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Monitoring antimicrobial consumption in animals across Europe and its link to resistance (the JIACRA project)

Zoltan Kunsagi - European Medicines Agency (EMA)

WOAH - Regional workshop on the interpretation of AMU / AMR data to improve evidence-based decision making in Asia and the Pacific

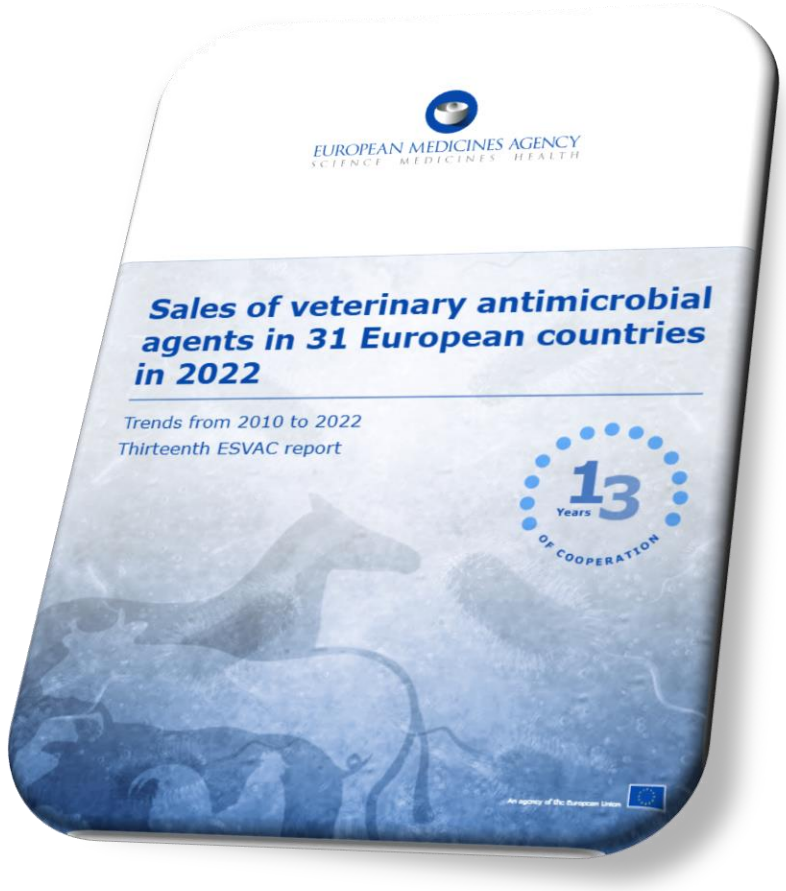
18-19 November 2025

Why do we need to collect antimicrobial consumption data?

- **understand how** antimicrobials are used in animals
- make data-driven **recommendations to improve** antimicrobial use
- **evaluate** how recommendations and strategies work in practice
- **help interpret** antimicrobial resistance results

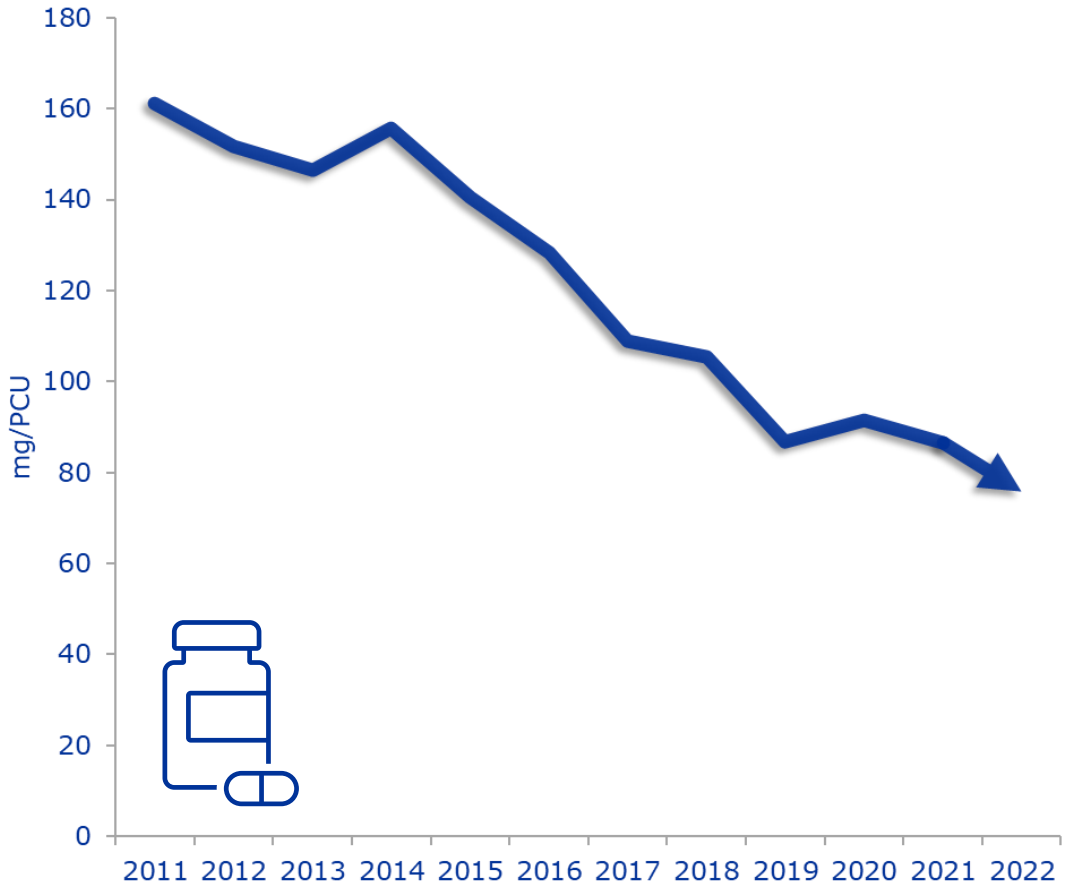
European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project: 2009-2023

Voluntary reporting of veterinary antibiotics sales data



ESVAC project: 2009-2023

53% overall sales decrease 2011-2022

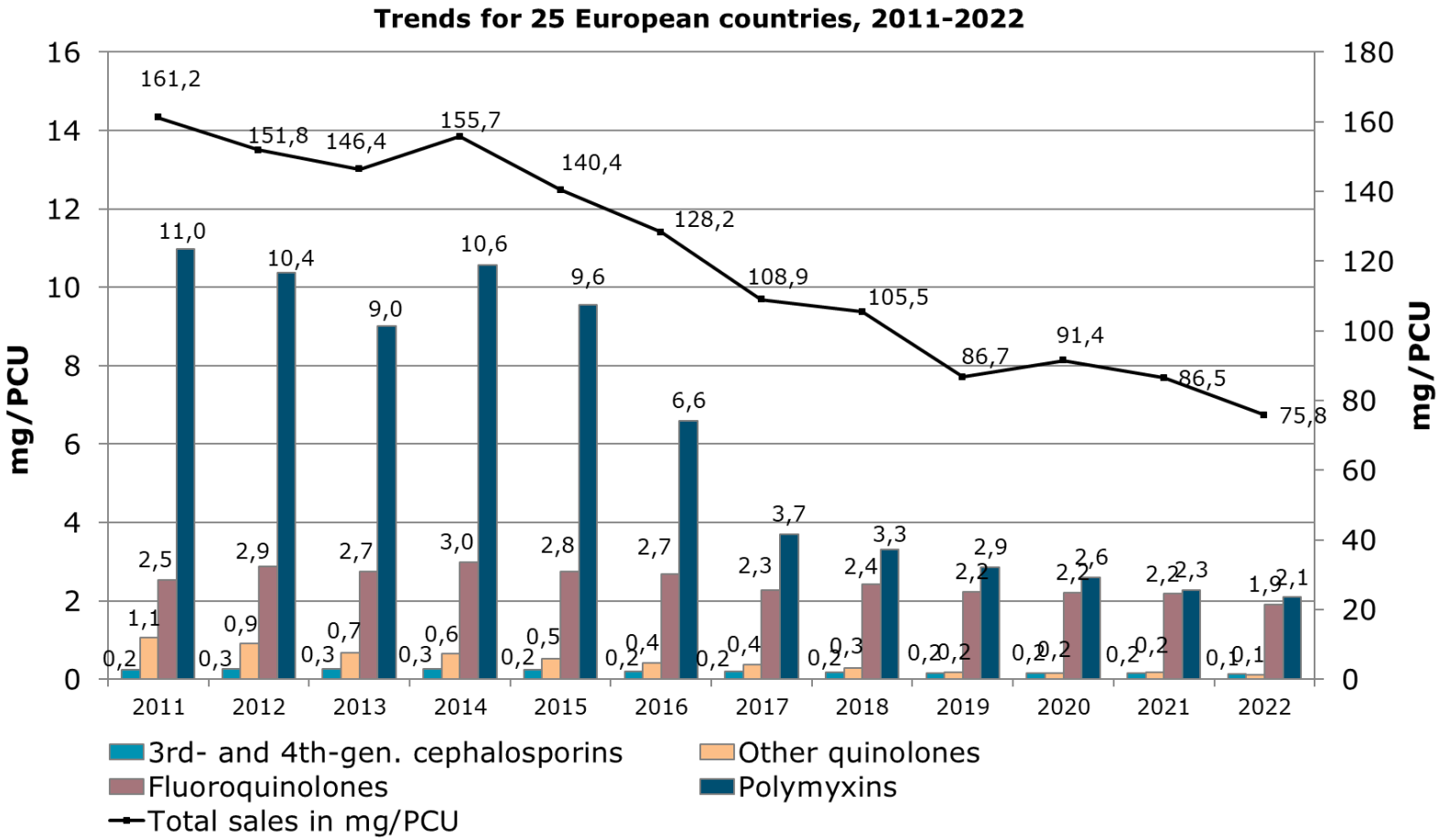


Aggregated sales for 25 European countries (mg/PCU)

ESVAC project: 2009-2023

Decrease:

↓ **49%** for **3rd- and 4th-gen. cephalosporins**
↓ **25%** for fluoroquinolones
↓ **90%** for other quinolones
↓ **81%** for **polymyxins**



Before 2023: ESVAC

From 2024: ESUAvet

New regulation including:

- ❑ ***Mandatory*** *collection of sales and use*
- ❑ ***Mandatory*** *reporting of the data to EMA*
- ❑ ***Use of UPD product data***
- ❑ ***ASU Platform*** *&* ***Power BI app.***

Challenges at National level:

- ❑ *Implementation of a* ***new system*** *for use data*

Challenges at European level:

