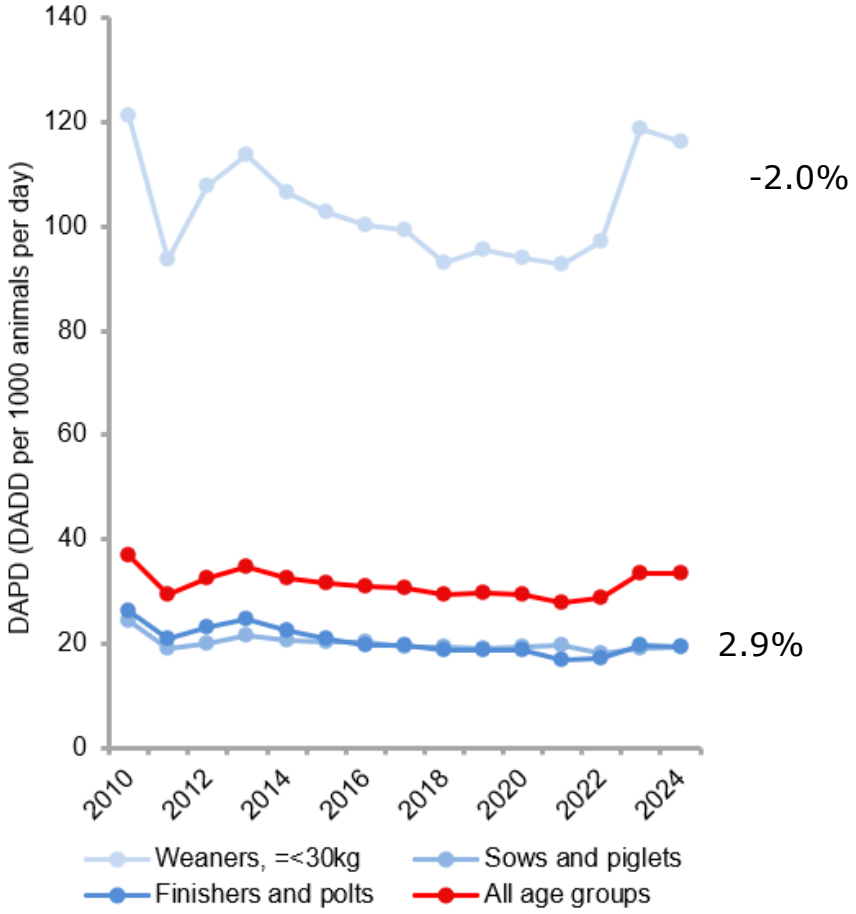


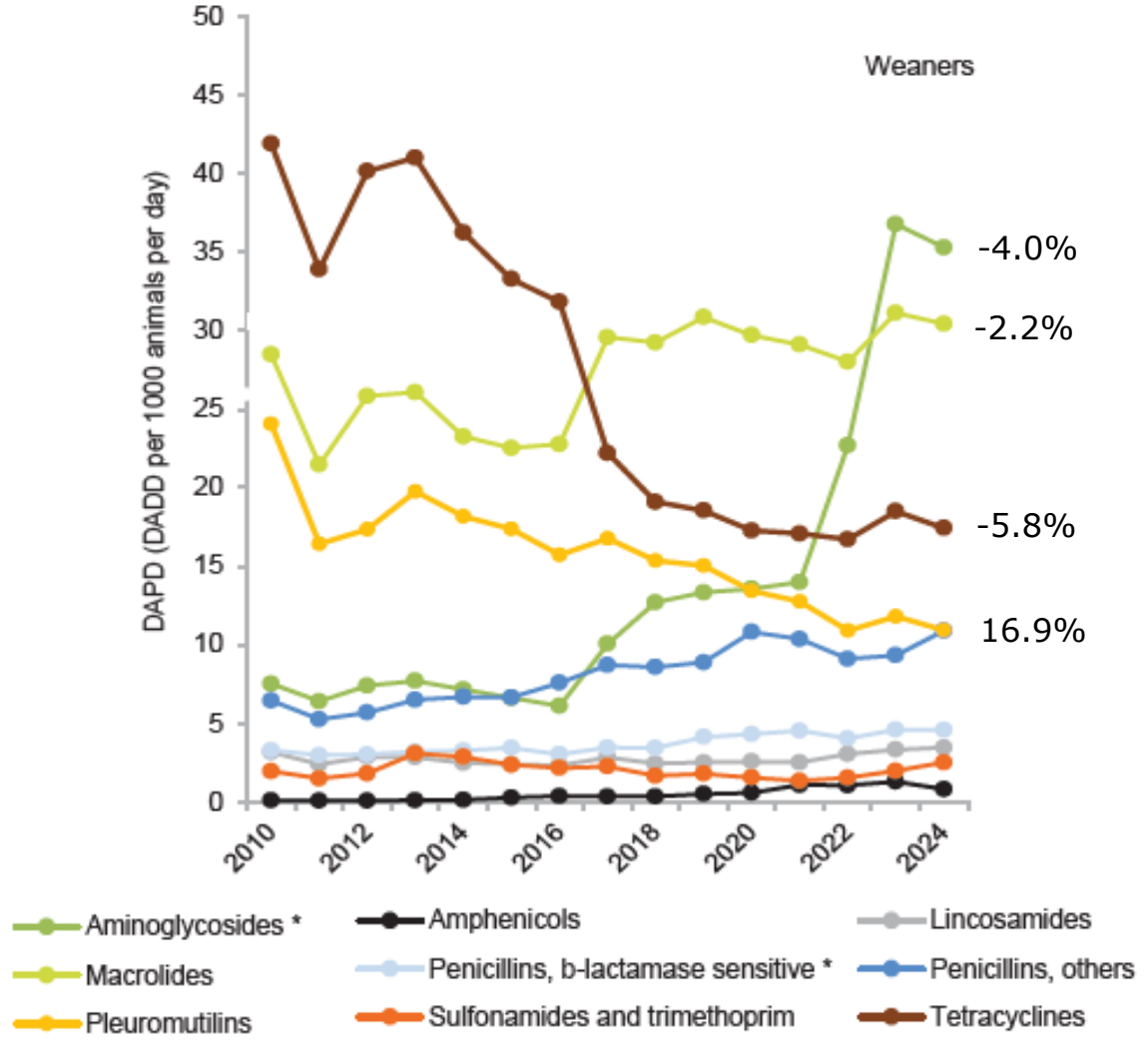
Antimicrobial consumption in pigs



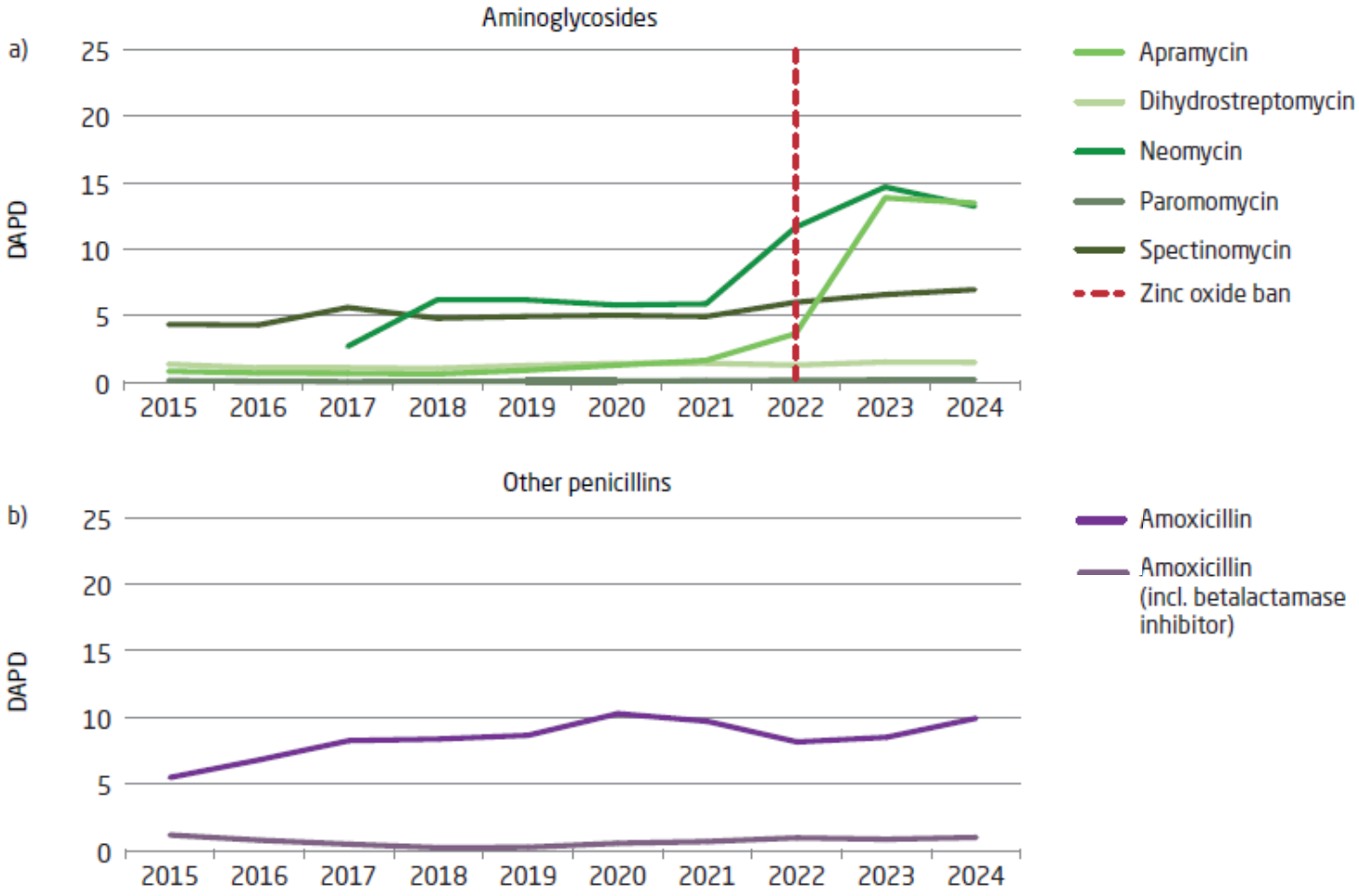


Antimicrobial consumption in pigs

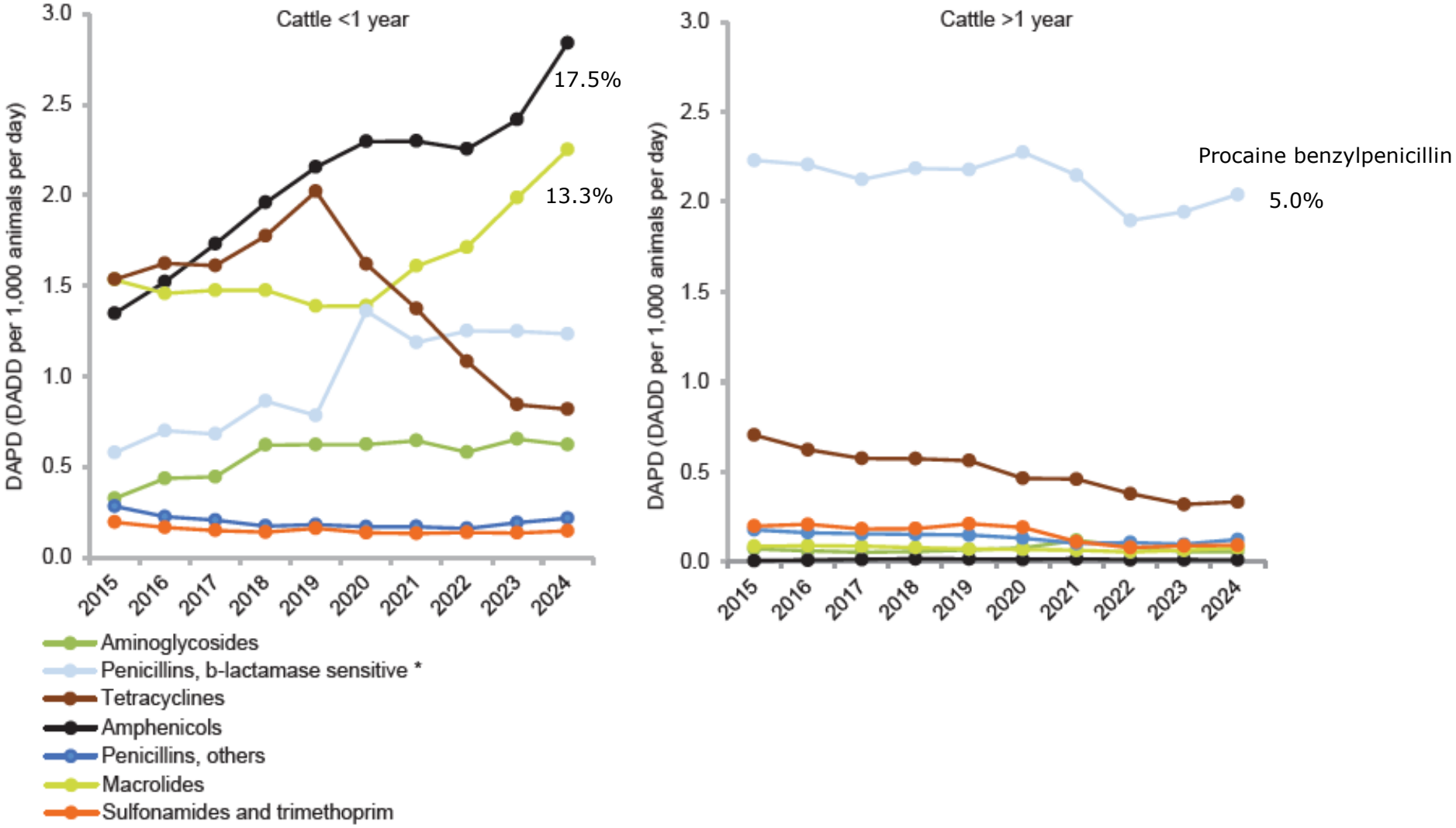




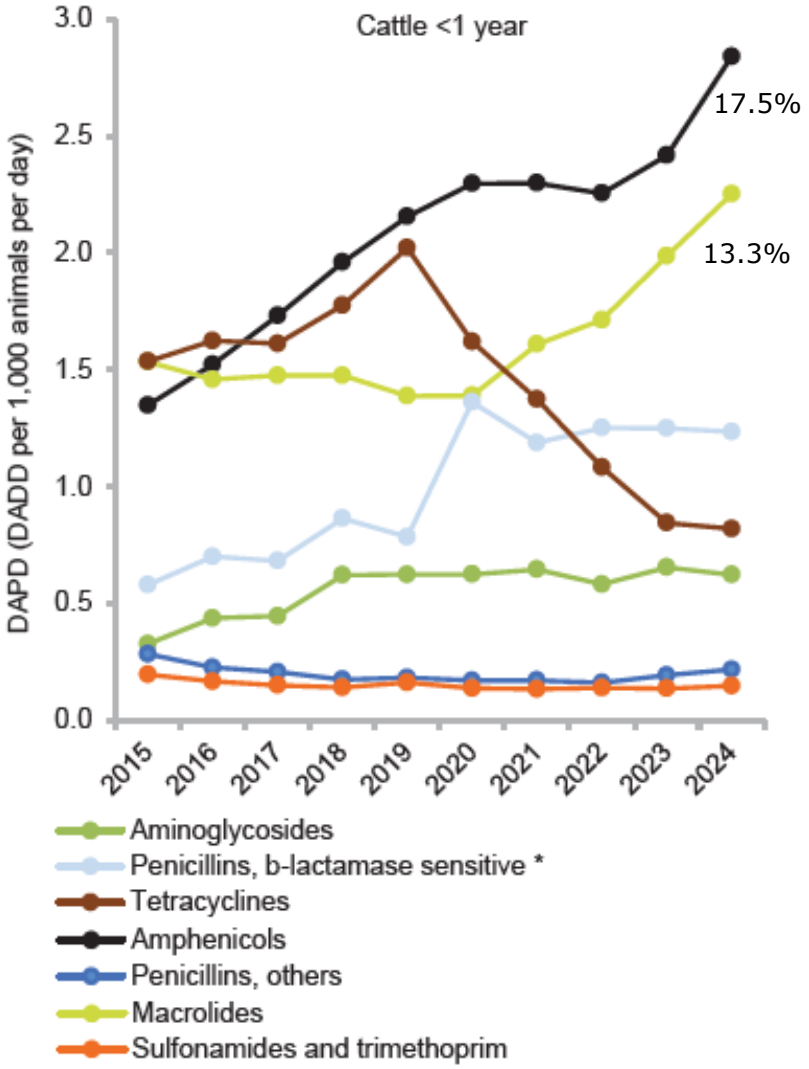
Antimicrobial consumption in weaners

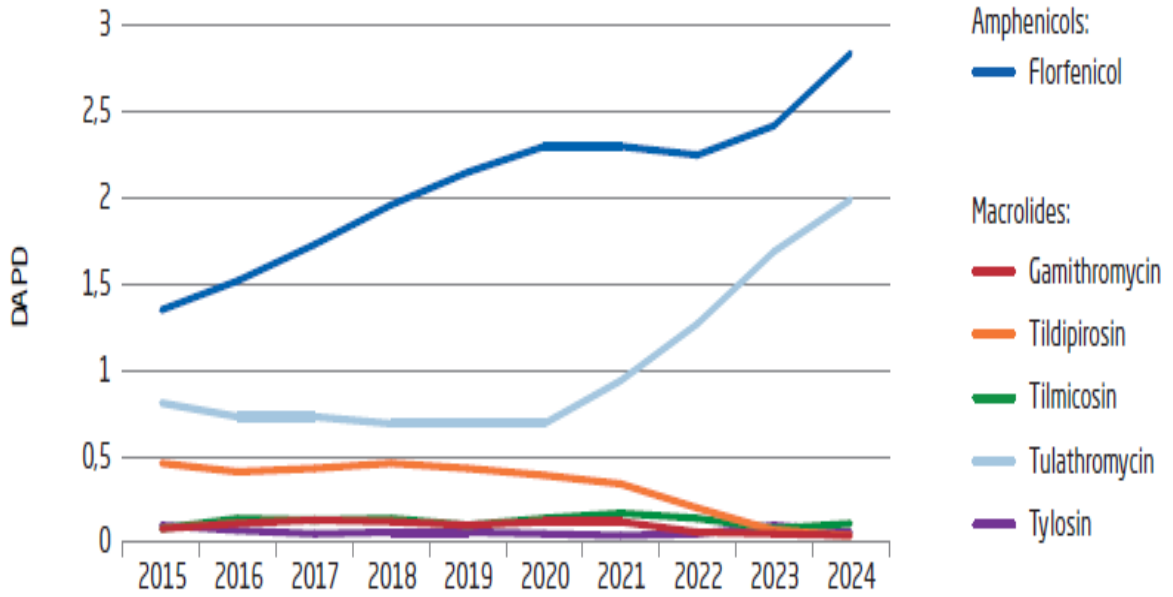


Antimicrobial consumption in cattle, systemic

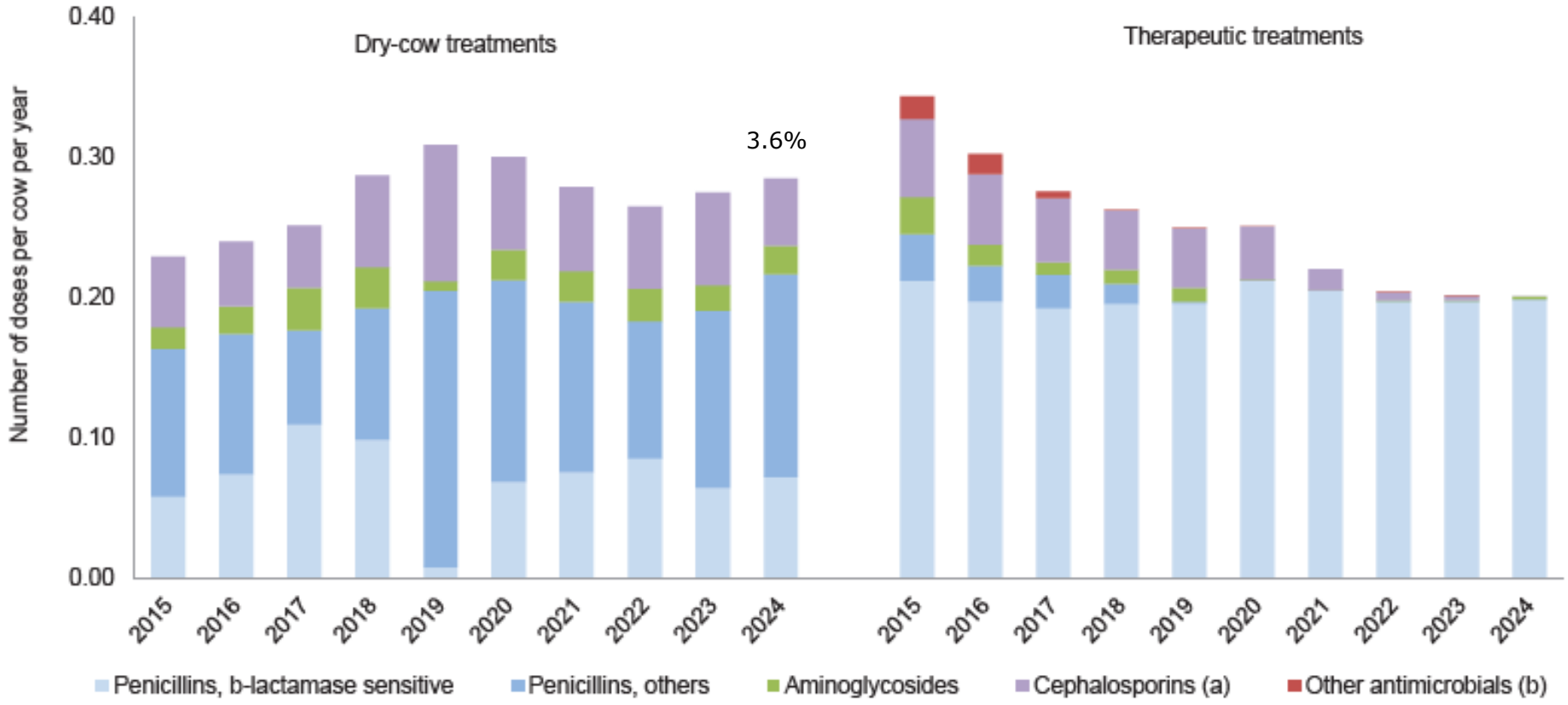


Antimicrobial consumption in cattle, systemic





Antimicrobial consumption in cattle, intramammaries



a) 1st generation cephalosporins only
b) Includes lincomycin for dry-cow treatments. For therapeutic treatment, mainly sulfonamides-trimethoprim, but also lincomycin and bacitracin

Textboxes

Textbox 4.1

The effect of the discontinued use of zinc oxide on antimicrobial usage in Danish pig farms

Background

On June 26, 2022, Denmark implemented a ban on veterinary medicinal products containing zinc oxide, generally used for prevention of *E. coli*-related post-weaning diarrhoea in pigs. The decision followed an EU directive issued in 2017 driven by environmental concerns. A five year phase-out period allowed farms the time to gradually discontinue the use of zinc oxide. In the year the ban was enforced, a national increase in antimicrobial usage (AMU) in pigs – primarily driven by an increase in the peroral use of neomycin in weaners – was observed by DANMAP.

Textbox 4.2

The european sales and use of antimicrobials for veterinary medicine (ESUAvet): 2023 surveillance report