- ❑ *Use of the* ***new ASU platform***

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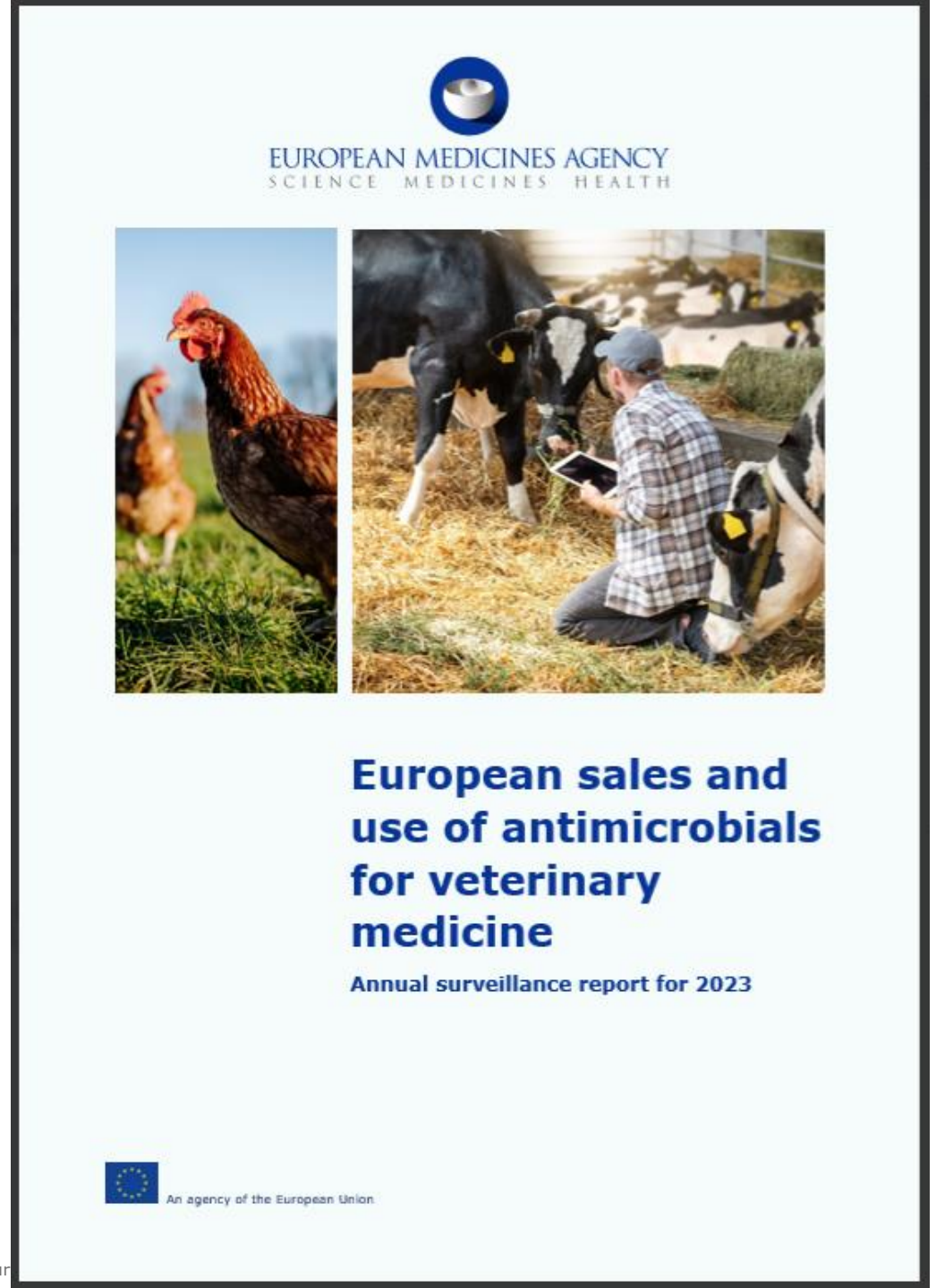
The first ESUAvet report with 2023 data is now published

Mandatory reporting of veterinary antibiotics sales and use data



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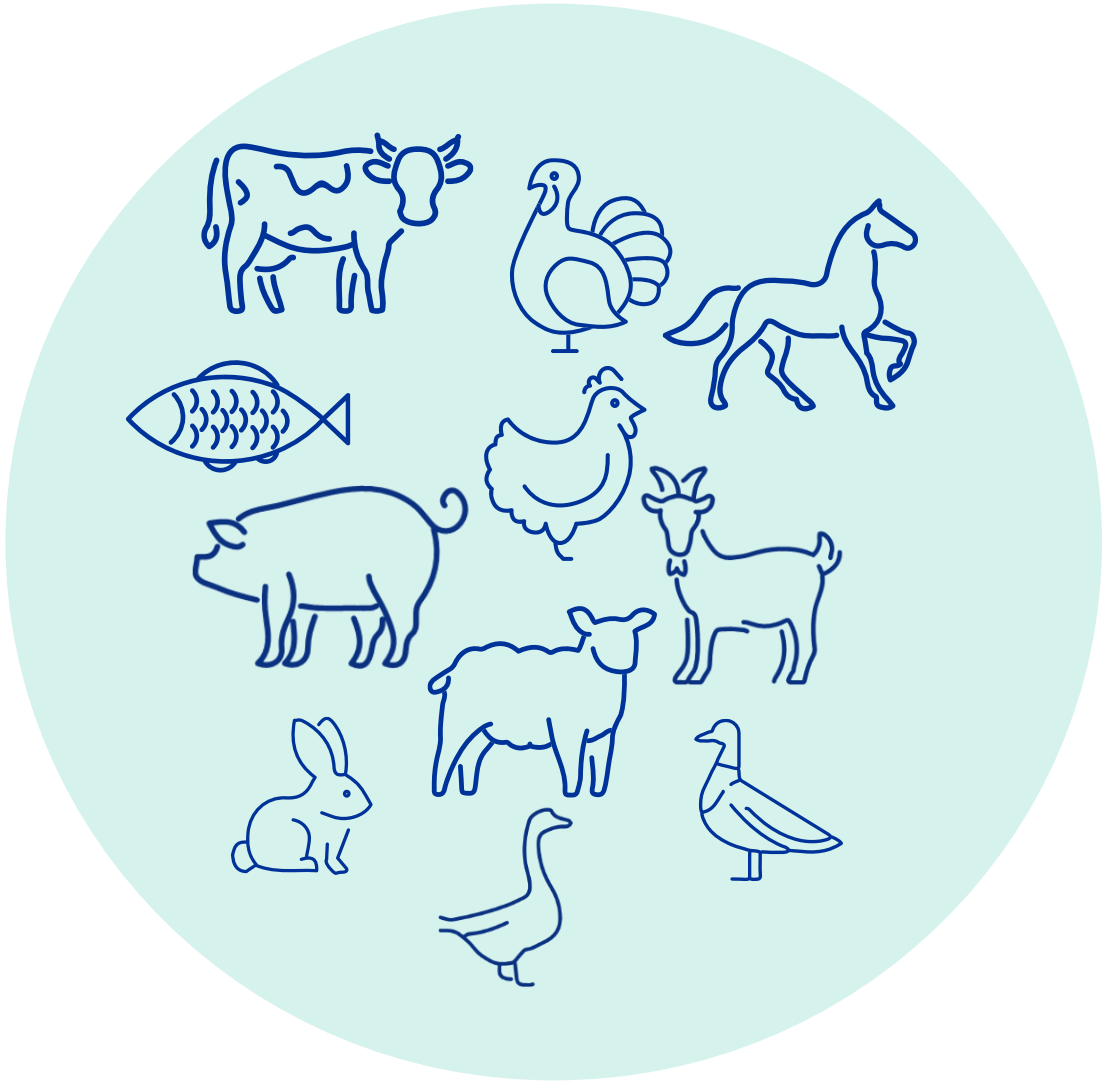
ESUAvet report:

Part 1: Sales data

Sales of antimicrobial VMPs for food-producing animals (mandatory scope)



Tonnes sold, proportion of tonnes sold and mg (antimicrobial active substance)/kg (animal biomass)

By product form and by antimicrobial class.

Sales of AMEG categories B, C and D.

Sales of 3rd- and 4th-generation cephalosporins, fluoroquinolones, other quinolones, and polymyxins (AMEG B).

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Sales of antimicrobials for food-producing animals in 2023 (mandatory scope)

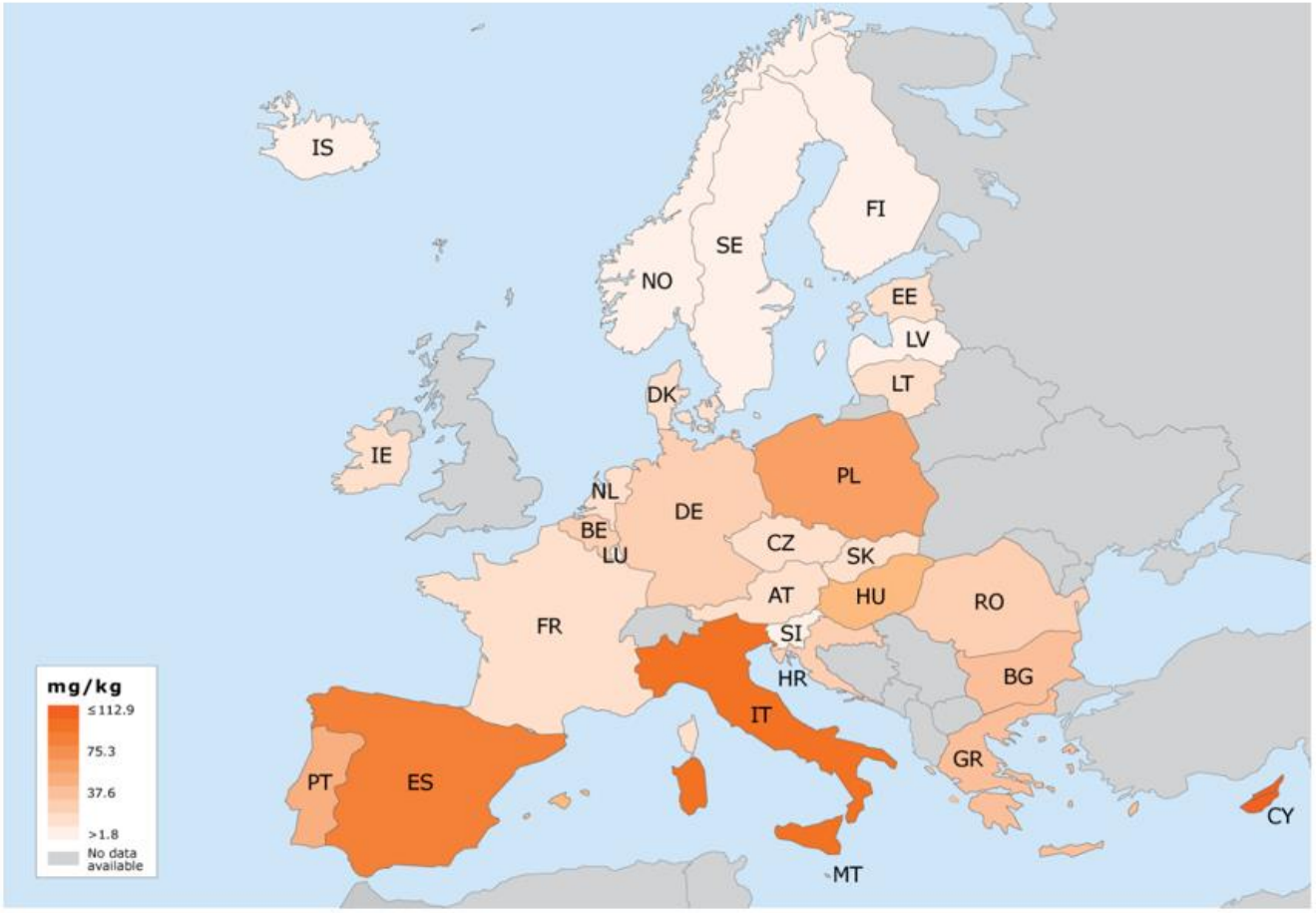
EU average: 45.1 mg/kg

Across European countries:1.8 mg/kg to 112.9 mg/kg

ESUAvet mandatory sales

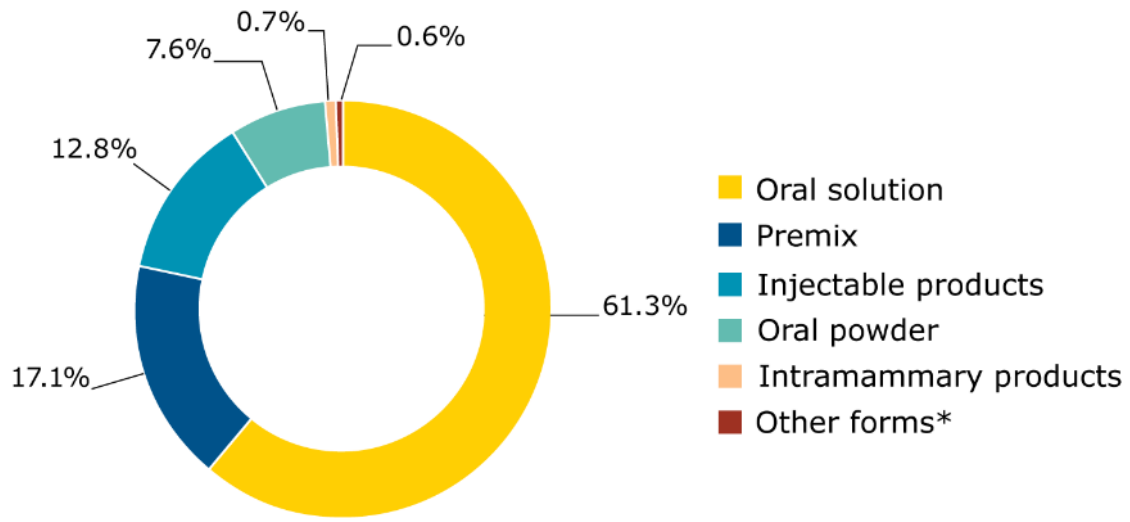
Note: Not to be compared against ESVAC maps. Although the ESUAvet mandatory data covers the same ATCvet codes as for ESVAC during the period 2010-2022, the ESUAvet and ESVAC normalised sales indicators are different (explained in Annex 5).

Figure 3. Sales of antimicrobial VMPs for food-producing animals (mg/kg) in the EU, IS and NO, in 2023[1,2]



Sales of antimicrobial for food-producing animals in 2023 (mandatory scope)

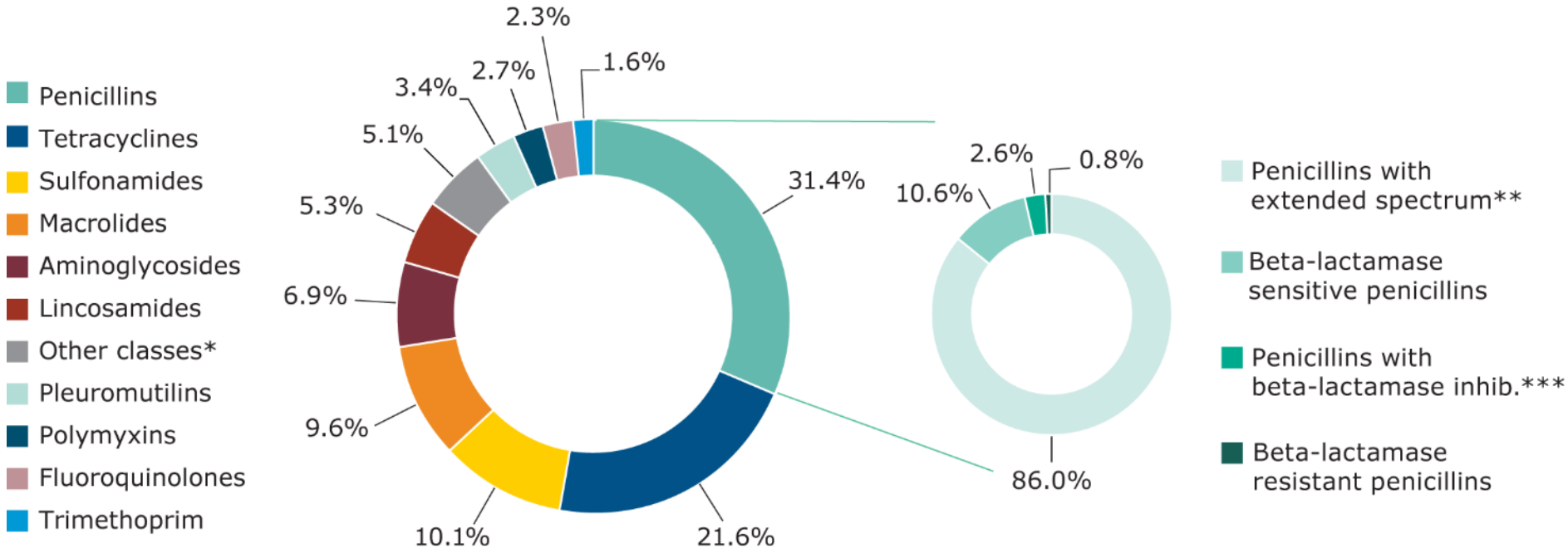
Figure 5. Proportion of sales of antimicrobial VMPs for food-producing animals by product form in the EU in 2023[1]



86% of all antimicrobials sold for use in food-producing animals were oral powders, oral solutions and premix.

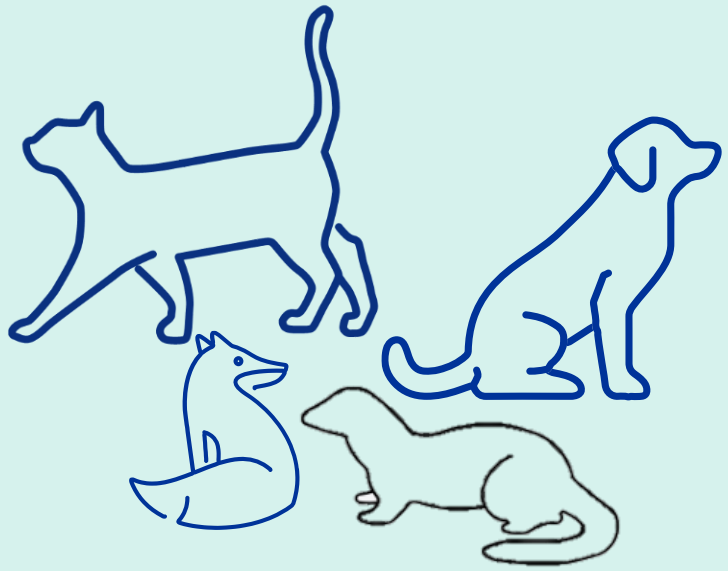
Sales of antimicrobial for food-producing animals in 2023 (mandatory scope)

Figure 6. Proportion of sales of antimicrobial VMPs for food-producing animals by antimicrobial class in the EU in 2023[1]



Three main classes account for more than 60% of antibacterial sales for food-producing animals: penicillins, tetracyclines and sulfonamides.

Sales of antimicrobial VMPs for other animals kept or bred (mandatory scope)



dogs, cats, fur animals (minks and foxes)

Tonnes sold, proportion of tonnes sold and mg (antimicrobial active substance)/kg (animal biomass)

By product form and by antimicrobial class.

Sales of AMEG categories B, C and D.

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Sales of antimicrobial for other animals kept or bred in 2023 (mandatory scope)

1.6% total tonnes sold under mandatory scope reported in 2023 (68.3 tonnes)

TOP Product form

- **90%** tablets
- **4.2%** premix
- **2.9%** oral solutions

TOP Antimicrobial class

- **50% penicillins** (of which app. 90% were sales of penicillins in combination with beta-lactamase inhibitors).
- **17% 1st- and 2nd-generation cephalosporins**
- **11% imidazole derivatives**

ESUAvet report:

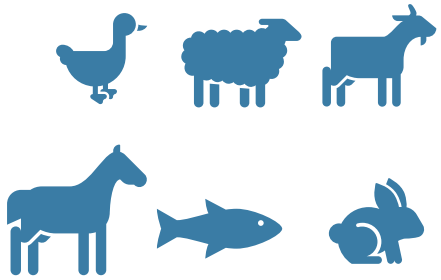
Part 2: Use data*

** For the first time!*

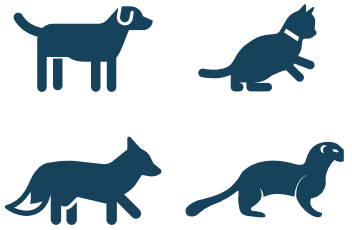
Timelines for the stepwise scaling up of use data collection and reporting

2025

2027



2030



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The second ESUAvet report with 2024 data will be published next month!

Why do we need to collect antimicrobial consumption data?

- **understand how** antimicrobials are used in animals
- make data-driven **recommendations to improve** antimicrobial use
- **evaluate** how recommendations and strategies work in practice
- **help interpret** antimicrobial resistance results

Joint inter-agency antimicrobial consumption and resistance analysis (JIACRA)

ecdc EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

efsa European Food Safety Authority

EUROPEAN MEDICINES AGENCY SCIENCE MEDICINES HEALTH

2015 (2011-2012)

2017 (2013-2015)

2021 (2016-2018)

2024 (2019-2021)

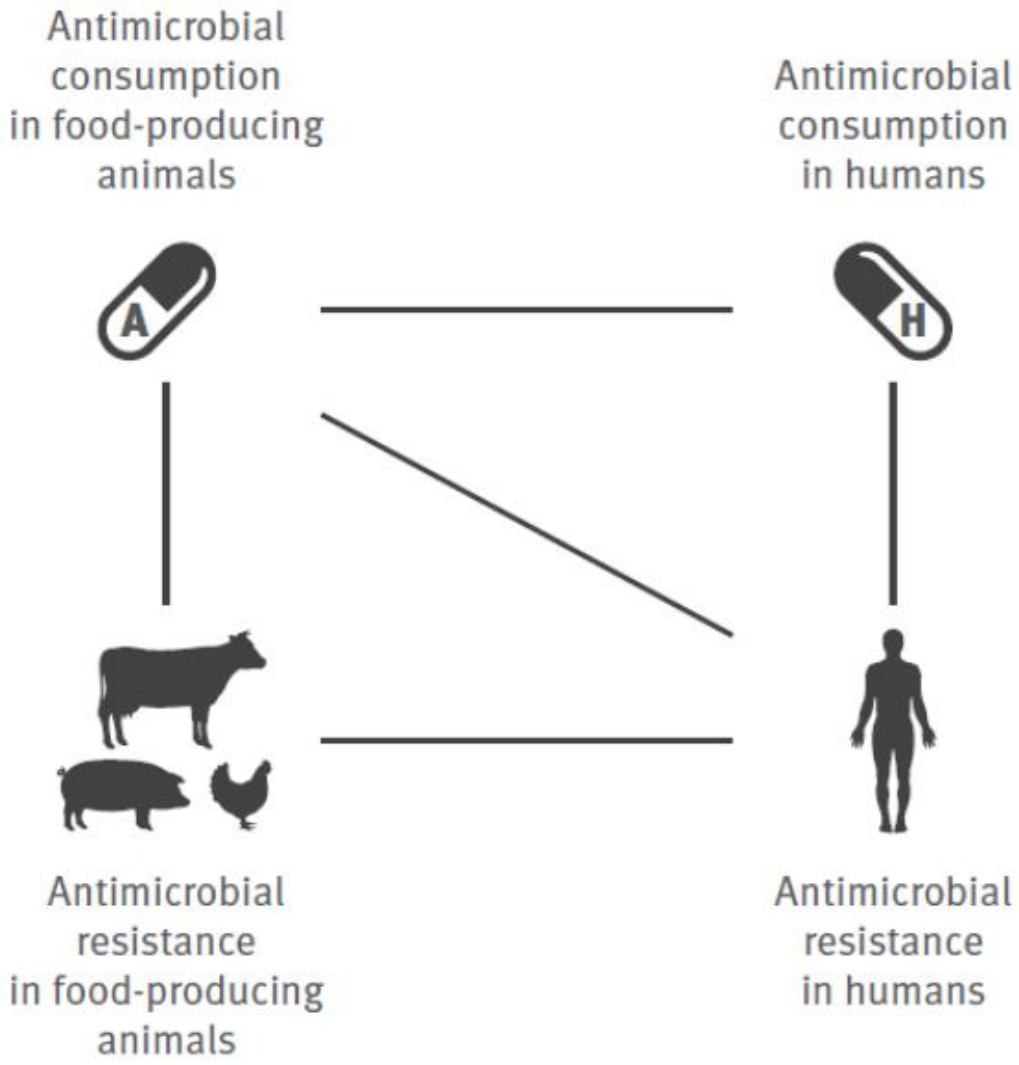
2026

Introduction

The 4th report was published in 2024.

It presents results of analysis to assess the **relationship between AMC and AMR** in food-producing animals and humans.