The European Sales and Use of Antimicrobials for Veterinary Medicine (ESUAvet) annual surveillance report is a new initiative launched by the European Medicines Agency aimed at addressing the critical challenge of antimicrobial resistance in veterinary medicine across the European Union. In March 2025, the first ESUAvet report was published, summarizing data reported from 2023 by all EU member states, as well as Iceland and Norway.

In conclusion

- **Consumption (kg) has increased slightly, but DAPD has decreased.**
- **DAPD**
  Sows – increase in the use of simple penicillins.
  Weaners – decrease in the use of aminoglycosides (neomycin and apramycin), macrolides, and tetracyclines, and an increase in the use of broad-spectrum penicillins (amoxicillin).

- **Consumption (kg) and DAPD have increased.**
- **DAPD**
  Adult cattle – increase in the use of systemic simple penicillins.
  Cattle under 1 year of age – increase in the use of amphenicols (florfenicol) and macrolides (tulathromycin).
- **Adult cattle** – increase in dry cow treatments.

- **Consumption (kg) has decreased.**
- **Third-generation cephalosporins and fluoroquinolones** are primarily used in **horses and companion animals**.

DTU

STATENS SERUM INSTITUT

DANMAP

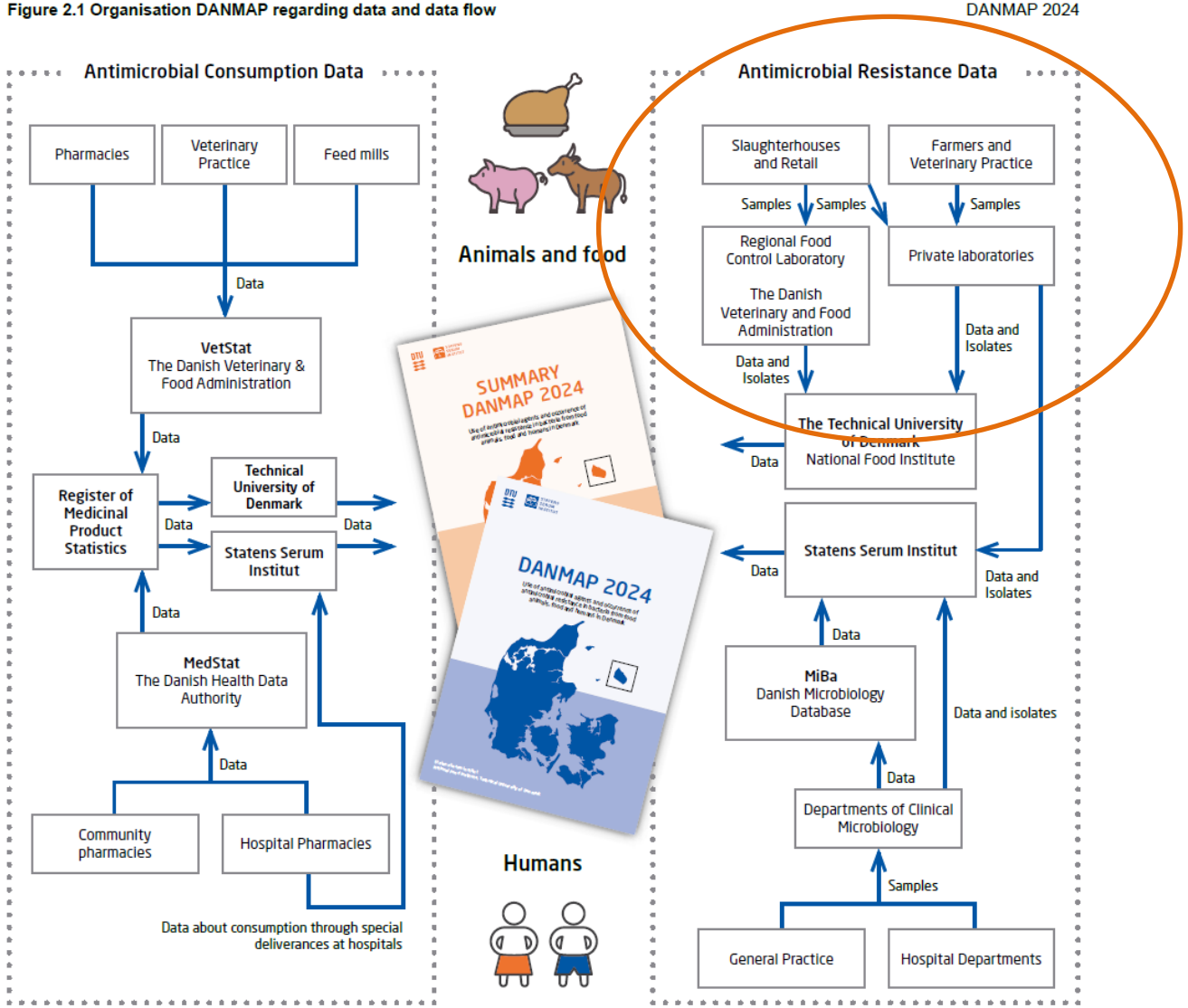
DANMAP Seminar 2024

Antimicrobial resistance in indicator and zoonotic bacteria

DANMAP data flow

Figure 2.1 Organisation DANMAP regarding data and data flow

DANMAP 2024



Antimicrobial resistance in zoonotic bacteria

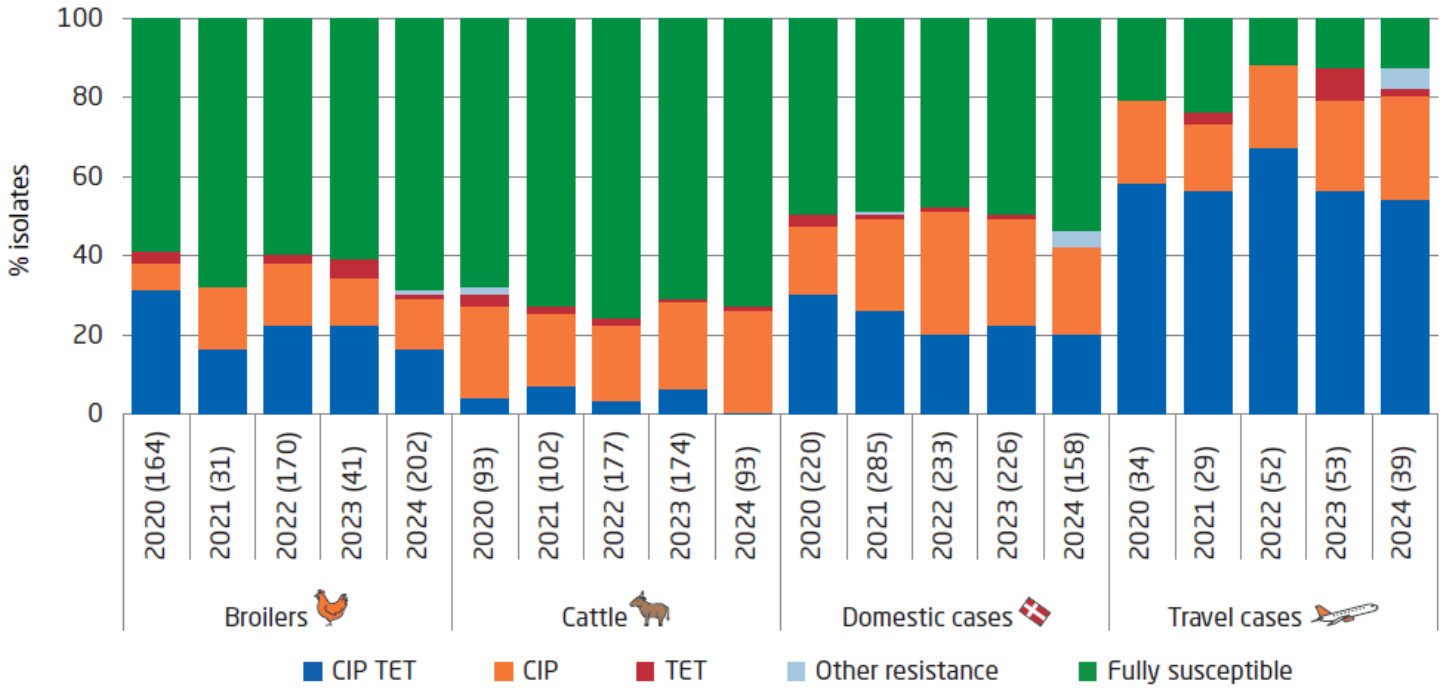
Joana Pessoa (DTU Food)
Sofia Duarte (DTU Food)
Egle Kudirkiene (SSI)
Jeppe Boel (SSI)

For further information:
Animal/food data – Joana Pessoa
Human data - Jeppe Boel

DANMAP 2024 – *Campylobacter jejuni*

AMR profiles among *C. jejuni*

Figure 4.1 Distribution (%) of AMR profiles among *Campylobacter jejuni* from broilers, cattle and human cases, Denmark, 2020-2024

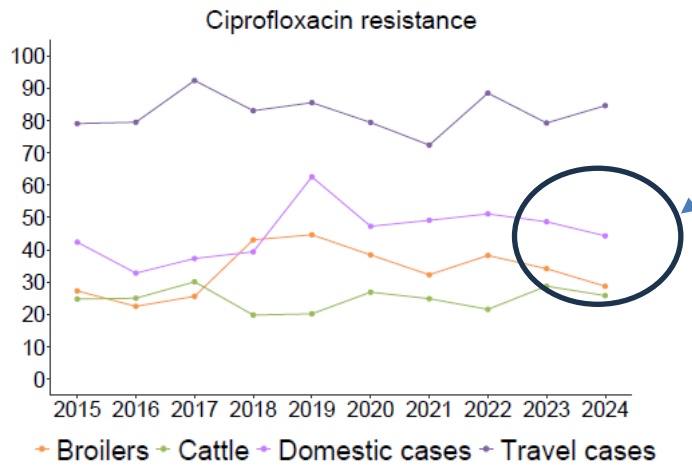


A human isolate is categorised as domestically acquired if the patient did not travel outside Denmark one week prior to the onset of disease

- No significant trends in **%FS**
- From **2023 to 2024**: %FS increase in broilers (61%-> 69%), cattle (70% -> 73%) and domestic cases (50% -> 54%)
- Overall highest resistance in human isolates, especially **travel cases**
- **CIP & TET** resistance remains common in human & animal isolates, but not observed in calves

DANMAP 2024 – *Campylobacter jejuni*

Antimicrobial	AMEG category	AWaRe category
Chloramphenicol	C	Access
Ciprofloxacin	B	Watch
Ertapenem	A	**Reserve**
Erythromycin	C	Watch
Gentamicin	C	Access
Tetracycline	D	Access



AWaRe = *Reserve*

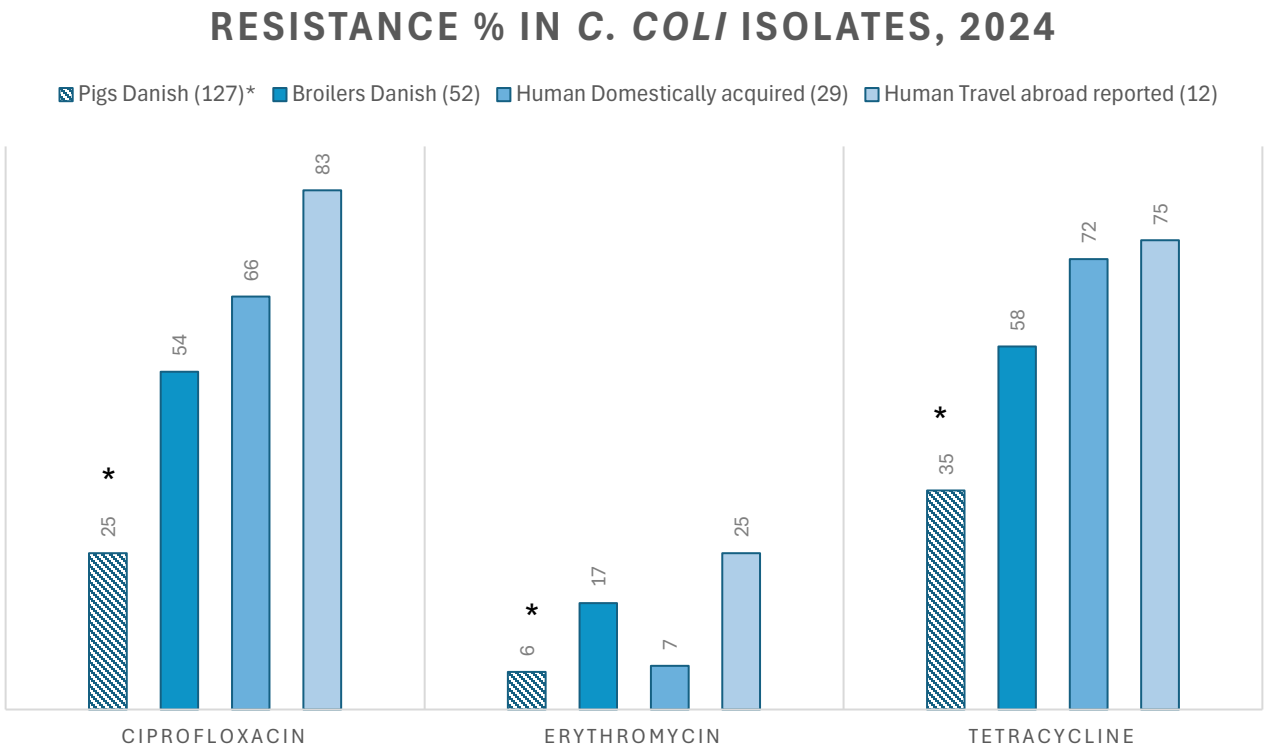
- Ertapenem: from 2023 to 2024, increase 2% -> 7% in broilers; not found in cattle isolates

AWaRe = *Watch*

- Ciprofloxacin: still common in animal isolates (26% and 29% in cattle and broilers), and human isolates (44% and 85% in domestic and travel cases); possible decreasing trend in broilers and domestic cases

- Erythromycin: Still rare. Not observed in humans and broilers; found in 1 cattle isolate

DANMAP 2024 – *Campylobacter coli*



* Pig data from 2023

- 2024: reported for the **2nd time in humans** and for the **1st time in broilers**
- Human results: 2024~2023
- Overall **higher** resistance **in humans**
- Overall **higher** resistance **than *C. jejuni***
- Low **%FS** and high levels of resistance to **ciprofloxacin** and **tetracycline**

DANMAP 2024 – *Campylobacter coli*

Antimicrobial	AMEG category	AWaRe category
Chloramphenicol	C	Access
Ciprofloxacin	B	Watch
Ertapenem	A	**Reserve**
Erythromycin	C	Watch
Gentamicin	C	Access
Tetracycline	D	Access

AWaRe = *Reserve*

- Ertapenem: found in 37% of broiler isolates

AWaRe = *Watch*

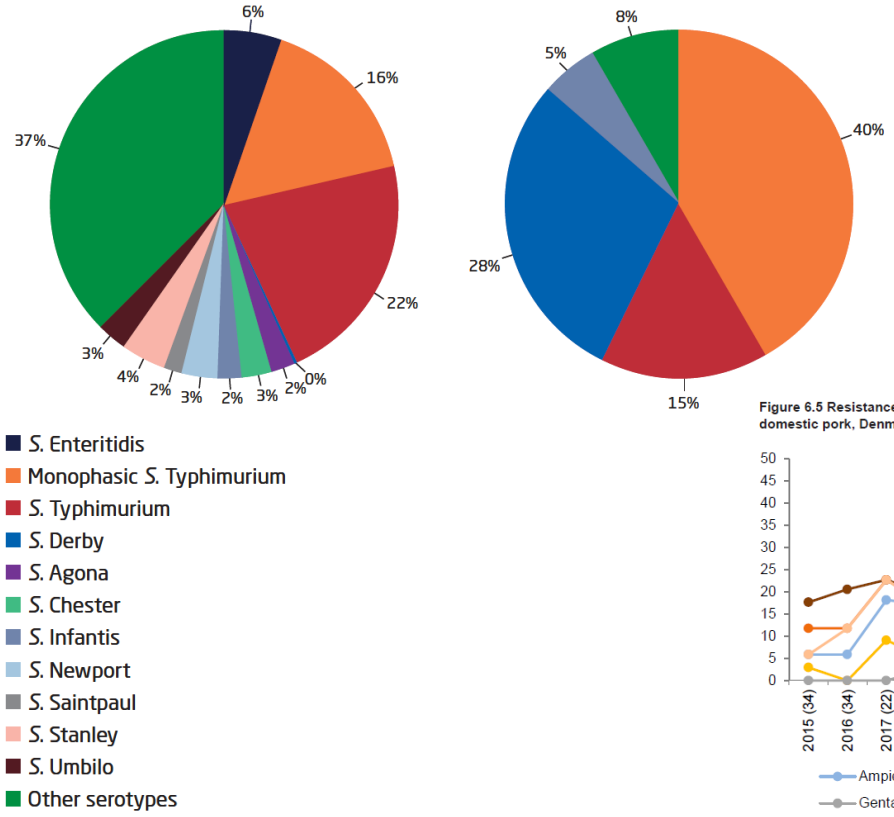
- Ciprofloxacin: common in broiler isolates (54%) and human isolates (66% and 83% in domestic and travel cases)

- Erythromycin: found in broiler isolates (17%) and human isolates (7% and 25% in domestic and travel cases)

Resistance to erythromycin was observed in 14% of the human isolates and in 17% of isolates from broilers. This is an important finding as macrolides are used for the treatment of severely ill human patients.

DANMAP 2024 – *Salmonella* spp.

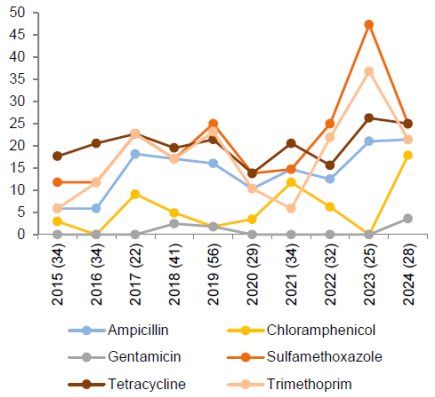
Serotype distribution



- 62% are not Typhimurium or monophasic S. Typhimurium
- Two outbreaks with FS strains, but apart from those strains…
- …resistance levels ~ 2023

S. Derby

Figure 6.5 Resistance (%) among *Salmonella* Derby from domestic pork, Denmark, 2015-2024 DANMAP 2024



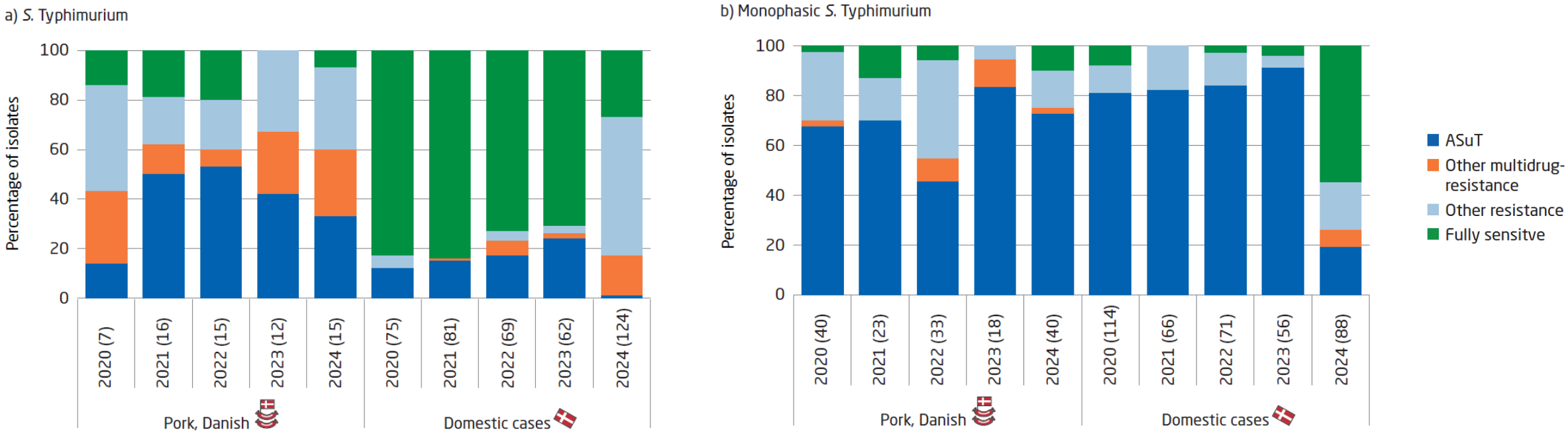
- S. Derby was the 2nd most common serotype in pork
- - From 2023-2024: mostly decrease in resistance, except for chloramphenicol and gentamicin

Table 6.4 Resistance (%) in other *Salmonella* serovars from humans, Denmark, 2024 DANMAP 2024

	Other *Salmonella* serovars		
	Human		
	Domestically acquired	Travel abroad reported	Total
Antimicrobial agent	%	%	%
Amikacin	0	0	0
Ampicillin	5	12	8
Azithromycin	2	1	1
Cefotaxime	2	3	2
Ceftazidime	2	3	2
Chloramphenicol	4	4	4
Ciprofloxacin	8	22	15
Colistin	2	3	4
Gentamicin	0	0	0
Meropenem	0	0	0
Nalidixic acid	7	19	13
Sulfamethoxazole	5	7	6
Tetracycline	10	12	10
Tigecycline	10	8	10
Trimethoprim	4	3	4
Fully susceptible (%)	76	67	69
Number of isolates	183	233	512

DANMAP 2024 – S. Typhimurium and monophasic *S.* Typhimurium

Phenotypic AMR profiles



- Obvious difference in patterns between human and pork isolates for Salmonella Typhimurium
- Markedly higher **%MDR** in **monophasic** *S.* Typhimurium
- Evident differences in **%ASuT** among ***S.* Typhimurium** & **monophasic** *S.* Typhimurium