Conclusions and recommendations based on results in a **One-Health perspective.**



Data source

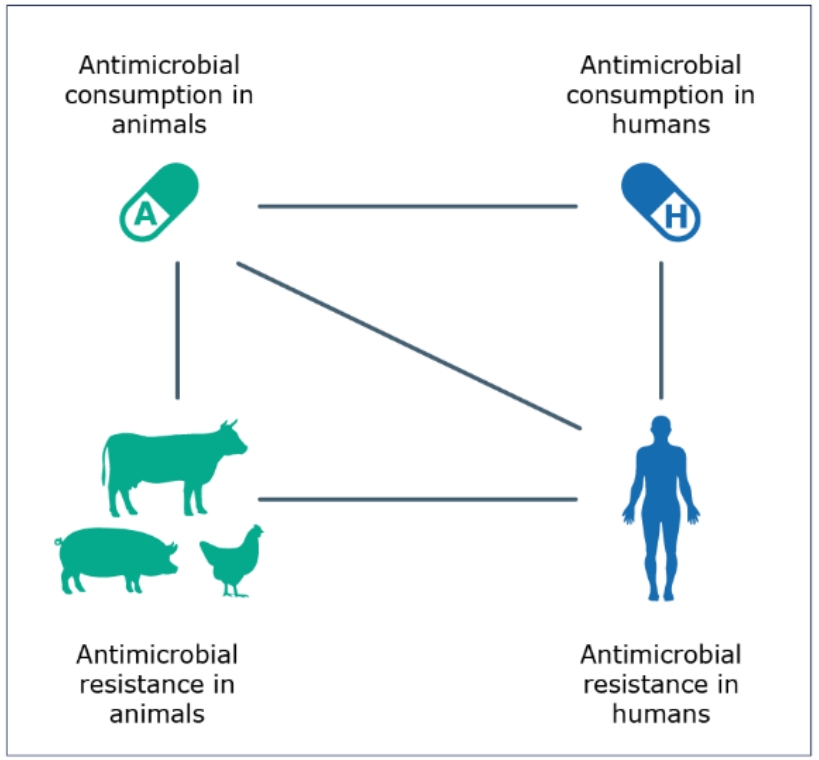
EUROPEAN MEDICINES AGENCY
SCIENCE MEDICINES HEALTH

European Surveillance of Veterinary Antimicrobial Consumption (**ESVAC**)

efsa
European Food Safety Authority

Network on Zoonoses Data Collection

EU Summary Report on AMR in zoonotic and indicator bacteria from humans, animals and food



European Surveillance of Antimicrobial Consumption Network (**ESAC-Net**)

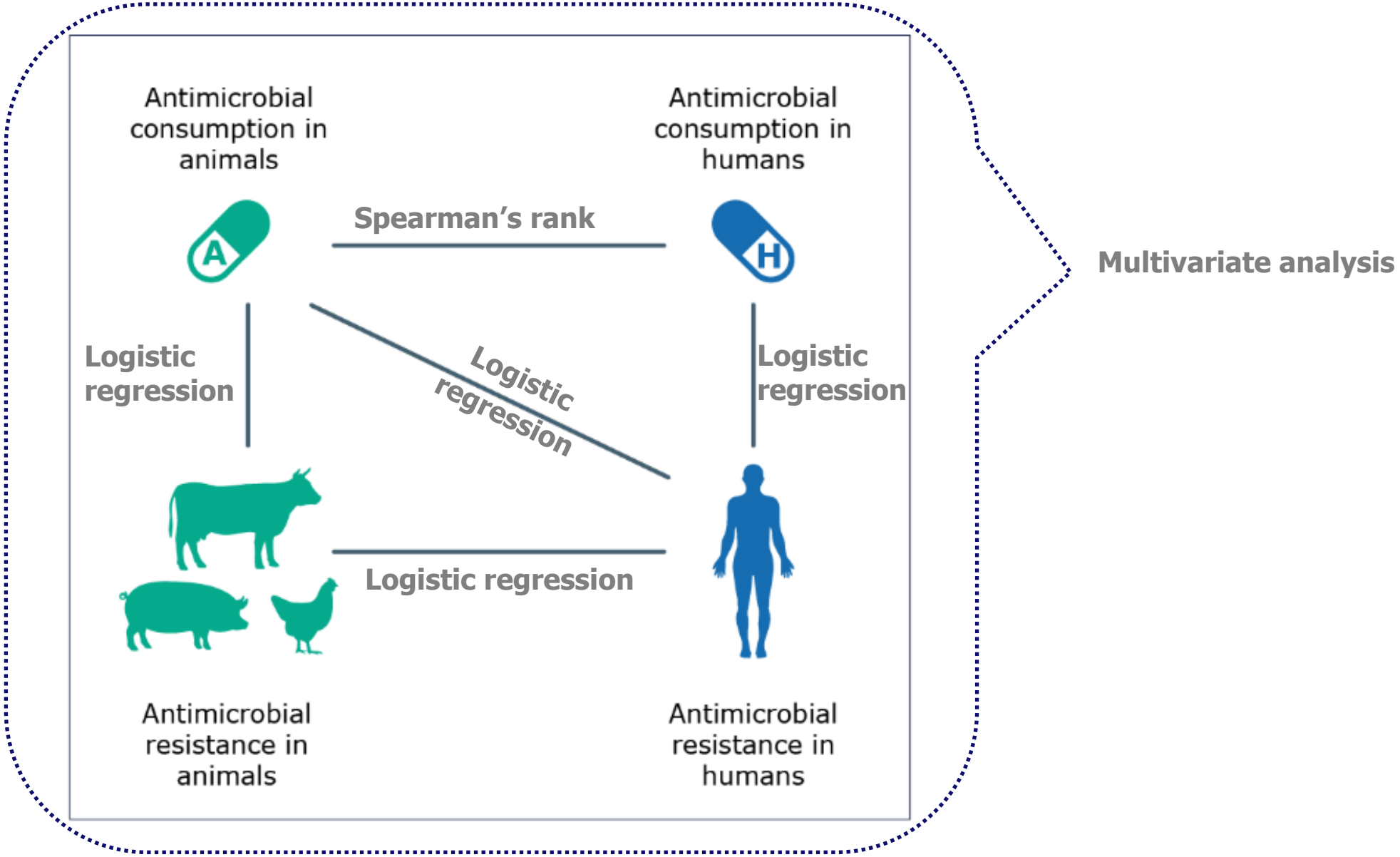
ecdc
EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

European Antimicrobial Resistance Surveillance Network (**EARS-Net**)

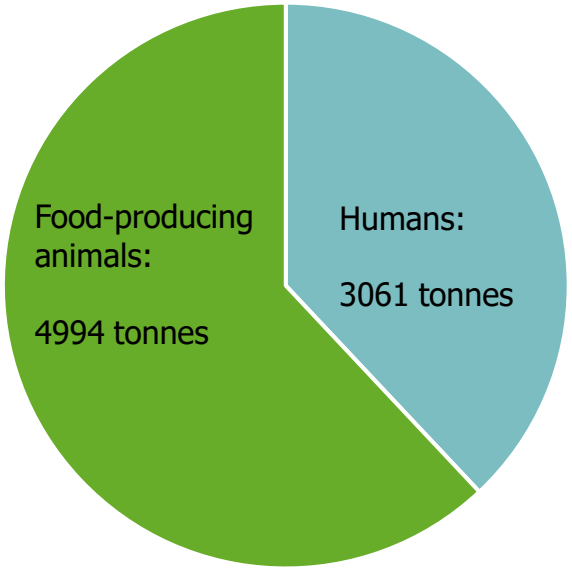
Food- and Water-borne Disease Network (**FWD-Net**)

Years: 2019, 2020 and 2021

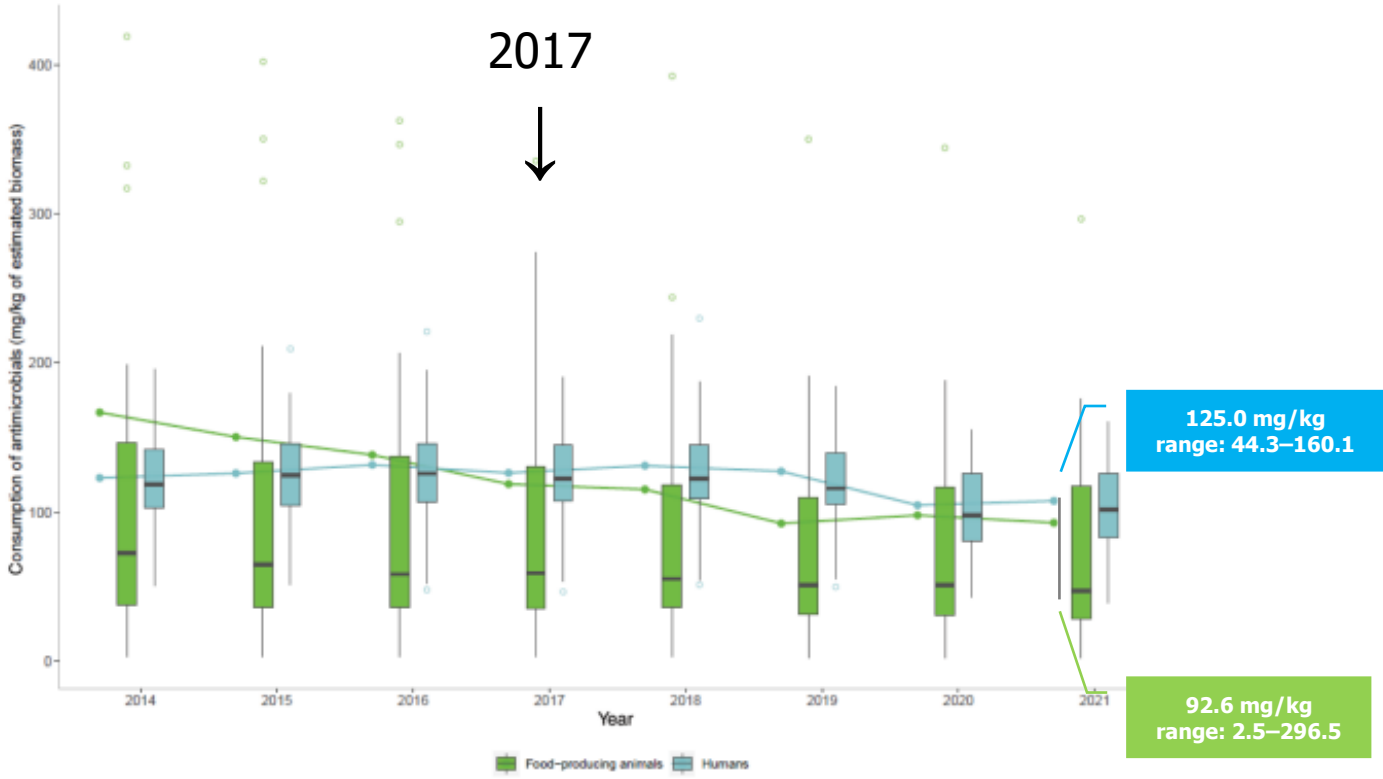
Analysis of possible associations



Antimicrobial consumption in humans and food-producing animals



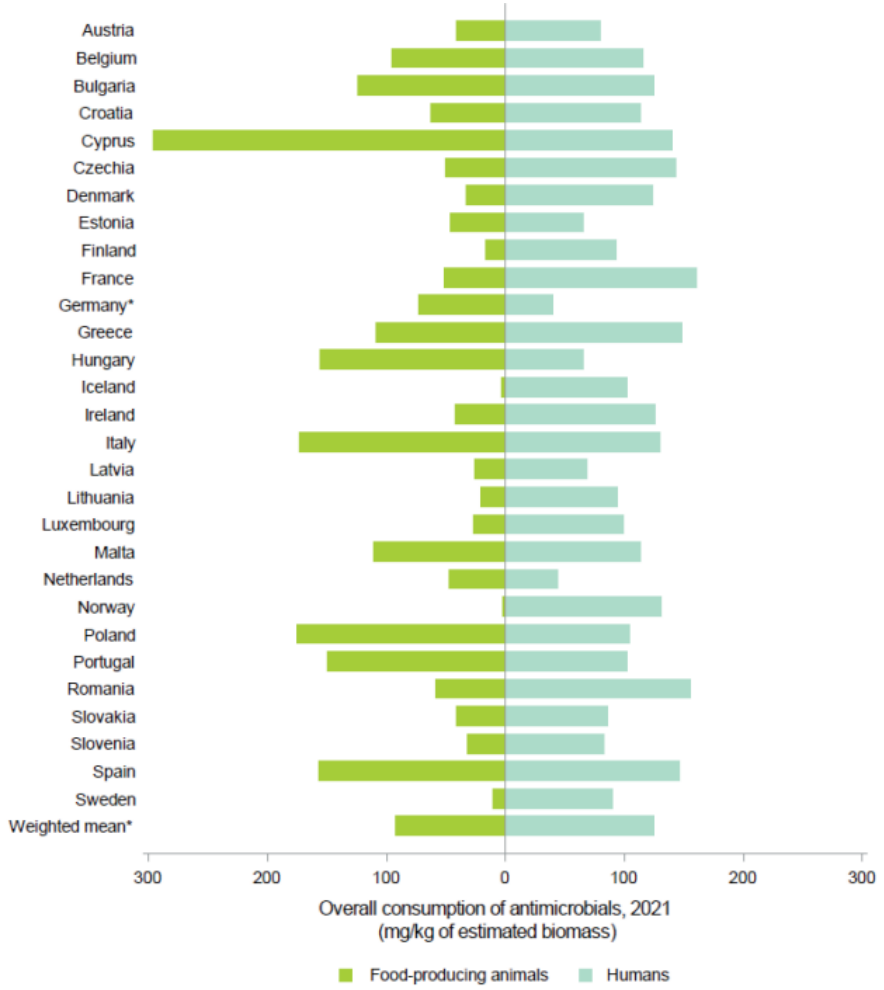
Total tonnes of the total consumption of antimicrobials in humans and food-producing animals in 28 EU/EEA countries for which data were available both for humans and food-producing animals, 2021.



Population-weighted mean of the total consumption of antimicrobials in humans and food-producing animals in 26 EU/EEA countries for which data were available both for humans and food-producing animals, mg per kg of estimated biomass, 2014–2021.

The levels of consumption should be compared with caution between humans and animals, as there are several limitations inherent to the characteristics of the data collected and the measurements used (see JIACRA IV for details).

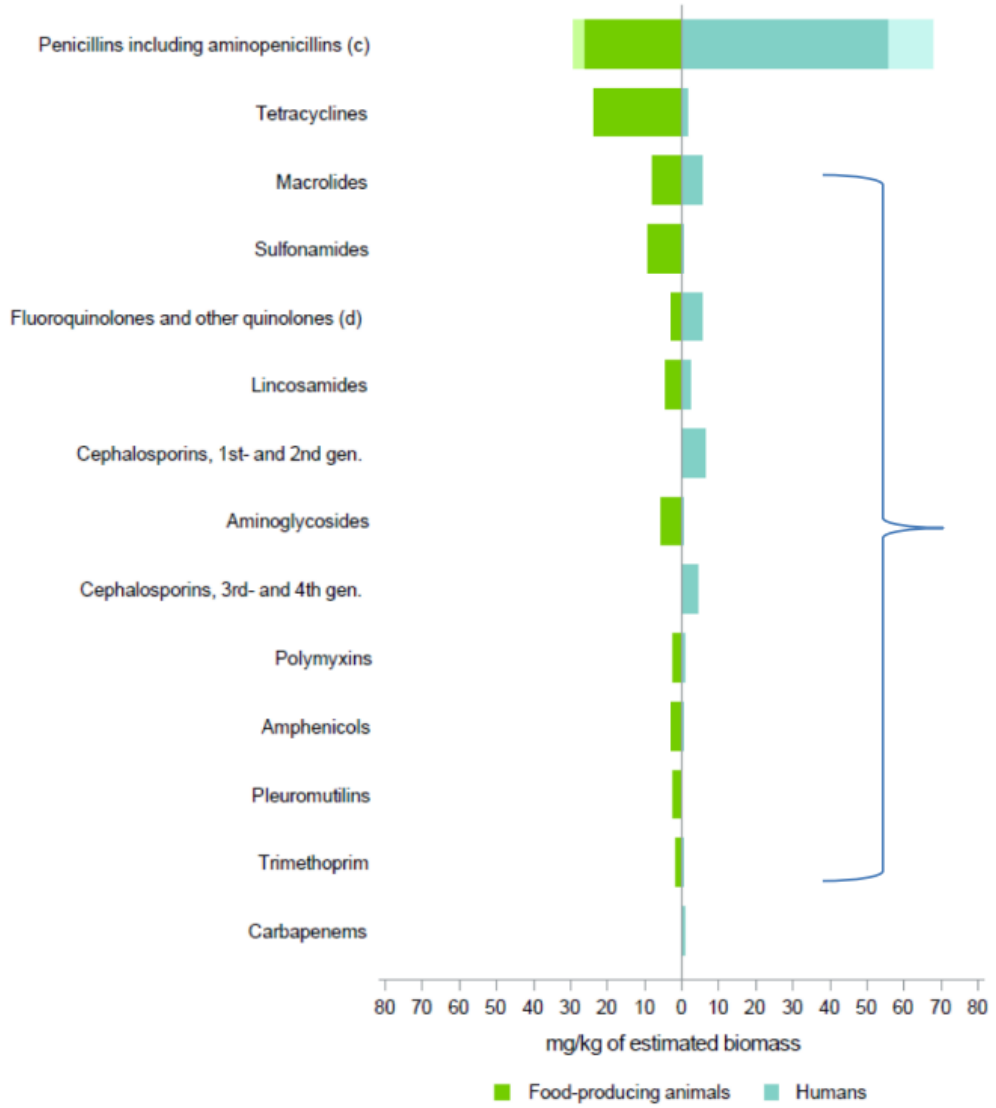
Population biomass-corrected consumption in humans and food-producing animals by country, 2021.

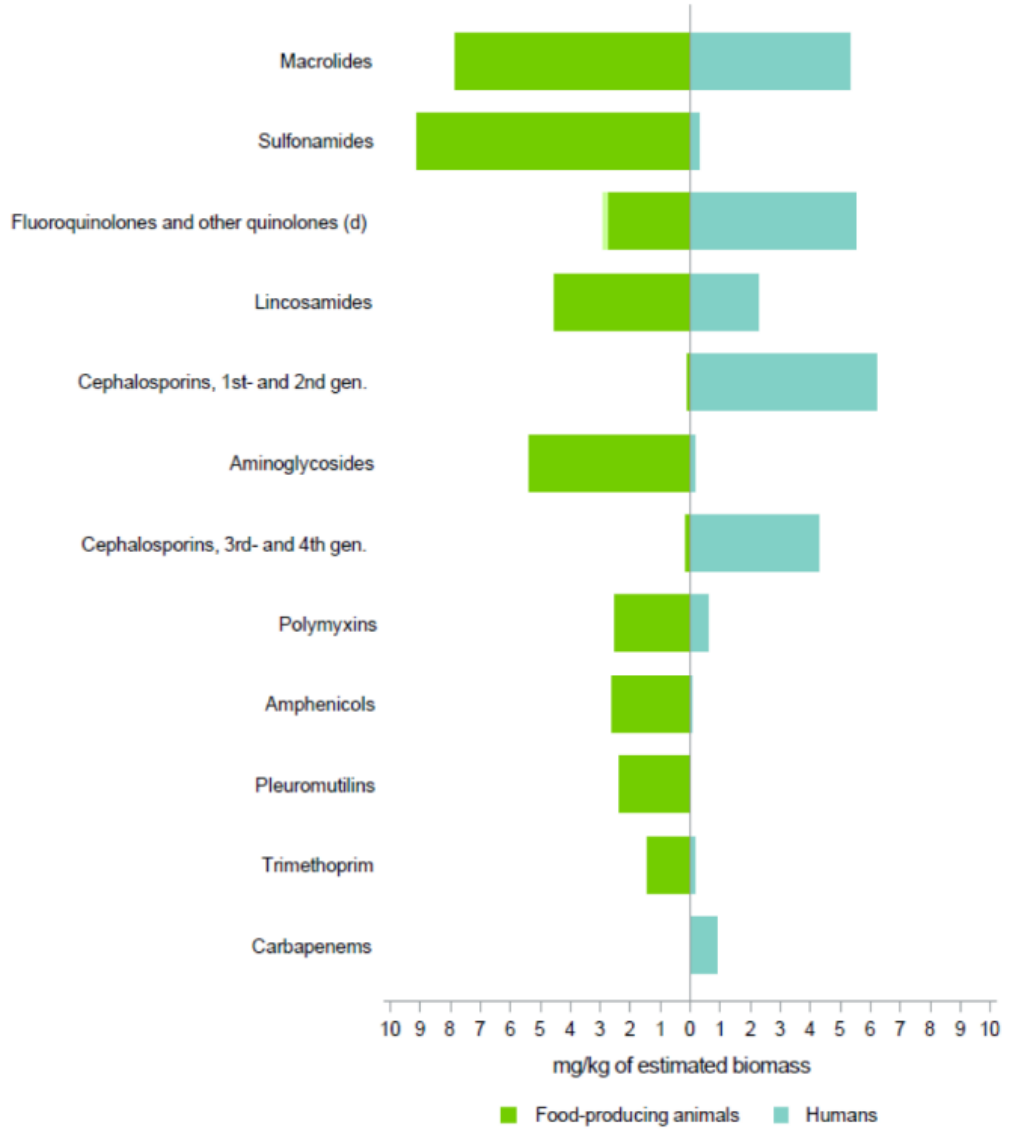


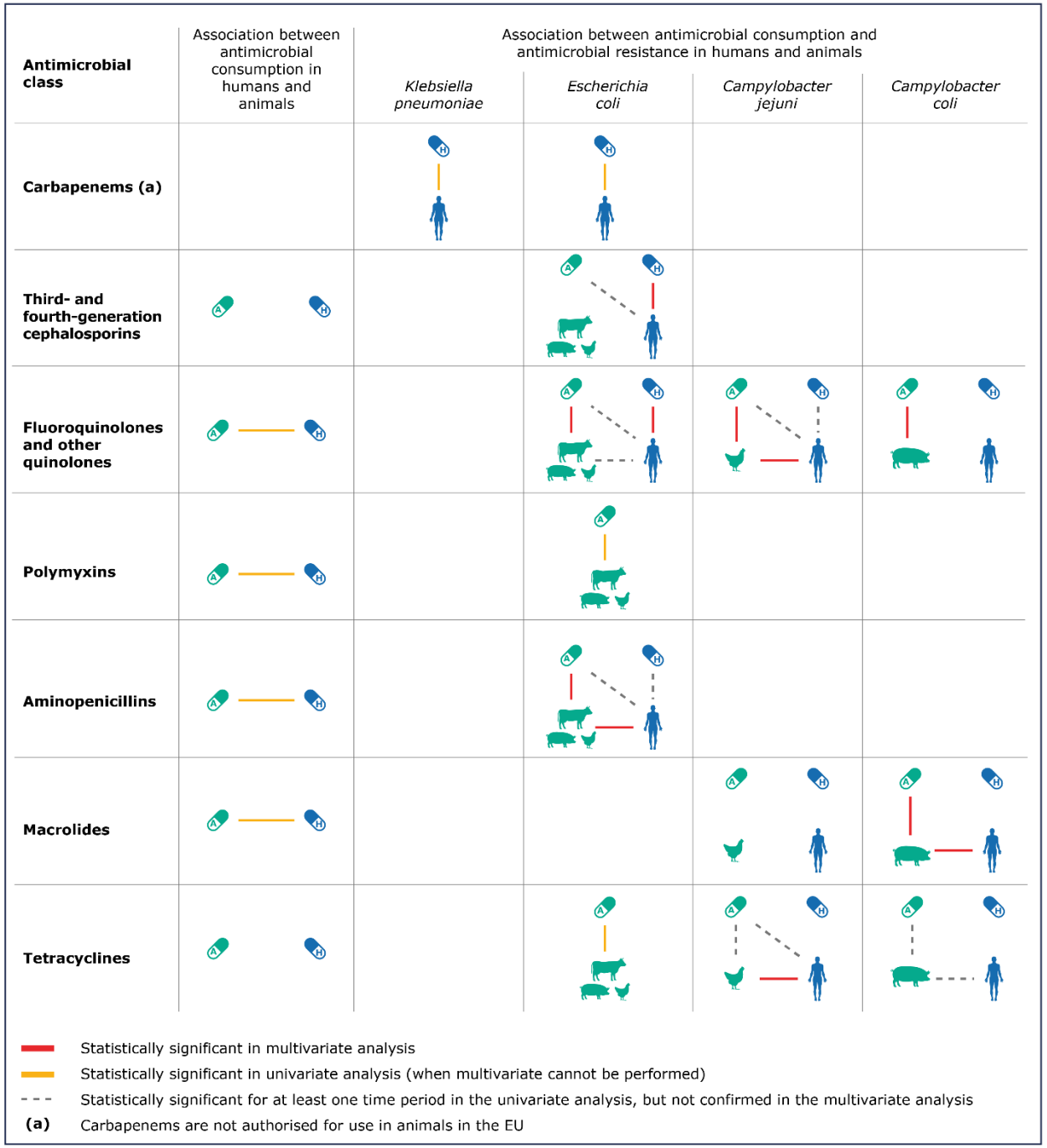
- Greater variation among food- producing animals AMC (2.5-296.5 mg/kg biomass) compared to human AMC (44.3-160.1 mg/kg biomass).
- There was no significant association between the total antimicrobial consumption in humans and food-producing animals within country.