DANMAP 2024 – S. Typhimurium and monophasic *S.* Typhimurium

Antimicrobial	AMEG category D -> A	AWaRe category Access -> Reserve
Amikacin/Gentamicin	C	Access
Ampicillin	D	Access
Azithromycin	C	Watch
Cefotaxime/**Ceftazidime**	B	Watch/**Reserve**
Ciprofloxacin/ Nalidixic acid	B	Watch
Colistin	**B**	**Reserve**
Chloramphenicol	C	Access
Meropenem	**A**	**Reserve**
Tetracycline	D	Access
Tigecycline	**A**	**Reserve**
Trimethoprim	D	Access
Sulfamethoxazole	D	Access

AWaRe = *Reserve*

- 3rd gen cephalosporins:
  - 2% of all clinical Salmonella spp.
  - Not observed in (monophasic) S. Typhimurium from pork
- Meropenem - not recorded in 2024 isolates

AWaRe = *Watch*

- Azithromycin:
  - 1% of all clinical Salmonella spp.
  - 5% of monophasic S. Typhimurium from pork
- Ciprofloxacin:
  - 6 & 7% of S. Typhimurium and monophasic S. Typhimurium; 15% of other serotypes in human cases
  - Not found in pork isolates since 2015

DANMAP 2024 – S. Typhimurium and monophasic *S.* Typhimurium

Antimicrobial	AMEG category D -> A	AWaRe category Access -> Reserve
Amikacin/Gentamicin	C	Access
Ampicillin	D	Access
Azithromycin	C	Watch
Cefotaxime/**Ceftazidime**	B	Watch/**Reserve**
Ciprofloxacin/ N acid		
Colistin		
Chloramphenicc		
Meropenem		
Tetracycline	D	Access
Tigecycline	**A**	**Reserve**
Trimethoprim	D	Access
Sulfamethoxazole	D	Access

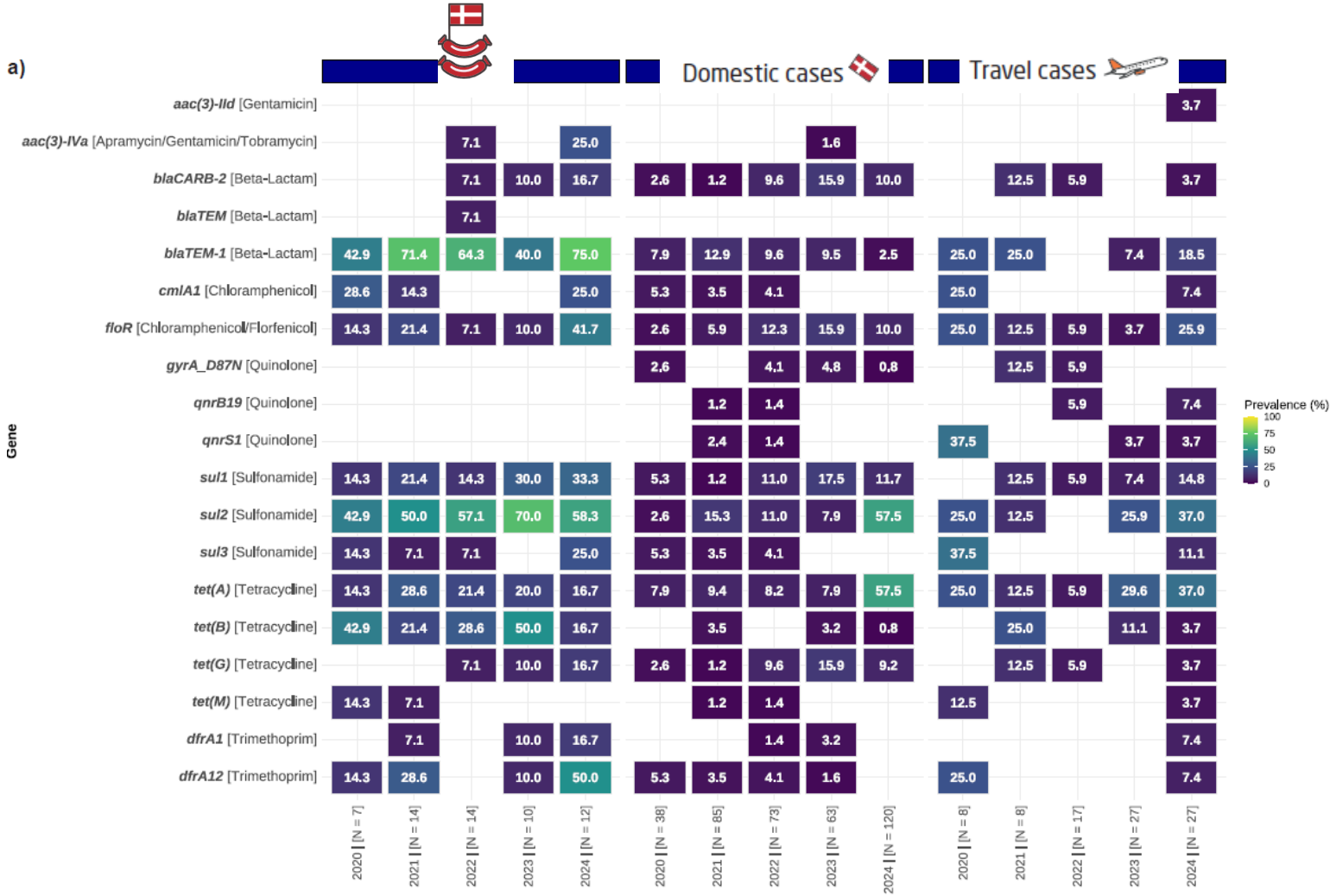
AWaRe = *Reserve*

- 3rd gen cephalosporins:
  - 2% of all clinical Salmonella spp.
  - Not observed in (monophasic) S. Typhimurium from pork
- Meropenem - not recorded in 2024 isolates

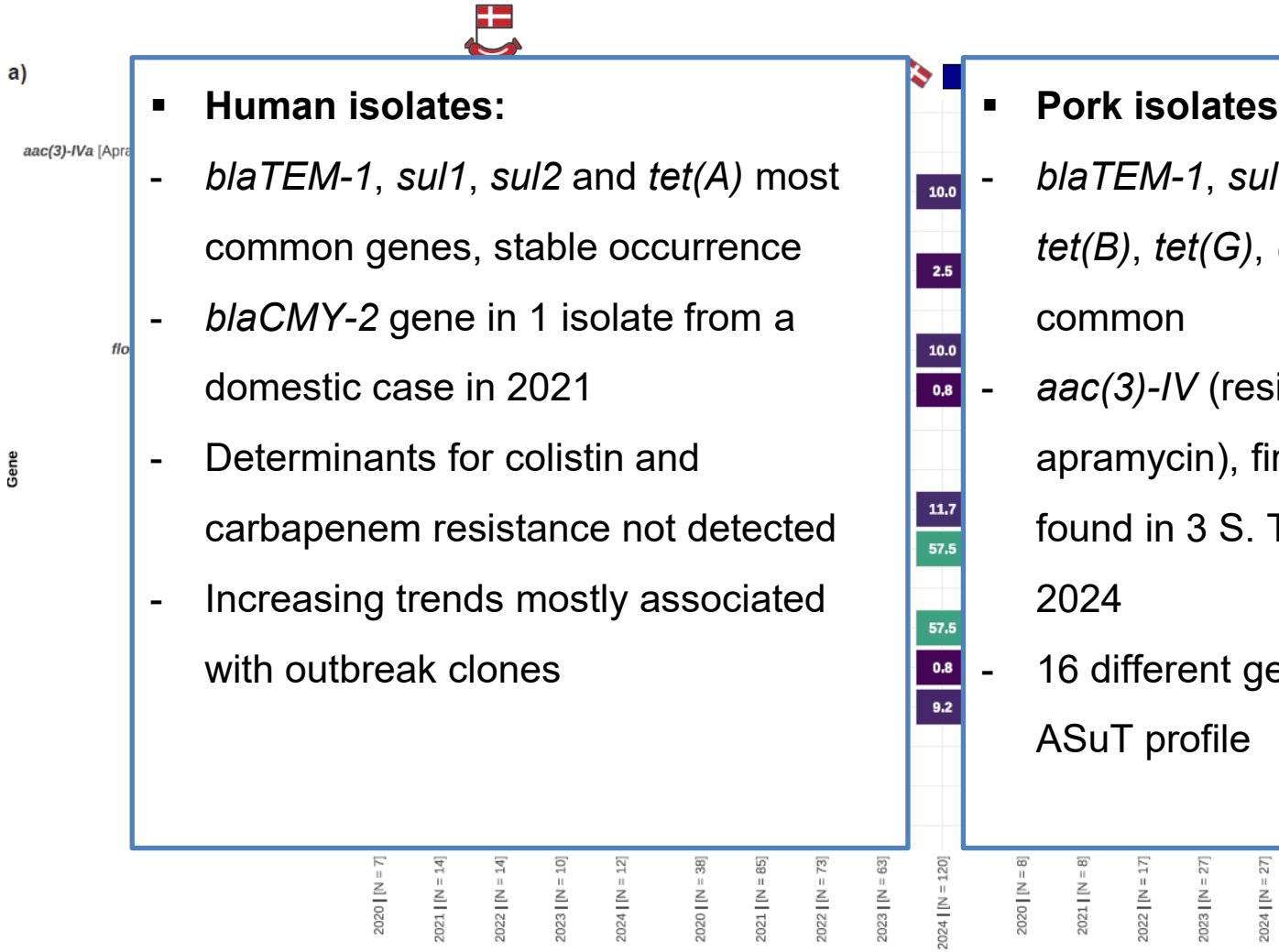
Six human isolates (1%) were simultaneously resistant to azithromycin, third-generation cephalosporins and ciprofloxacin and thereby resistant towards antimicrobials that are frequently used for empirical treatment of human infections. The infections in the six cases were caused by monophasic *S.* Typhimurium (3), *S.* Muenster (1) and *S.* Saintpaul (2). Three of the six cases were associated with travel, and three cases were acquired domestically.

- Ciprofloxacin:
  - 6 & 7% of S. Typhimurium and monophasic S. Typhimurium; 15% of other serotypes in human cases
  - Not found in pork isolates since 2015

AMR genotypic profiles in *Salmonella* Typhimurium, 2020-2024



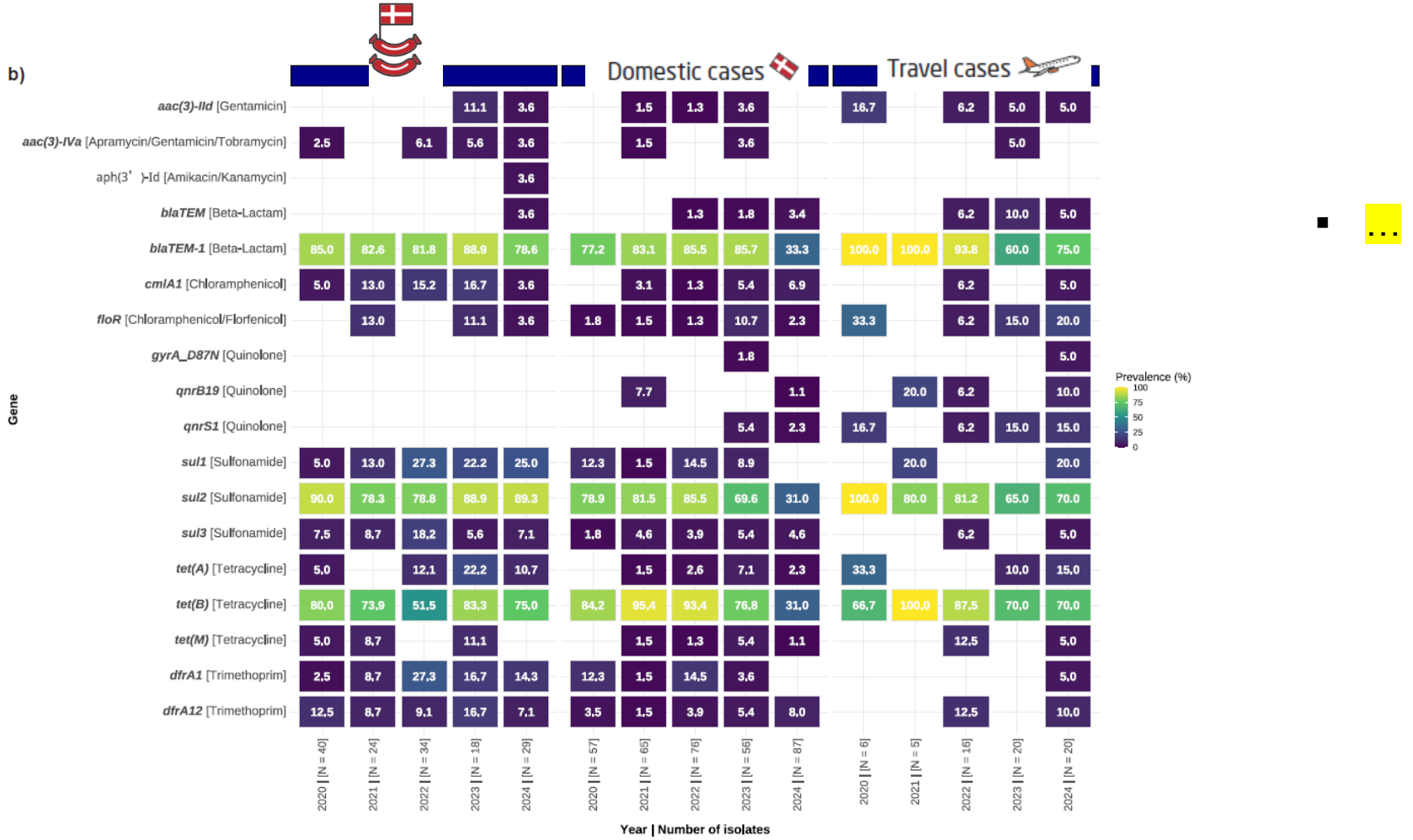
AMR genotypic profiles in *Salmonella* Typhimurium, 2020-2024



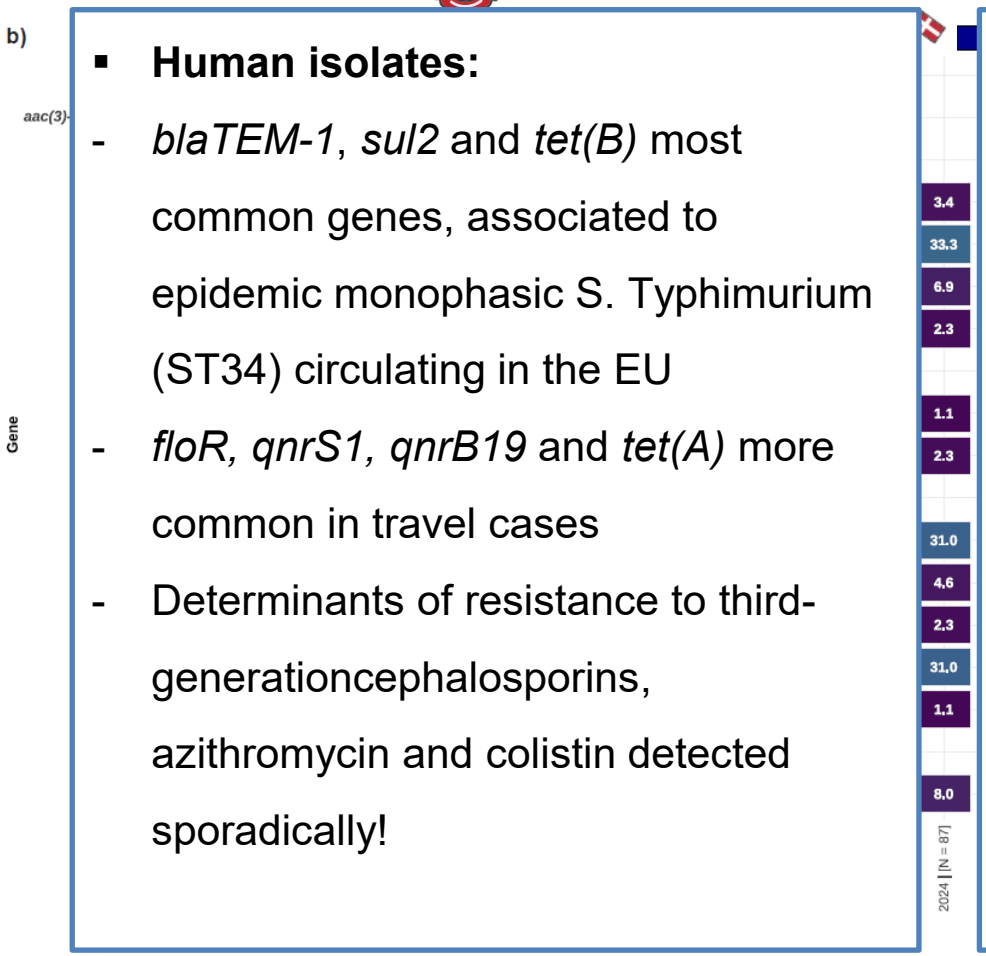
- **Human isolates:**
- *blaTEM-1*, *sul1*, *sul2* and *tet(A)* most common genes, stable occurrence
- *blaCMY-2* gene in 1 isolate from a domestic case in 2021
- Determinants for colistin and carbapenem resistance not detected
- Increasing trends mostly associated with outbreak clones

- **Pork isolates:**
- *blaTEM-1*, *sul1*, *sul2*, *sul3*, *tet(A)*, *tet(B)*, *tet(G)*, *dfrA12* and *dfrA1* most common
- *aac(3)-IV* (resistance to gentamicin and apramycin), first detected in 2022 and found in 3 S. Typhimurium isolates in 2024
- 16 different gene combinations for the ASuT profile

AMR genotypic profiles in monophasic *S.* Typhimurium, 2020-24



AMR genotypic profiles in monophasic *S.* Typhimurium, 2020-24



- **Human isolates:**
- *blaTEM-1*, *sul2* and *tet(B)* most common genes, associated to epidemic monophasic S. Typhimurium (ST34) circulating in the EU
- *floR, qnrS1, qnrB19* and *tet(A)* more common in travel cases
- Determinants of resistance to third-generationcephalosporins, azithromycin and colistin detected sporadically!

- **Pork isolates:**
- *blaTEM-1*, *sul2*, *and tet(B)* most common genes, associated to epidemic ST34 circulating in the EU
- 100% concordance between ASuT phenotype and genotype
- *aac(3)-IId, aac(3)-IVa I* and *aph(3')-Id* (resistance to gentamicin and apramycin) detected
- *mph(A)* (azithromycin resistance) in 1 isolate
- *mef(B)* (azithromycin and erythromycin resistance) found in 2021 (4%) and 2022 (12%)

DANMAP Seminar 2024

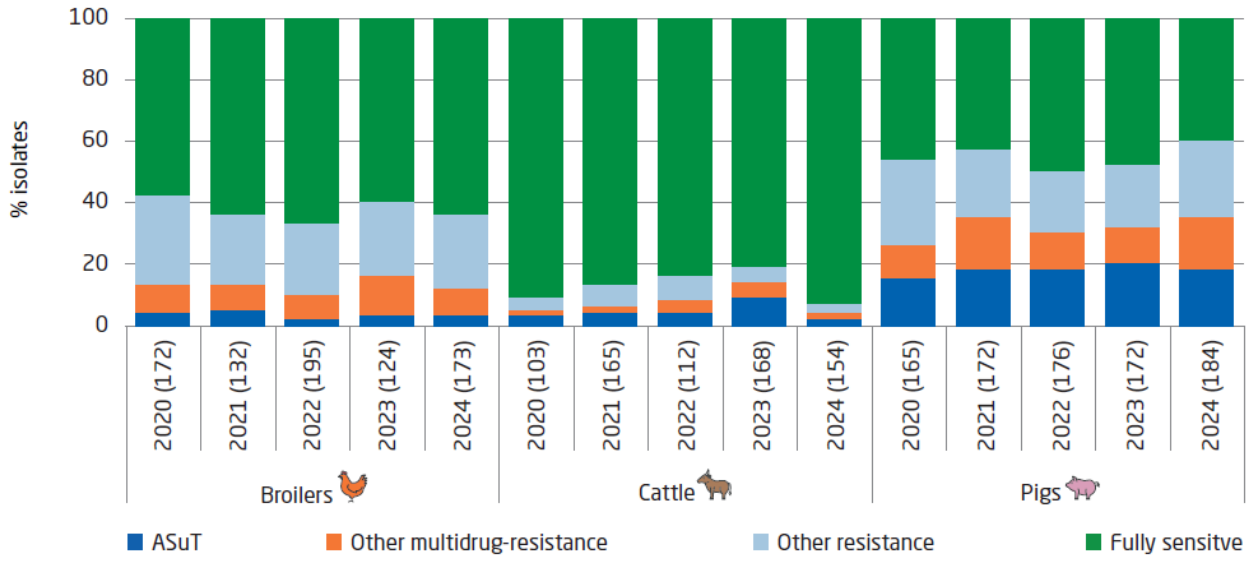
Antimicrobial resistance in indicator bacteria from food animals and food

Ana Sofia Ribeiro Duarte
Senior Researcher, DVM, PhD

Foodborne Pathogens and Epidemiology
DTU National Food Institute

DANMAP 2024 - Indicator *E. coli*

Figure 5.1 Distribution (%) of fully susceptible, resistant and multidrug-resistant *Escherichia coli* isolates from broilers, cattle (calves) and pigs, Denmark, 2020-2024



- **Full susceptibility:**
  - Last 5-years: no significant trend in %FS
  - From 2023 to 2024: %FS increase in cattle (82%-> 93%) and decrease in pigs (48% -> 40%)

- **Multidrug-resistance:**
  - %MDR relatively stable in broilers and pigs
  - From 2023 to 2024: clear decrease in cattle (14% -> 4%)
  - ASuT is still the most common MDR profile in pigs; other MDR patterns dominate in broilers

DANMAP 2024 – Indicator *E. coli*

Antimicrobial	AMEG category D -> A	AWaRe category Access -> Reserve
Amikacin/Gentamicin	C	Access
Ampicillin	D	Access
Azithromycin	C	Watch
Cefotaxime/**Ceftazidime**	B	Watch/**Reserve**
Ciprofloxacin/ Nalidixic acid	B	Watch
Colistin	**B**	**Reserve**
Chloramphenicol	C	Access
Meropenem	**A**	**Reserve**
Tetracycline	D	Access
Tigecycline	**A**	**Reserve**
Trimethoprim	D	Access
Sulfamethoxazole	D	Access

AWaRe = *Reserve*

- Resistance to colistin, meropenem, tigecycline, ceftazidime not detected

AWaRe = *Watch*

- Azithromycin: resistance detected in few isolates from pigs (3% in 2023 -> 4% in 2024)
- Cefotaxime: still not detected or detected at very low levels (≤1%).
- Ciprofloxacin: still very low levels (≤1%) in cattle and pigs, and continued decrease in broilers (18% -> 15% -> 11%)

Ampicillin
Chloramphenicol
Gentamicin
Tetracycline
Cefotaxime
Ciprofloxacin
Sulfamethoxazole
Trimethoprim

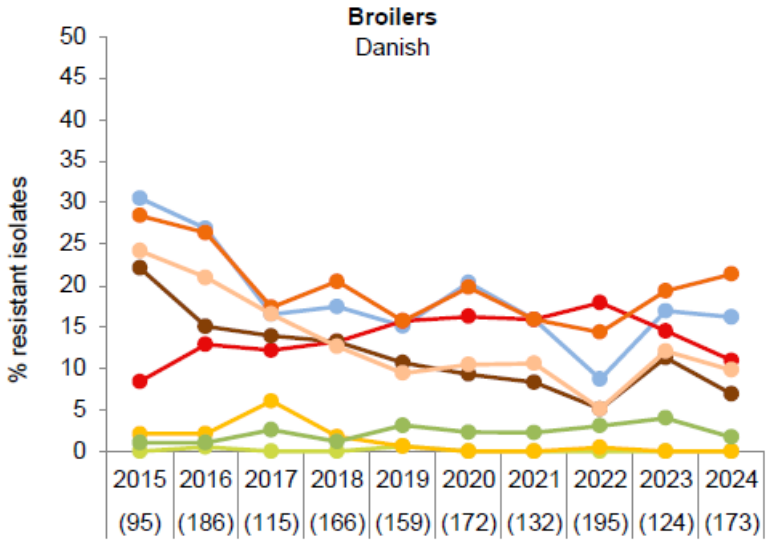
DANMAP

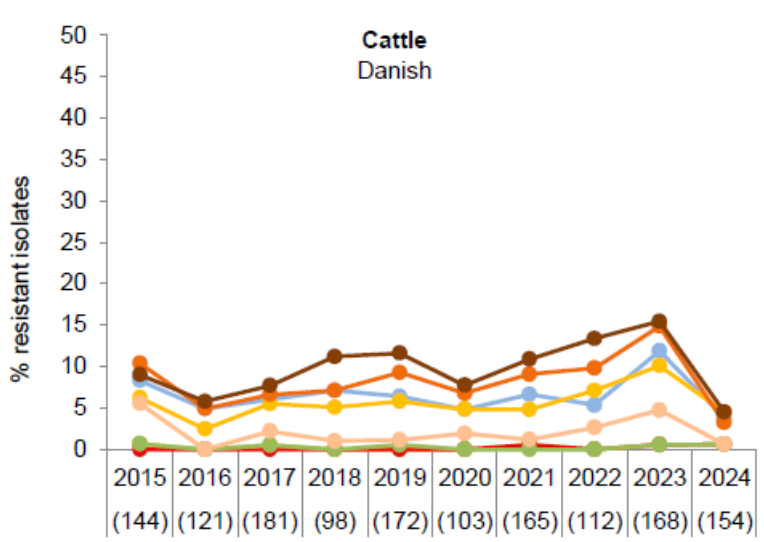
DANMAP 2024 - Indicator *E. coli*

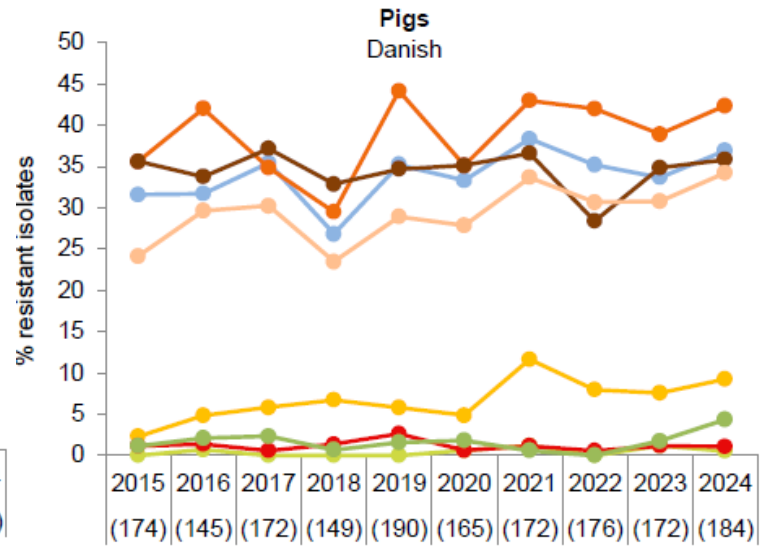
Broilers

Cattle

Pigs







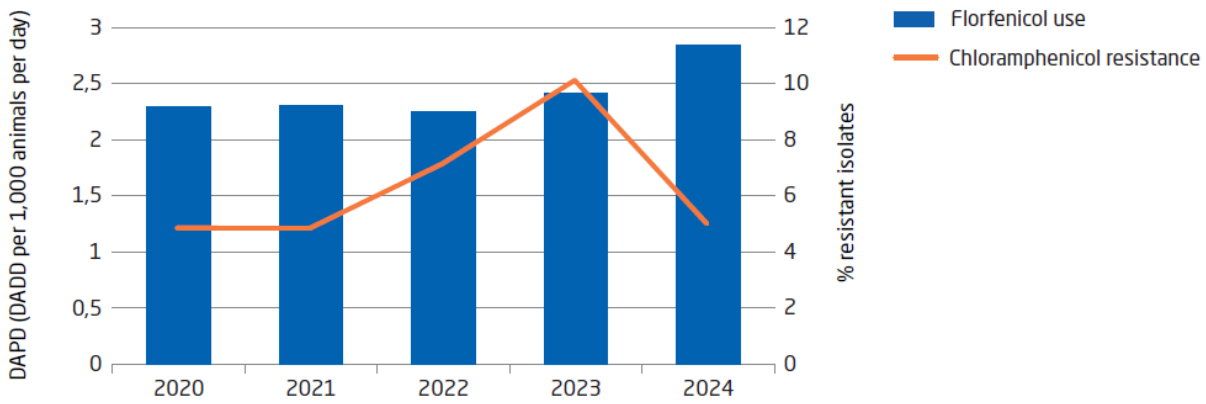
- Increase in % resistance to sulfamethoxazole in **broilers**
- Slight increase in % resistance to several substances in **pigs**
- Fluctuations of 1-5% points from 2023 to 2024

- Decrease in % resistance to most substances in **cattle**
- Fluctuations of 5-12% points from 2023 to 2024

Trends of antimicrobial consumption and resistance in indicator *E. coli*

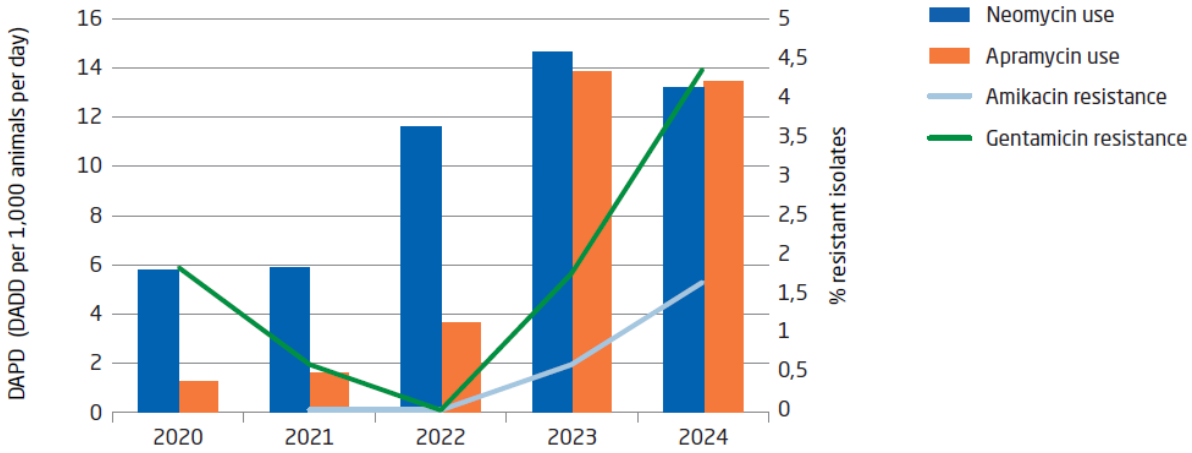
- **5-year trends in the consumption of florfenicol and resistance to chloramphenicol in calves**