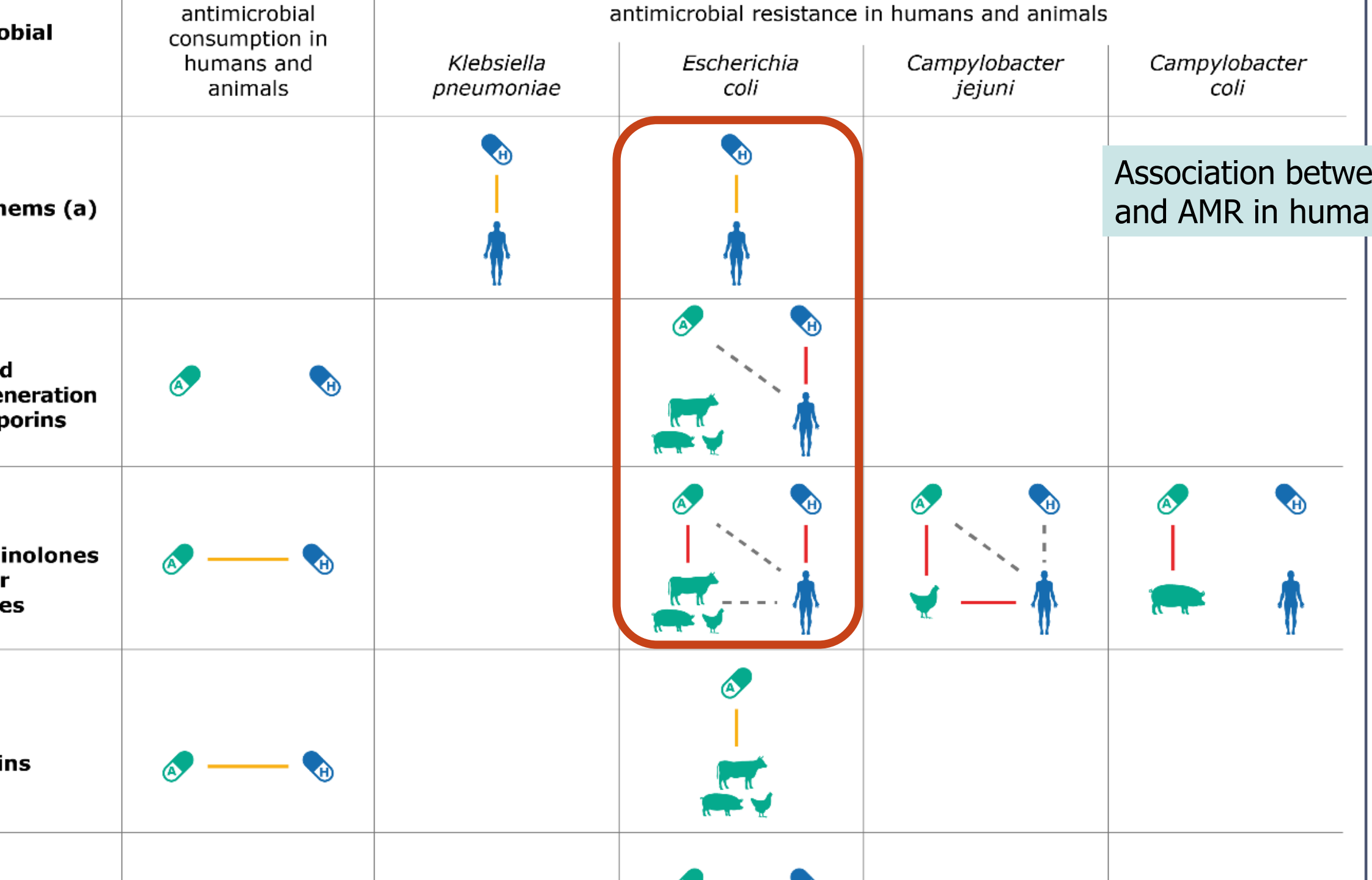
Analyses restricted to 29 EU/EEA countries for which data were available both for humans and food-producing animals. An asterisk (*) denotes that only community consumption was provided for human medicine. The weighted mean represents the population-weighted mean of data from included countries providing total consumption (community and hospital sectors combined).
The levels of consumption should be compared with caution between humans and animals, as there are several limitations inherent to the characteristics of the data collected and the measurements used (see JIACRA IV for details).

Comparison of consumption of antimicrobial classes in humans and animals






Antimicrobial class
Association between antimicrobial consumption in humans and animals
Association between antimicrobial consumption and antimicrobial resistance in humans and animals
Klebsiella pneumoniae
Escherichia coli
Campylobacter jejuni
Campylobacter coli
Carbapenems (a)
Third- and fourth-generation cephalosporins
Fluoroquinolones and other quinolones
Polymyxins
Aminopenicillins
Macrolides
Tetracyclines
Statistically significant in multivariate analysis
Statistically significant in univariate analysis (when multivariate cannot be performed)
Statistically significant for at least one time period in the univariate analysis, but not confirmed in the multivariate analysis
(a) Carbapenems are not authorised for use in animals in the EU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antimicrobial consumption in humans and animals
antimicrobial resistance in humans and animals
Klebsiella pneumoniae
Escherichia coli
Campylobacter jejuni
Campylobacter coli
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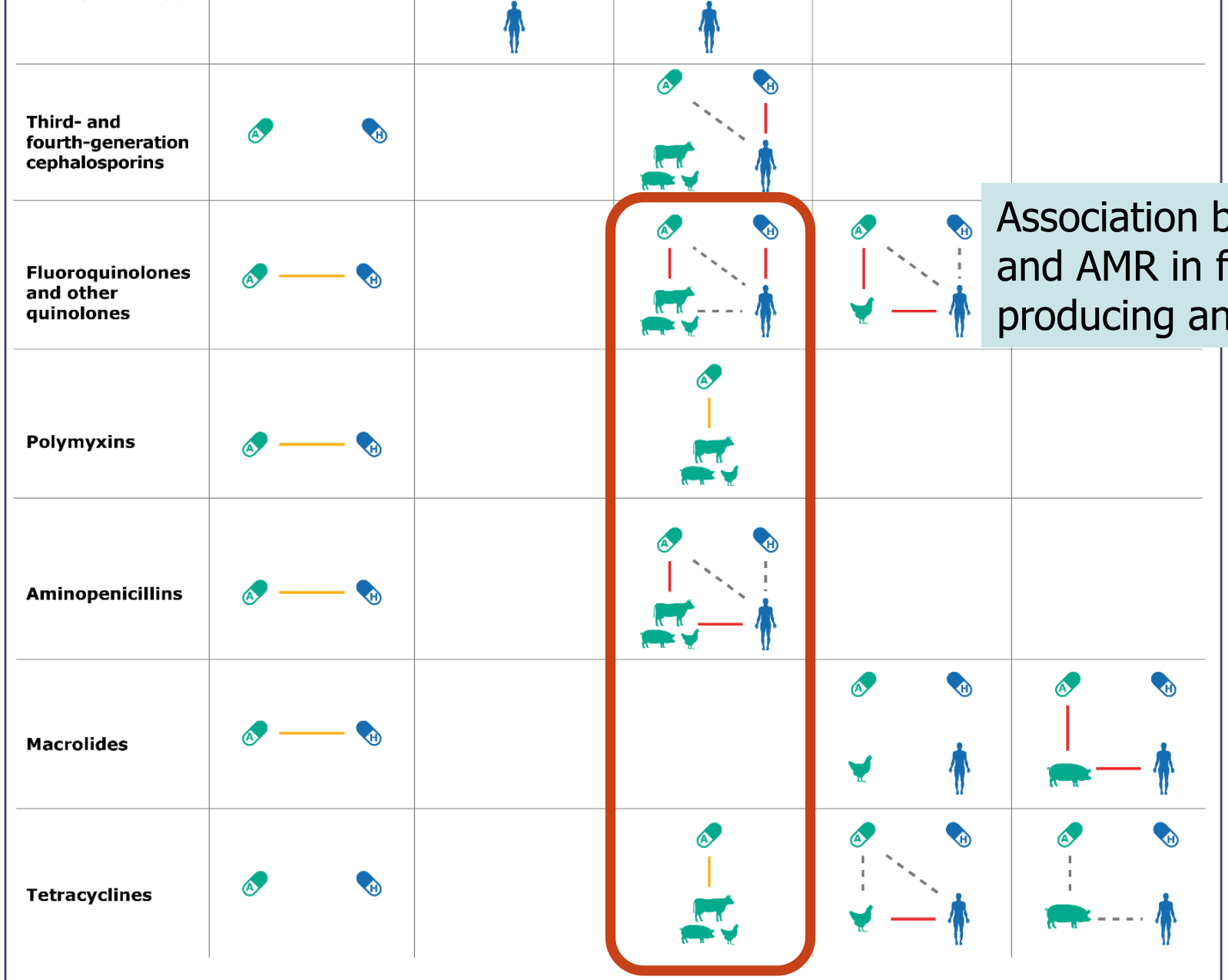
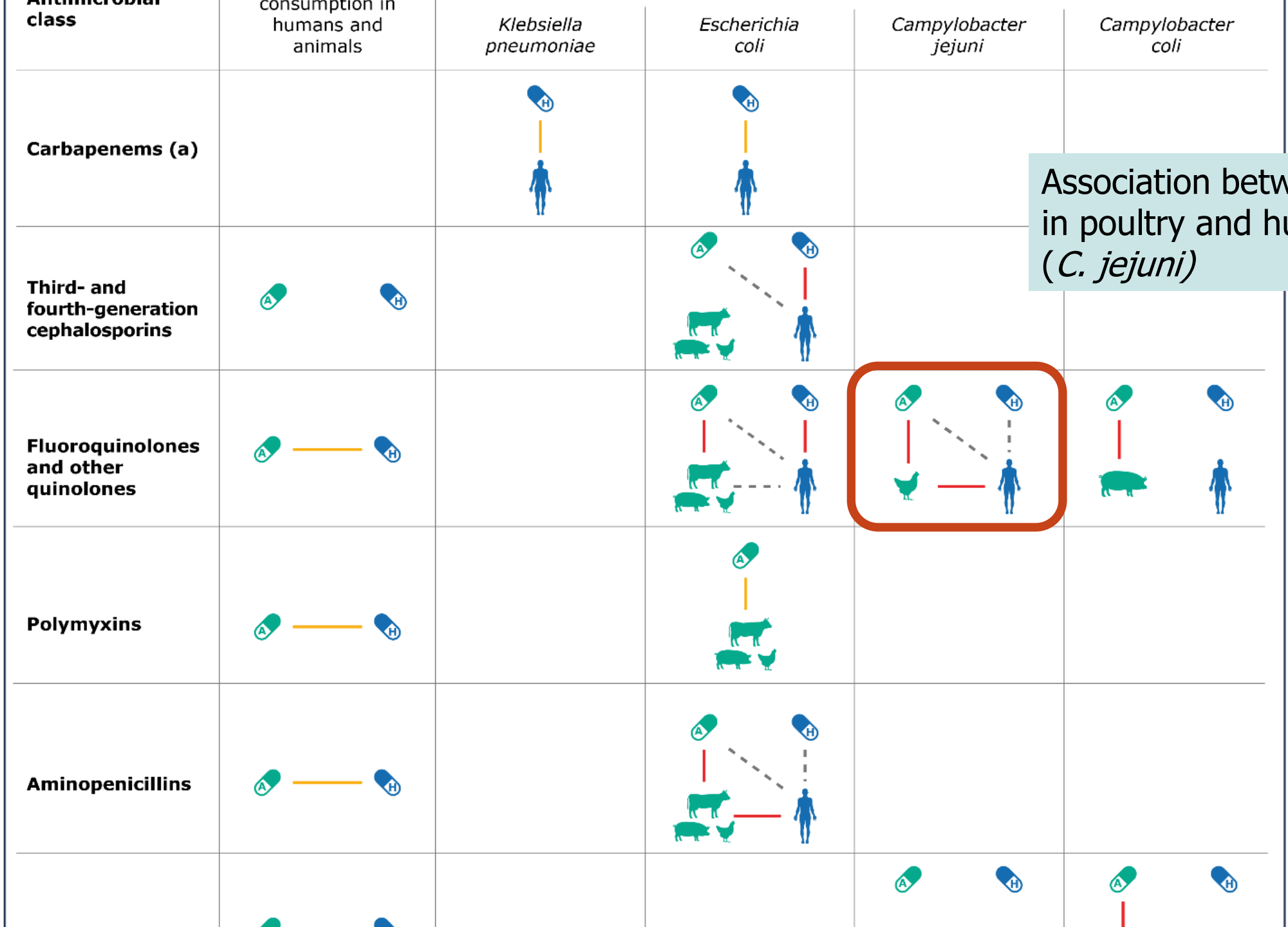
Association between AMC and AMR in humans (E. coli)