Figure 5.5 Use of florfenicol (DAPD) in calves and resistance to chloramphenicol (%) among indicator *E. coli* from calves at slaughter, Denmark, 2020-2024



- **5-year trends in the consumption of aminoglycosides and aminoglycoside resistance in pigs**

Figure 5.6 Use of aminoglycosides (DAPD) in weaners and resistance to aminoglycosides (%) among indicator *E. coli* from pigs at slaughter, Denmark, 2020-2024

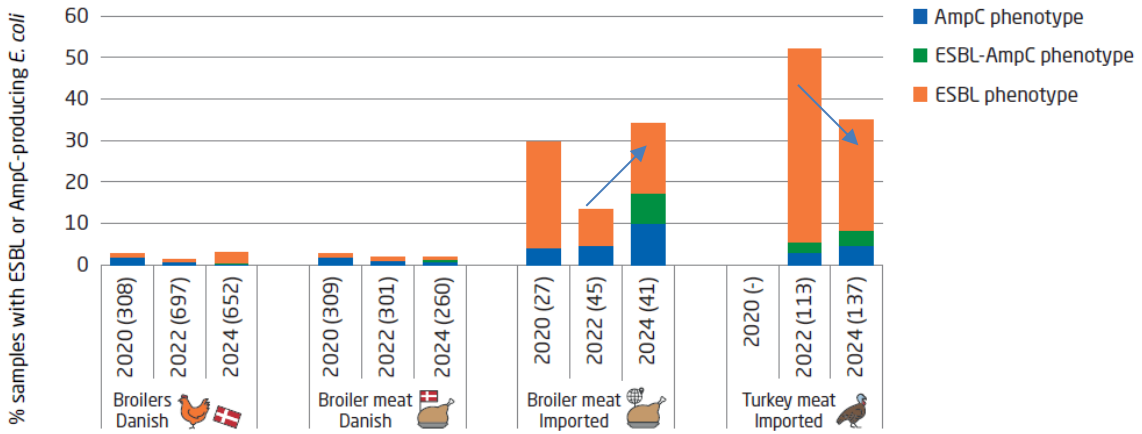


DANMAP 2024 - ESBL-, AmpC-, CP-producing *E. coli* in poultry and poultry meat

- No detection of **CP-producing *E. coli***

- **%ESBL/AmpC-producing *E. coli*:**
  - Still low in broilers and domestic broiler meat (3% and 2%)
  - 2022 to 2024: increase in imported broiler meat (13% -> 34%)
  - 2022 to 2024: decrease in imported turkey meat (52% -> 35%)
  - higher in turkey meat than in broiler meat (imported)

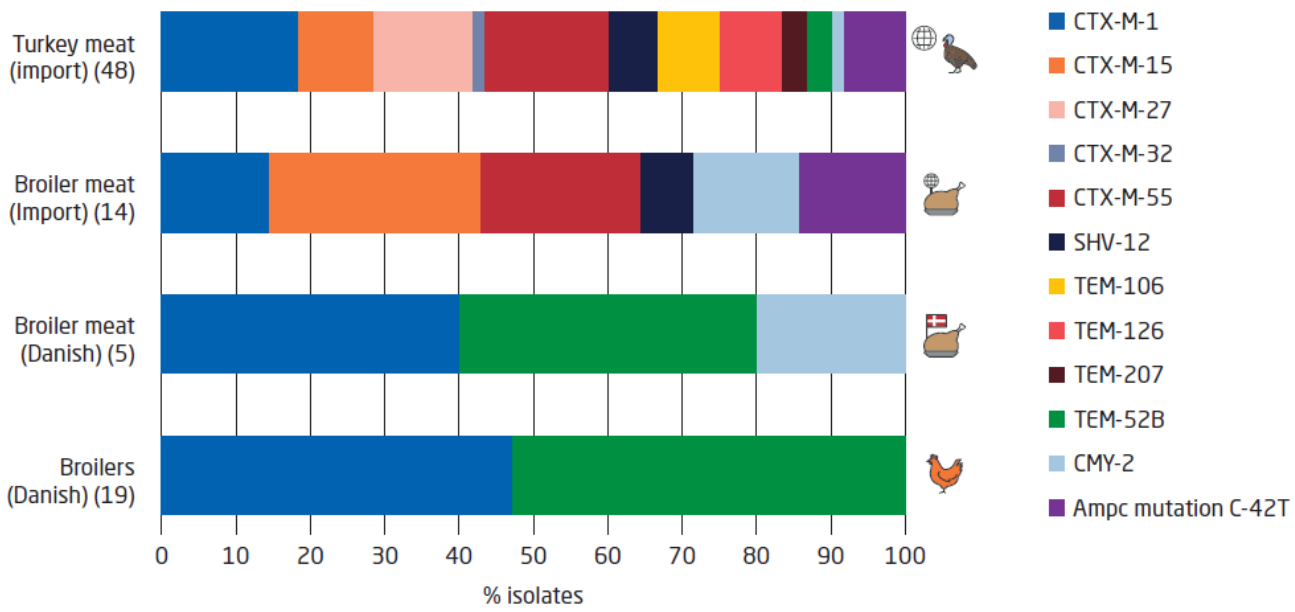
Figure 5.2 Occurrence (%) of samples with ESBL- and/or AmpC-producing *E. coli* from animals and meat recovered by selective enrichment, Denmark, 2020-2024



Classification of ESBL and/or AmpC phenotypes based on antimicrobial susceptibility testing. Number of samples tested per year is presented in parentheses. In 2024, the numbers of ESBL-/AmpC-producing *E. coli* isolates recovered were: 19 for broilers; 5 for domestic broiler meat; 14 for imported broiler meat; 48 for imported turkey meat

DANMAP 2024 - ESBL-, AmpC- producing *E. coli*

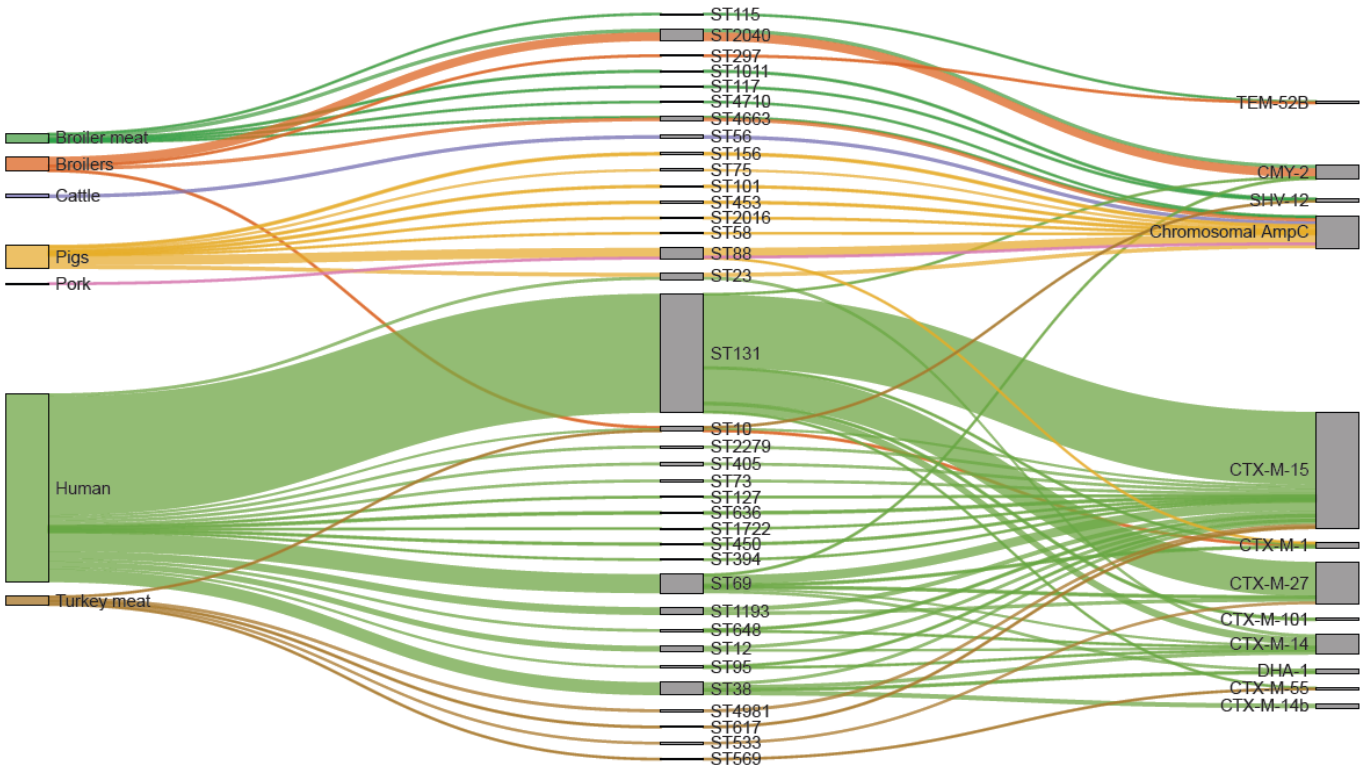
Figure 5.3 Distribution of ESBL and AmpC enzymes detected by whole genome sequencing in β-lactamase-producing *E. coli* isolates from animals and meat recovered by selective enrichment, Denmark, 2024

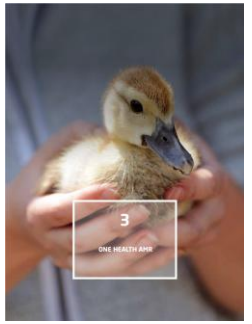


- Phenotypic and genotypic profiles mostly in concordance
- Majority ESBL-producing; no AmpC-producing in broilers
- 10 different **ESBL genes** detected: **CTX-M-1**, followed by **CTX-M-15** and **CTX-M-55** most common
- Imported turkey meat: **CTX-M-27** frequent; all ESBL genes detected; 15% of isolates with >1 ESBL gene
- Upregulated **AmpC** promotor **C-42T mutation,** followed by **CMY-2 gene** among AmpC-producing isolates

DANMAP 2024 - ESBL-, AmpC- producing *E. coli* in a One Health context

Figure 3.1 A Sankey diagram comprised of 1,272 ESBL Ec MLST-gene/mutation combinations from humans, animals and food showing the relationship between the isolates' source, sequence type and ESBL/AmpC gene or mutation DANMAP 2024





Mikkel Lindegaard (SSI)
Ana Sofia Ribeiro Duarte (DTU Food)

Understanding the spread of extended-spectrum cephalosporin-resistant *E. coli*: Insights from a dual modelling study

Background
Extended-spectrum cephalosporin-resistant *Escherichia coli* (ESC-EC) is an increasing public health concern, as it is now frequently detected not only in clinical settings but also in healthy individuals and various animal species. This study used two complementary modelling approaches to explore the spread of ESC-EC in Denmark: a compartmental model to simulate the risk of transmission in various sub-populations, and a Bayesian source attribution model to estimate the relative contribution of dif-

Infection prevention and control and prevention of antimicrobial resistance are interconnected

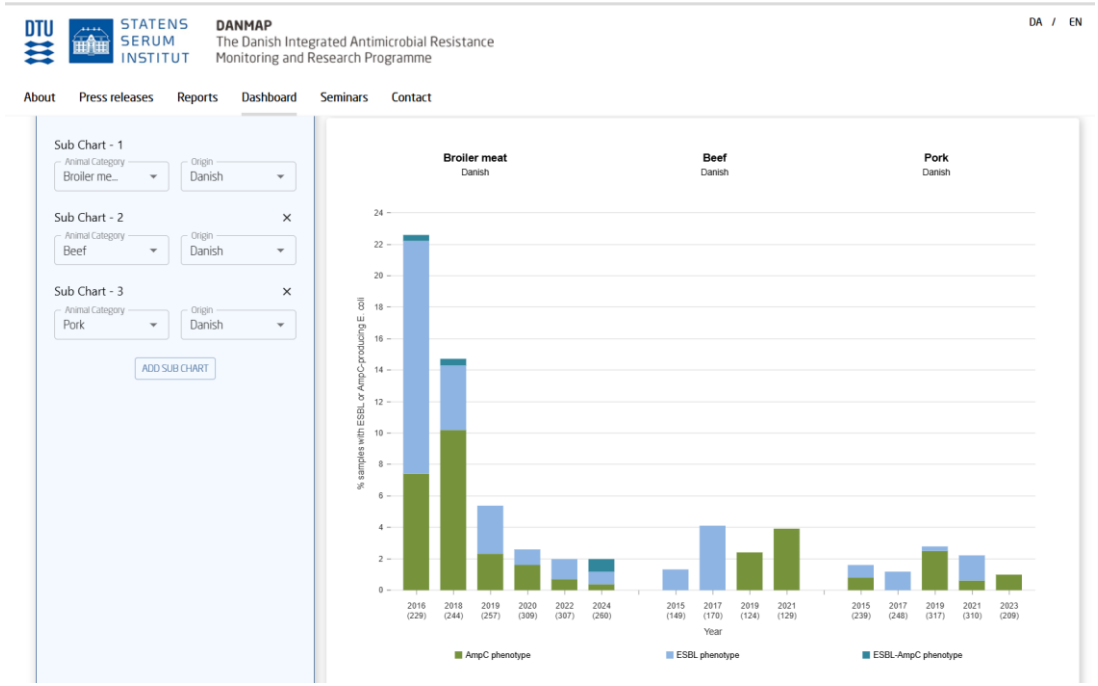
In Denmark there are numerous activities concerning infection prevention and control (IPC) and antimicrobial resistance (AMR) - both on the national and on the international level. Across Europe as well as globally it is increasingly stressed that controlling AMR in human health must be based on aligning efforts within surveillance, antimicrobial stewardship (AMS) and IPC.