Association between AMC and AMR in food-producing animals (*E. coli*)




Antimicrobial class
consumption in humans and animals
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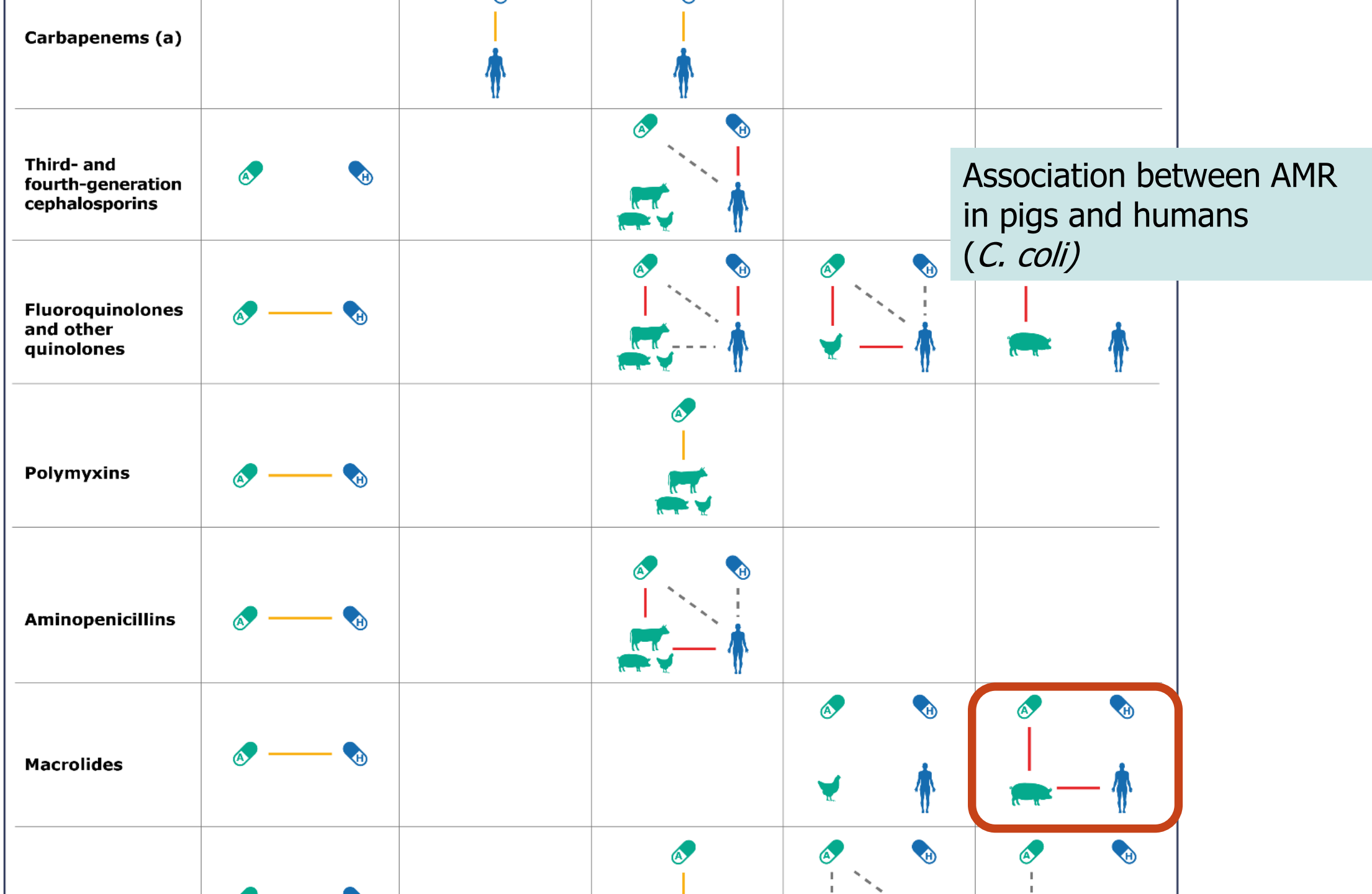
Campylobacter coli
Carbapenems (a)
Third- and fourth-generation cephalosporins
Fluoroquinolones and other quinolones
Polymyxins
Aminopenicillins
Association between AMR in poultry and humans (C. jejuni)


Carbapenems (a)
Third- and fourth-generation cephalosporins
Fluoroquinolones and other quinolones
Polymyxins
Aminopenicillins
Macrolides
Association between AMR in pigs and humans (C. coli)

Examples of univariate and multivariate analyses

Consumption of macrolides in pigs and the probability of resistance to macrolides in *Campylobacter coli* from slaughter pigs in 2021

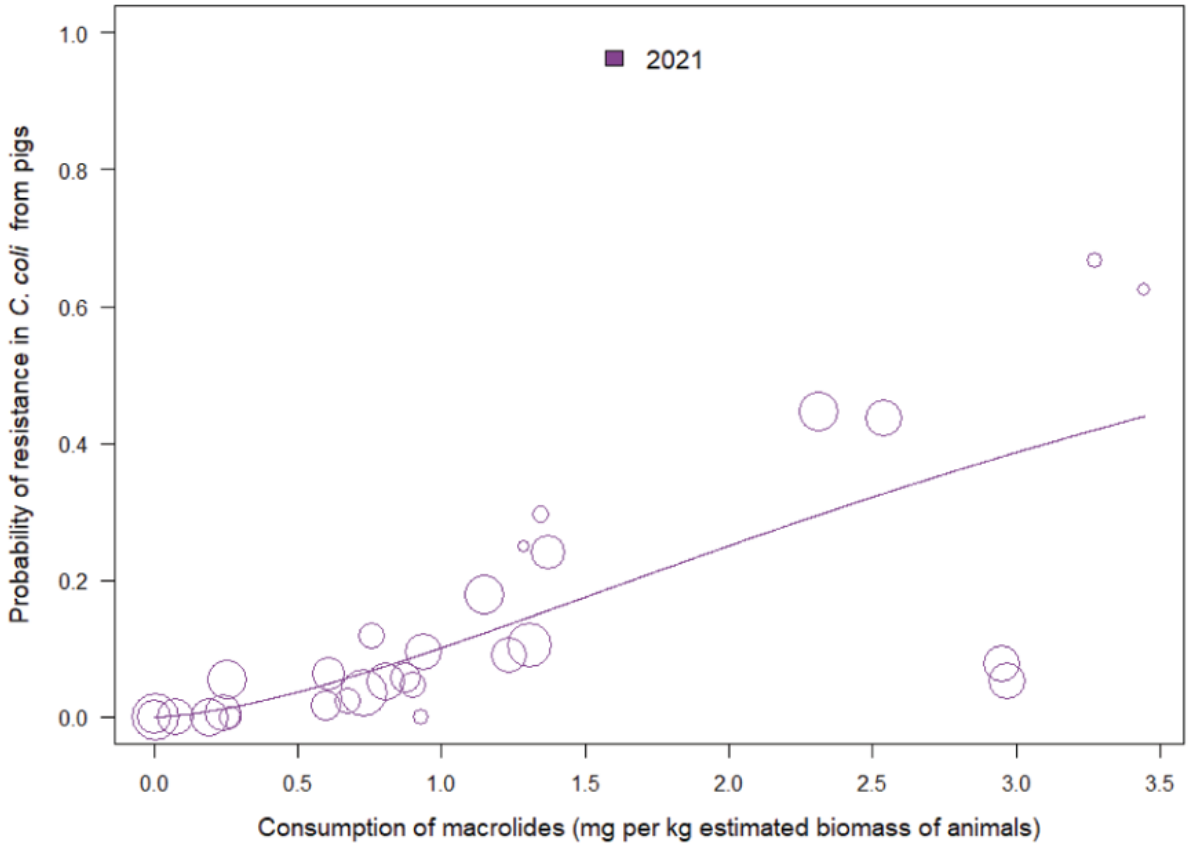
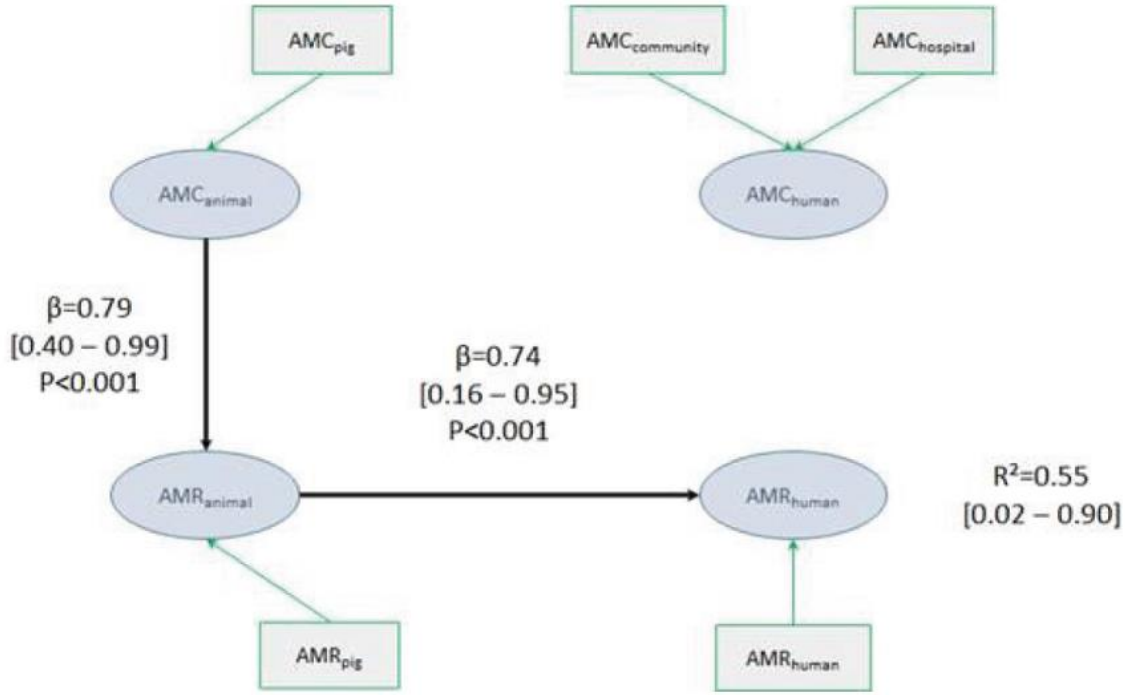