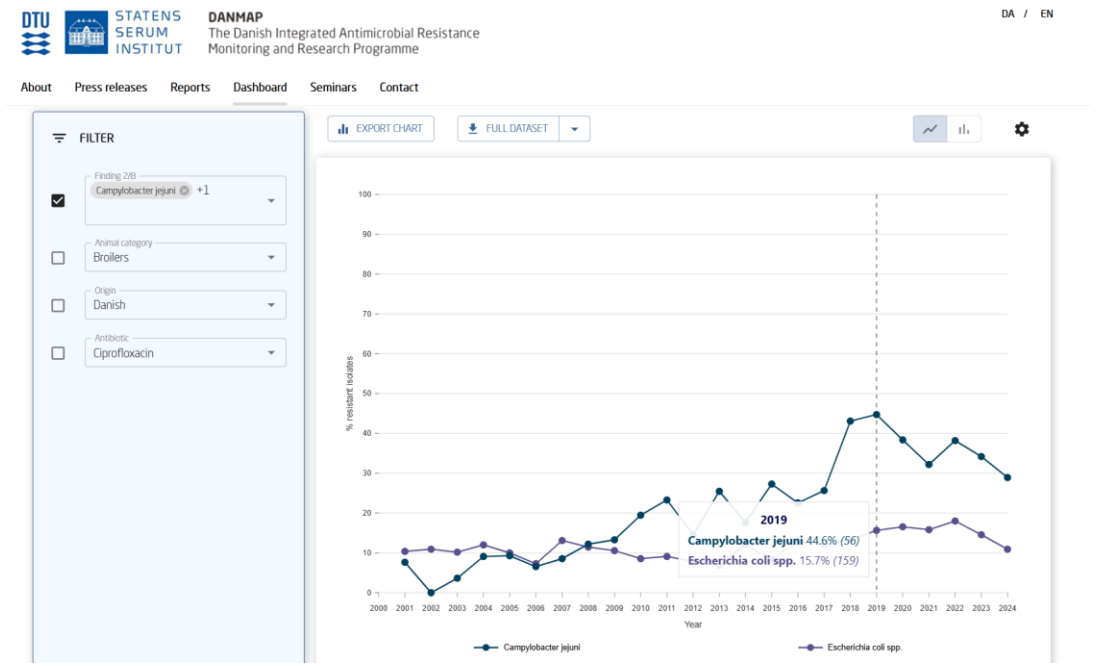
Antibiotics in wastewater and surface water

A) Current and forthcoming regulation on antibiotics in wastewater.

The Urbane Wastewater Treatment Directive
Antibiotics, as active pharmaceutical ingredients or partly degraded compounds, can be excreted to urban wastewater as a result of human consumption.

DANMAP Explorer - interactive visualisation of AMR data from animal and meat isolates





Available at: https://www.danmap.org/dashboard

DANMAP Seminar 2025

Resistance in animal pathogens

Lina M. Cavaco, Øystein Angen, Mikkel Lindegaard, Ute W. Sönksen, Pia T. Hansen, Line T. Madsen & Jesper Larsen
Bacteria, Parasites and Fungi
Statens Serum Institut

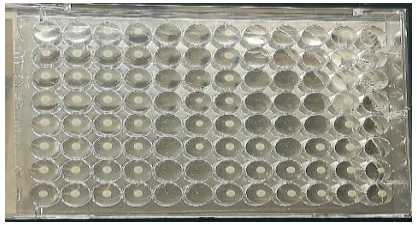
Peter Damborg
Department of Veterinary and Animal Sciences
University of Copenhagen

Svend Haugegaard & Charlotte M. Salomonsen
Veterinary Laboratory
The Danish Agriculture and Food Council

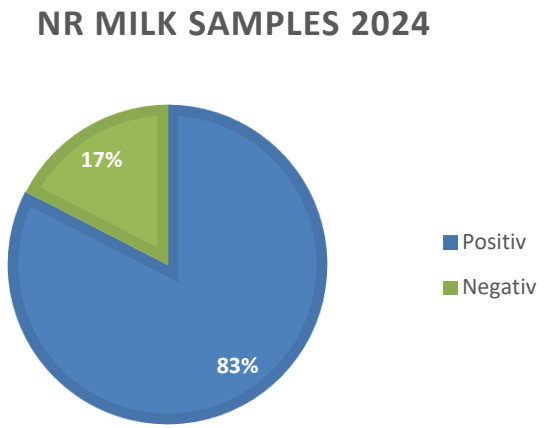
Data from AMR surveillance in cattle - Clinical mastitis

- Sampling
  - Milk samples collected by veterinarians (and frozen on arrival to clinic)
  - 15 large cattle specialized veterinary clinics cover >90% of cattle herds in Denmark
  - Materials provided and transportation organized by SSI
  - Samples - milk samples ±10 per clinic send three times per year - received 487 samples

- Lab analyses
  - Aerobic cultivation milk samples
  - Identification to species level with MALDI-TOF
  - MIC testing with standard panels (EUST2 G+ and EUVSEC3 til G-)
  - MIC data collection and analysis for DANMAP report



Results bacterial culture- Mastitis samples



Bacterial species relevant for mastitis	Nr isolates	%
Streptococcus uberis	127	27.5%
Escherichia coli	93	20.1%
Staphylococcus aureus	62	13.4%
Streptococcus dysgalactiae	50	10.8%
Coagulase-negative staphylococci	25	5.4%
Trueperella pyogenes	15	3.2%
Streptococcus agalactiae	13	2.8%
Klebsiella pneumoniae	12	2.6%

Other bacterial species	Nr isolates	%
Coagulase-negative staphylococc found in mixed cultures	8	1.7%
Lactococcus garviae	7	1.5%
Enterococcus faecium	4	0.9%
Lactococcus lactis	4	0.9%
Pseudomonas spp.	4	0.9%
Serratia liquefaciens	4	0.9%
Streptococcus spp.	4	0.9%
Enterococcus faecalis	3	0.6%
Helcococcus ovis	3	0.6%
Pantoea agglomerans	3	0.6%
Corynebacterium bovis	2	0.4%
Enterococcus cecorum	2	0.4%
Streptococcus parauberis	2	0.4%
Aerococcus viridans	1	0.2%
Bacillus licheniformis	1	0.2%
Enterococcus spp	1	0.2%
Helcococcus kunzii	1	0.2%
Lysinibacillus sphaericus	1	0.2%
Mannheimia spp.	1	0.2%
Mycobacterium smegmatis	1	0.2%
Pseudomonas aeruginosa	1	0.2%
Raoultella planticola	1	0.2%
Serratia plymuthica	1	0.2%
Serratia rubidea	1	0.2%
Serratia spp.	1	0.2%
Streptococcus canis	1	0.2%
Streptococcus equinus	1	0.2%
Streptococcus gallolyticus	1	0.2%

Additionally <1% samples had yeast isolates.

Susceptibility testing results- MIC

DANMAP

376 isolates tested

	E. coli (n=89) R (%)	*K. pneumoniae* (n=12) R (%)	*S. aureus* (n=62) R (%)	CoNS (n=25) R (%)	*S. agalactiae* (n=11) R (%)	*S. dysgalactiae* (n=50) R (%)	*S. uberis* (n=127) R (%)
Amikacin	0 (0.0%)	0 (0.0%)*	NT	NT	NT	NT	NT
Ampicillin	12 (13.5%)	11 (91.7%)*	NT	NT	NT	NT	NT
Azithromycin	1 (1.1%)	ND	NT	NT	NT	NT	NT
Cefotaxime	1 (1.1%)	0 (0.0%)*	NT	NT	NT	NT	NT
Cefoxitin	NT	NT	0 (0.0%)	ND	ND	ND	ND
Ceftazidime	1 (1.1%)	0 (0.0%)*	NT	NT	NT	NT	NT
Chloramphenicol	1 (1.1%)	0 (0.0%)*	0 (0.0%)	1 (4.0%)	1 (9.1%)*	0 (0.0%)	0 (0.0%)
Clindamycin	NT	NT	0 (0.0%)	ND	1 (9.1%)*	0 (0.0%)	4 (3.1%)
Ciprofloxacin	1 (1.1%)	0 (0.0%)*	0 (0.0%)	ND	0 (0.0%)*	ND	ND
Colistin	0 (0.0%)	0 (0.0%)*	NT	NT	NT	NT	NT
Erythromycin	NT	NT	0 (0.0%)	1 (4.0%)	2 (18.2%)*	2 (4.0%)	6 (4.7%)
Fusidate	NT	NT	0 (0.0%)	ND	ND	ND	ND
Gentamicin	0 (0.0%)	0 (0.0%)*	0 (0.0%)	0 (0.0%)	0 (0.0%)*	ND	ND
Kanamycin	NT	NT	0 (0.0%)	ND	ND	ND	ND
Linezolid	NT	NT	0 (0.0%)	0 (0.0%)	0 (0.0%)*	ND	ND
Meropenem	0 (0.0%)	0 (0.0%)*	NT	NT	NT	NT	NT
Mupirocin	NT	NT	0 (0.0%)	ND	ND	ND	ND
Nalidixic acid	2 (2.2%)	ND	NT	NT	NT	NT	NT
Penicillin	NT	NT	3 (4.8%)	3 (12.0%)	1 (9.1%)*	ND	25 (19.7%)
Quinopristin/dalfopristin	NT	NT	0 (0.0%)	ND	ND	ND	ND
Rifampin	NT	NT	0 (0.0%)	0 (0.0%)	ND	ND	ND
Streptomycin	NT	NT	0 (0.0%)	ND	ND	ND	ND
Sufamethoxazole	11 (12.4%)	ND	ND	ND	ND	ND	ND
Tetracycline	9 (10.1%)	2 (16.7%)*	0 (0.0%)	0 (0.0%)	9 (82%)*	7 (14%)	25 (19.7%)
Tiamulin	NT	NT	0 (0.0%)	ND	ND	ND	ND
Tigecycline	0 (0.0%)	0 (0.0%)*	NT	NT	NT	NT	NT
Trimethoprim	10 (11.2%)	1 (8.3%)*	0 (0.0%)	ND	ND	ND	ND
Vancomycin	NT	NT	0 (0.0%)	0 (0.0%)	0 (0.0%)*	0 (0.0%)	0 (0.0%)

One single ESBL and MDR *E. coli* found

19.7% of *S. uberis* show MIC one or 2 steps above TECOFF for Penicillin, likely due to mutations (no WGS), no info if clinically resistant

Generally low resistance levels

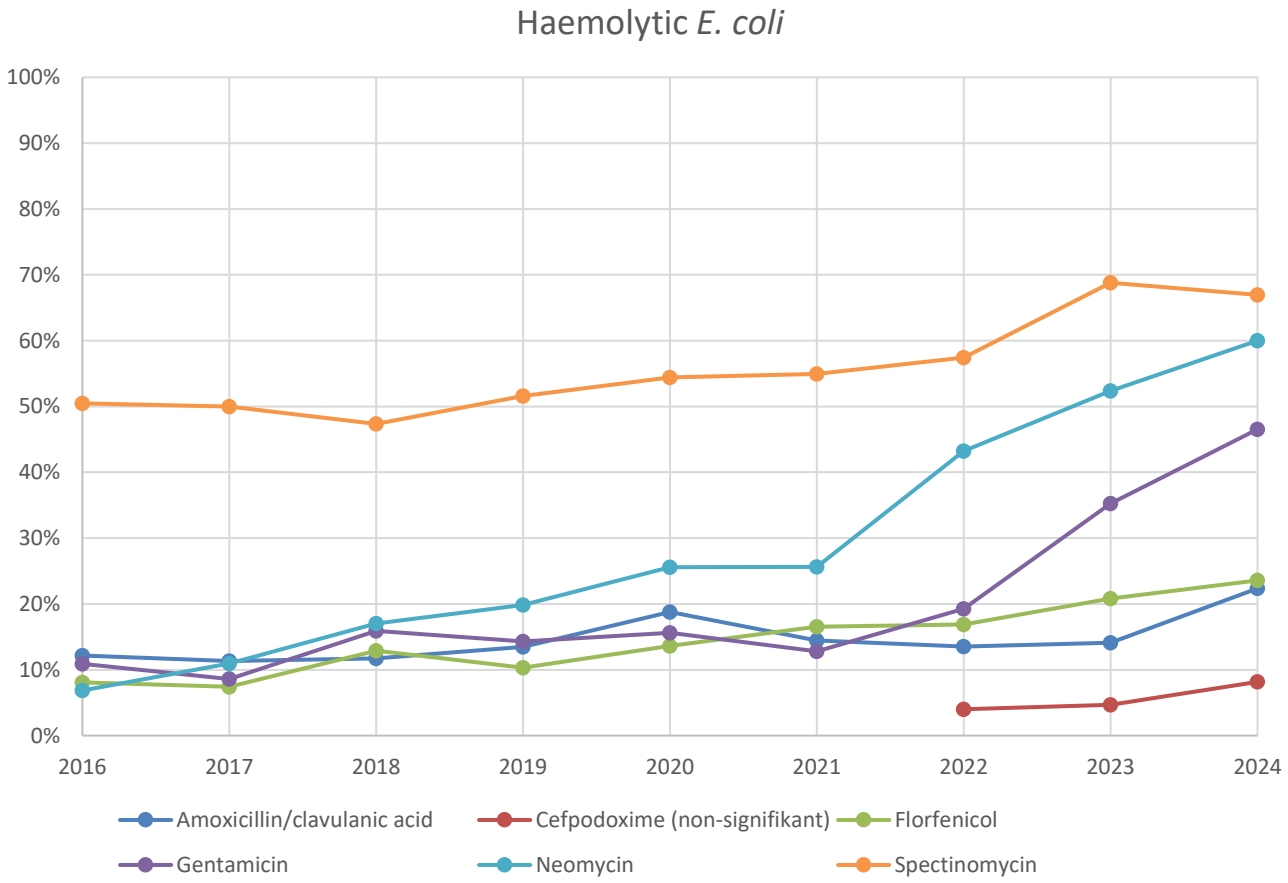
Main issues and perspectives

- Mastitis AMR surveillance in 2024 showed low resistance levels
- One single *E. coli* isolate ESBL and MDR med $bla_{\text{CTX-M-15}}$, not found related to patient isolates
- Penicillin resistance in *S. uberis* (low-level MIC rise)- likely mutation based but cannot be confirmed without WGS based analyses- no info on intramammary treatment sucess
- Mastitis AMR surveillance was continued in 2025

Data from pigs

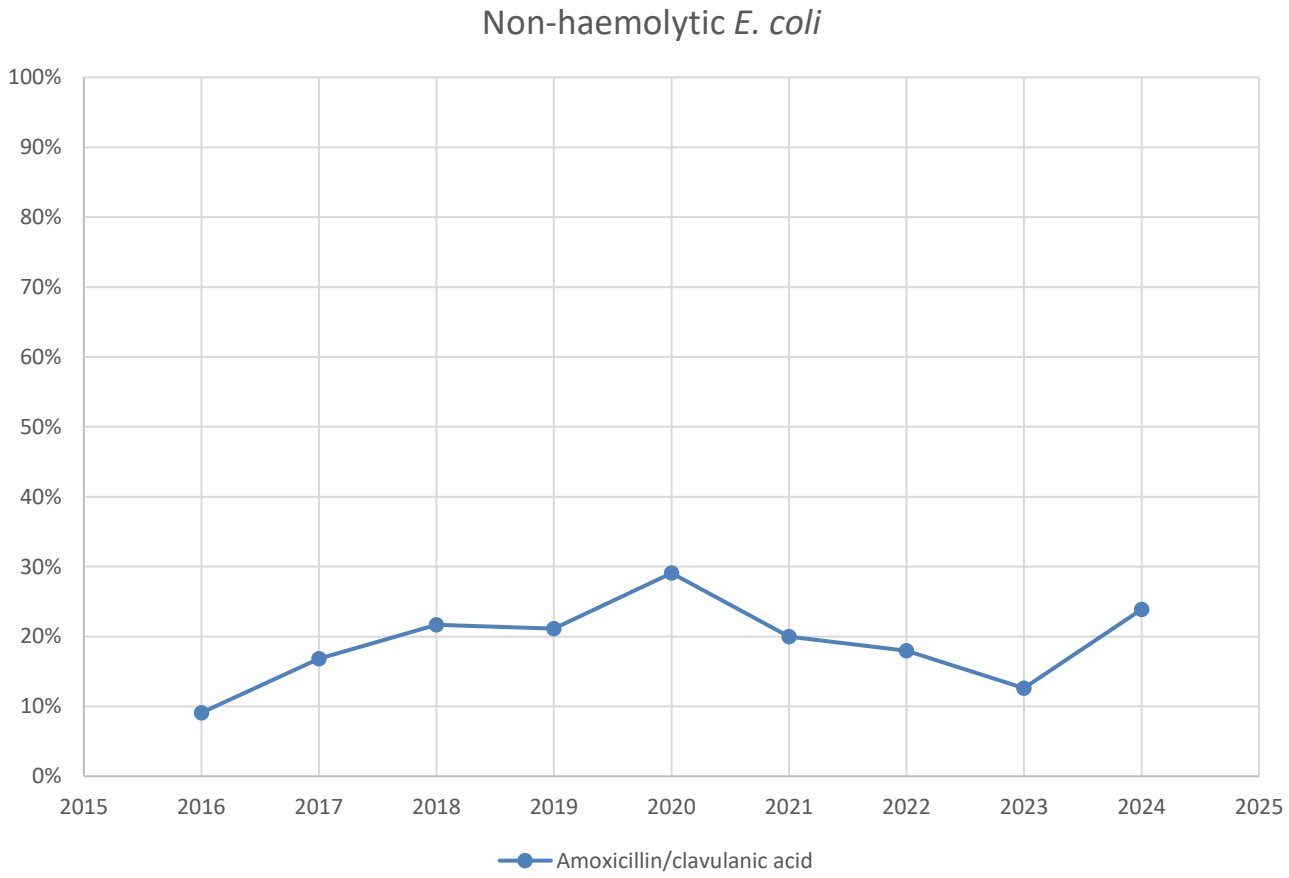
- **Veterinary Laboratory, The Danish Agriculture and Food Council**
  - Receives clinical samples from pigs
  - Performs bacterial culturing, species identification and antimicrobial susceptibility testing (AST)
  - Pathogens covered (only AST results in 2024):
    - *A. pleuropneumoniae*
    - *Bordetella bronchiseptica*
    - Haemolytic and non-haemolytic *E. coli*
    - *Klebsiella pneumoniae*
    - *Salmonella enterica*
    - *Staphylococcus hyicus*
    - *S. suis*

AST (phenotypic resistance)



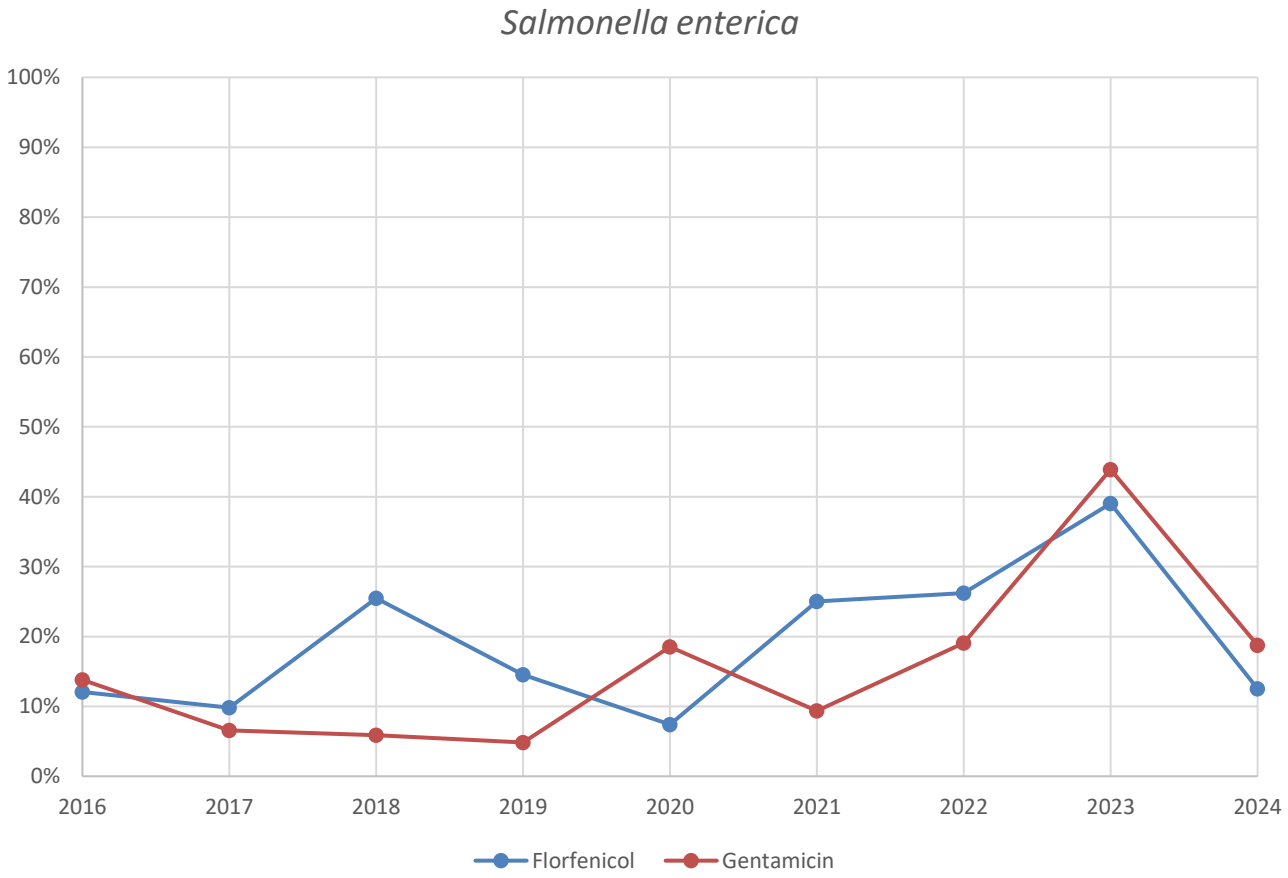
Antibiotic	2024 vs 2023	2024 vs 2020
Amoxicillin/clavulanic acid	0.013	0.010
Cefpodoxime (non-significant)	0.110	
Florfenicol	0.468	0.000
Gentamicin	0.008	0.000
Neomycin	0.083	0.000
Spectinomycin	0.645	0.001

AST (phenotypic resistance)



Antibiotic	2024 vs 2023	2024 vs 2020
Amoxicillin/clavulanic acid	0.006	0.536

AST (phenotypic resistance)



Antibiotic	2024 vs 2023	2024 vs 2020
Florfenicol	0.017	1.000
Gentamicin	0.027	0.058

Main issues and perspectives

- Haemolytic *E. coli*
  - Increased resistance towards amoxicillin-clavulanic, florfenicol, gentamicin, neomycin and spectinomycin
  - Highest rate of resistance towards 3rd generation cephalosporin recorded
- Non-haemolytic *E. coli*
  - Increased resistance towards amoxicillin/clavulanic acid
- *Salmonella enterica*
  - Decreased resistance towards florfenicol and gentamicin

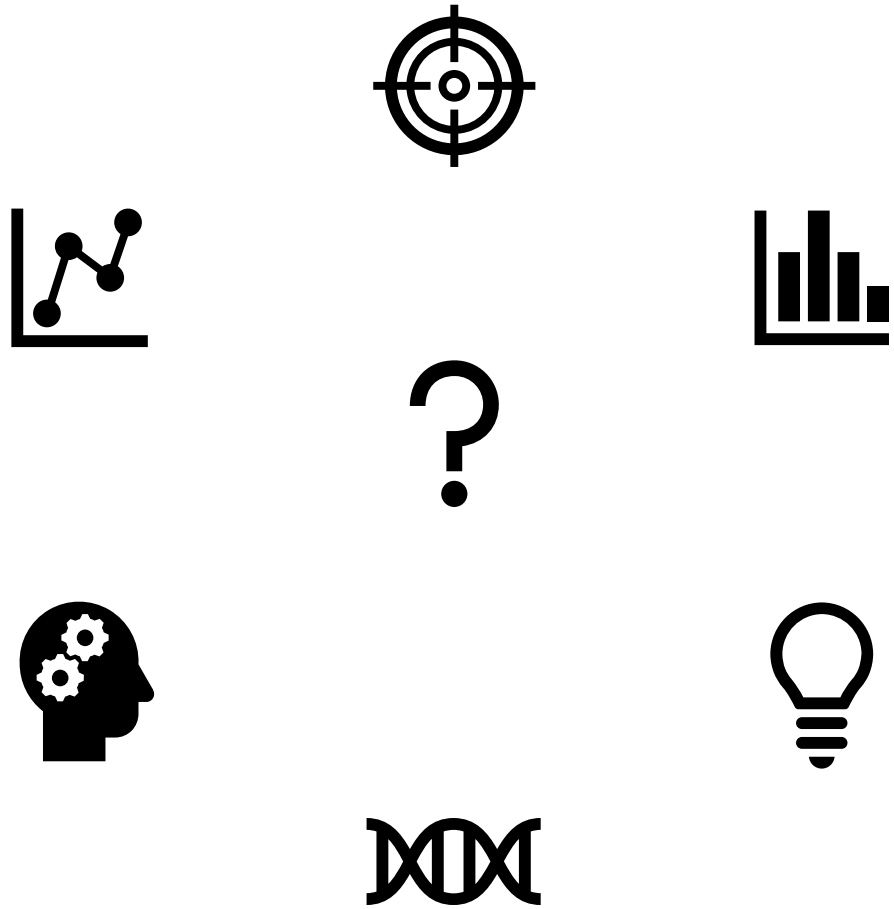
- Six significant increases, two significant decreases

Textbox 9.1

Textbox 9.1

Antimicrobial resistance in clinical isolates from dogs and cats

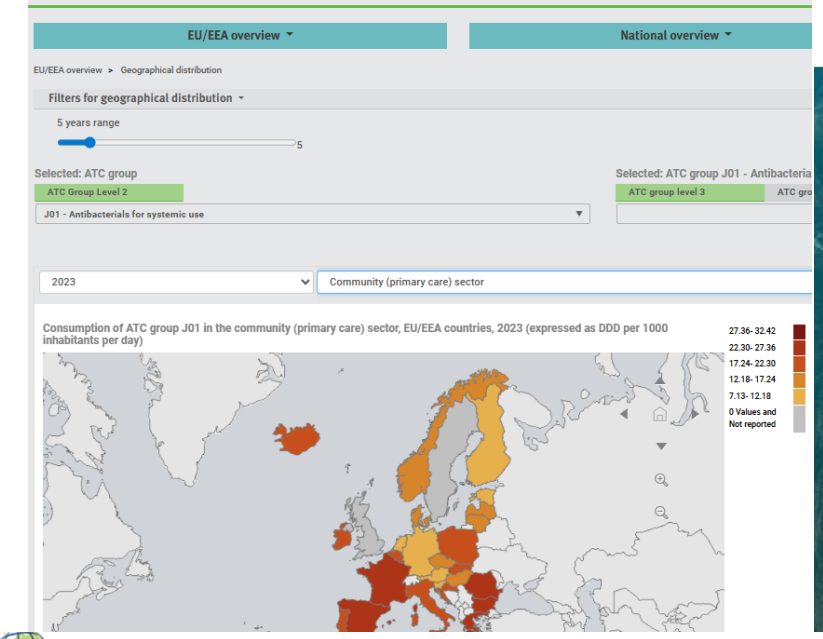
Questions and comments

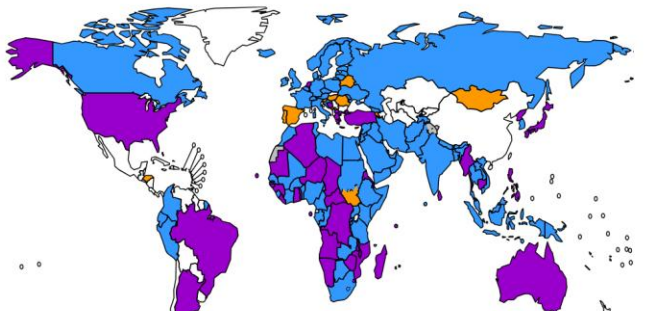


International surveillance

DANMAP

European Centre for Disease Prevention and Control
Latest surveillance data on antimicrobial consumption

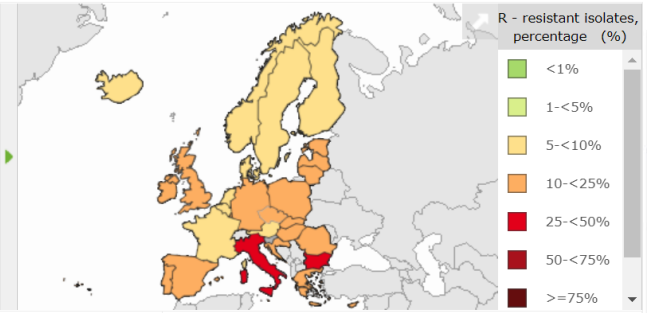




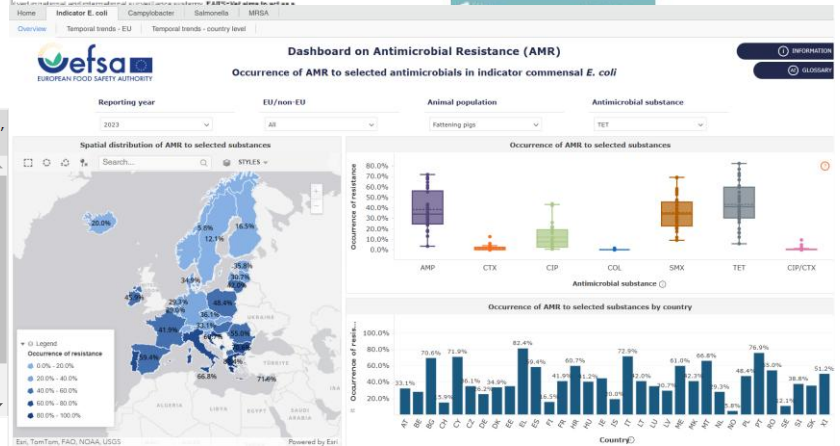
Surveillance Atlas of Infectious Diseases

Antimicrobial resistance
Escherichia coli
Third-generation cephalosporins
R - resistant isolates, percentage
2019

Region	R - resistant isolates, percentage (%)
Austria	9.3
Belgium	10.0
Bulgaria	38.6
Croatia	15.9
Cyprus	20.7
Czechia	15.9
Denmark	7.5
Estonia	11.5



R - resistant isolates proportion, by age
Bar



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SCIENCE MEDICINES HEALTH

← Antimicrobial resistance in veterinary medicine

European Sales and Use of Antimicrobials for Veterinary Medicine (ESUAvet) annual surveillance reports

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DANMAP Seminar 2025

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