Diagram of the PLS- PM of resistance to macrolides in *Campylobacter coli* from humans (2021), considering resistance to macrolides in *C. coli* from food-producing animals, consumption of macrolides in humans and consumption of macrolides in pigs



Primary Key Indicators over 2014-2021

Key AMC Indicators

- Total consumption of antimicrobials in humans, expressed as defined daily doses (DDD) per 1,000 inhabitants and per day
- The overall sales of veterinary antimicrobials in milligram in food-producing animals in mg/PCU

Key AMR Indicators

- The proportion of *E. coli* from humans with **resistance** to **3rd-generation cephalosporins**
- The proportion of *Staphylococcus aureus* resistant to methicillin (**MRSA**) in humans
- The proportion of *E. coli* from food-producing animals with **complete** antimicrobial **susceptibility**

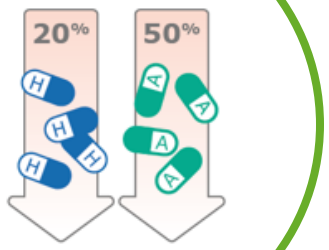
Country		Indicator	2014	2015	2016	2017	2018	2019	2020	2021
Austria	AMC	AMC Humans*						11.6	8.8	8.8
		AMC Animals**	56.3	50.7	46.1	46.7	50.2	42.6	46.3	41.3
	AMR	3GCR Ecoli Humans	9.4	9.7	10.0	9.6	10.2	9.3	9.5	8.3
		MRSA Humans	7.7	7.4	7.2	5.9	6.4	5.2	4.4	3.1
		Complete S EC Animals†	44.0		46.0	47.8	47.0	38.0	38.5	37.4
Belgium	AMC	AMC Humans*	24.0	24.4	24.2	22.8	22.3	21.4	16.7	17.4
		AMC Animals**	158.1	149.9	139.9	131.1	113.0	101.9	103.4	95.3
	AMR	3GCR Ecoli Humans	9.7	9.7	10.5	9.7	9.0	10.0	9.9	8.3
		MRSA Humans	13.5	12.3	12.2	8.5	9.0	6.7	6.9	4.1
		Complete S EC Animals†	35.5		34.0	25.6	25.0	32.9	31.7	33.1
Bulgaria	AMC	AMC Humans*	20.0	20.1	19.2	20.5	21.1	20.7	22.7	24.4
		AMC Animals**	82.9	121.8	155.2	129.8	119.6	112.7	120.9	124.5
	AMR	3GCR Ecoli Humans	40.4	38.5	41.6	41.3	38.7	38.6	41.4	37.3
		MRSA Humans	20.8	13.1	14.3	13.7	17.6	14.8	11.8	15.2
		Complete S EC Animals†	0.0		2.1	8.9	10.6	11.0	8.4	8.2
Croatia	AMC	AMC Humans*	19.4	19.7	18.7	18.6	18.8	18.8	15.7	18.2
		AMC Animals**	103.5	90.5	83.6	68.0	70.8	62.8	68.6	62.7
	AMR	3GCR Ecoli Humans	10.8	12.5	14.7	16.5	14.8	15.9	16.6	18.6
		MRSA Humans	21.3	24.5	25.3	28.5	26.4	24.9	29.2	34.8
		Complete S EC Animals†	29.6		28.7	31.2	32.7	34.7	38.2	34.6
Cyprus	AMC	AMC Humans*	22.2	26.6	28.4	28.9	28.0	30.1	28.9	25.0
		AMC Animals**	317.0	350.2	346.4	335.2	392.3	350.0	344.2	296.5
	AMR	3GCR Ecoli Humans	28.8	28.5	30.2	30.8	37.1	20.7	29.8	32.8
		MRSA Humans	36.0	43.4	38.8	31.2	40.2	36.2	49.1	42.9
		Complete S EC Animals†	2.8		1.0	5.2	5.7	1.5	1.1	7.9
Czechia	AMC	AMC Humans*						16.9	13.4	13.69732
		AMC Animals**	79.8	68.0	61.2	63.5	56.9	53.8	56.2	50.0
	AMR	3GCR Ecoli Humans	14.0	14.5	15.1	14.2	15.2	15.9	13.3	14.4
		MRSA Humans	13.2	13.3	13.7	14.1	13.7	12.5	9.3	9.4
		Complete S EC Animals†	35.7		36.8	35.4	34.3	36.2	34.3	34.3
Denmark	AMC	AMC Humans*	17.1	17.5	17.0	16.2	15.6	15.3	14.3	14.4
		AMC Animals**	43.8	41.8	40.4	38.9	37.8	37.1	37.2	33.4
	AMR	3GCR Ecoli Humans	7.0	7.5	6.6	6.9	7.7	7.5	6.7	6.2
		MRSA Humans	2.5	1.5	2.0	2.5	1.7	2.2	1.7	1.8
		Complete S EC Animals†	48.3		47.5	50.1	50.4	43.8	43.6	52.9
Estonia	AMC	AMC Humans*	11.9	12.1	12.0	11.6	11.8	11.8	10.5	10.1
		AMC Animals**	76.8	64.9	63.7	56.3	52.9	53.5	49.2	46.6
	AMR	3GCR Ecoli Humans	9.3	11.4	9.0	8.8	9.8	11.5	8.3	8.1
		MRSA Humans	3.1	4.0	3.5	2.1	3.3	3.0	3.0	1.5
		Complete S EC Animals†	42.4		42.8	59.4	59.1	54.8	56.7	49.0
Finland	AMC	AMC Humans*	19.1	18.1	17.4	15.7	15.4	14.7	11.9	11.3
		AMC Animals**	21.8	19.9	18.1	18.9	18.2	19.1	16.2	17.0
	AMR	3GCR Ecoli Humans	5.5	6.1	6.9	6.9	7.6	7.9	7.2	6.6
		MRSA Humans	3.0	2.1	2.3	2.1	2.1	2.3	2.6	2.6
		Complete S EC Animals†	73.6		74.0	78.8	78.4	78.8	79.5	79.5
France	AMC	AMC Humans*	24.9	25.6	25.6	24.7	25.3	25.1	20.3	21.5
		AMC Animals**	105.8	69.4	71.2	68.0	64.2	58.3	56.6	51.7
	AMR	3GCR Ecoli Humans	9.9	11.0	11.2	10.2	9.6	8.8	9.5	8.3
		MRSA Humans	17.4	15.7	13.8	12.9	12.1	11.6	12.1	11.0
		Complete S EC Animals†	26.5		27.9	26.9	28.8	28.4	30.8	38.8

Country		Indicator	2014	2015	2016	2017	2018	2019	2020	2021
Germany	AMC	AMC Humans*								
		AMC Animals**	149.3	98.2	89.2	89.1	88.4	78.6	83.8	73.2
	AMR	3GCR Ecoli Humans	10.5	10.3	11.1	12.3	12.2	11.5	10.4	9.1
		MRSA Humans	12.9	11.5	10.2	9.1	7.7	6.7	5.5	4.9
		Complete S EC Animals†	34.9		34.4	43.3	42.5	40.2	41.0	42.7
Greece	AMC	AMC Humans*	31.0	33.2	33.1	34.2	34.1	34.1	28.1	23.5
		AMC Animals**		58.2	64.8	95.7	93.6	84.8	96.4	108.8
	AMR	3GCR Ecoli Humans	21.0	19.8	17.6	18.3	19.3	18.9	21.9	21.7
		MRSA Humans	37.1	39.4	38.8	38.4	36.4	37.6	40.2	41.9
		Complete S EC Animals†			10.0	4.9	4.4	7.2	11.5	14.1
Hungary	AMC	AMC Humans*	15.2	15.8	14.4	14.6	14.8	14.4	11.2	11.9
		AMC Animals**	193.0	211.4	187.0	190.9	180.5	184.8	163.4	155.6
	AMR	3GCR Ecoli Humans	16.4	16.7	16.7	20.1	22.6	20.6	20.1	20.4
		MRSA Humans	23.1	24.7	25.2	23.6	23.1	19.4	21.0	19.3
		Complete S EC Animals†	22.5		21.5	20.2	20.4	22.9	21.5	22.3
Iceland	AMC	AMC Humans*				20.7	20.4	19.3	16.5	16.8
		AMC Animals**	4.8	4.7	4.5	4.4	4.8	3.5	3.8	3.6
	AMR	3GCR Ecoli Humans	3.3	1.7	4.2	6.1	8.1	7.0	11.0	10.4
		MRSA Humans	3.3	0.0	1.3	1.4	0.0	5.8	5.2	1.1
		Complete S EC Animals†				76.3	71.7	69.5	71.7	61.1
Ireland	AMC	AMC Humans*	21.0	23.0	22.0	20.9	22.4	22.8	18.6	17.8
		AMC Animals**	47.5	50.8	52.0	46.5	45.9	40.8	47.0	42.4
	AMR	3GCR Ecoli Humans	10.7	11.4	11.4	12.0	12.9	12.1	11.8	10.0
		MRSA Humans	19.4	18.1	14.3	16.3	12.4	12.6	11.6	10.6
		Complete S EC Animals†	27.7		27.6	25.7	30.3	33.5	32.2	36.6
Italy	AMC	AMC Humans*	24.5	24.5	24.0	20.9	21.4	21.7	18.4	17.5
		AMC Animals**	332.3	321.9	294.7	273.7	244.0	191.1	181.8	173.5
	AMR	3GCR Ecoli Humans	28.7	30.1	29.8	29.5	28.7	30.9	26.4	23.8
		MRSA Humans	33.6	34.1	33.6	33.9	34.0	34.3	33.5	30.0
		Complete S EC Animals†	12.8		11.3	8.7	12.9	12.6	17.7	23.9
Latvia	AMC	AMC Humans*	12.6	13.1	12.9	13.9	13.4	13.9	11.9	11.6
		AMC Animals**	36.6	37.6	29.9	33.2	35.9	28.2	29.6	25.5
	AMR	3GCR Ecoli Humans	10.9	17.9	24.1	22.0	20.4	19.7	24.1	18.3
		MRSA Humans	8.2	5.6	4.2	5.7	5.7	7.8	9.3	5.3
		Complete S EC Animals†	34.4		39.0	41.6	41.5	38.0	37.7	39.1
Lithuania	AMC	AMC Humans*	15.1	15.8	16.6	16.6	16.3	16.1	14.1	13.7
		AMC Animals**	35.5	35.0	37.4	34.2	32.7	20.8	20.5	20.3
	AMR	3GCR Ecoli Humans	8.1	16.0	14.7	16.8	15.3	13.9	15.9	13.6
		MRSA Humans	7.3	9.0	11.5	8.8	8.4	9.3	9.8	9.0
		Complete S EC Animals†	21.1		20.1	27.1	28.4	33.0	31.9	25.0
Luxemburg	AMC	AMC Humans*	23.2	23.5	22.9	22.6	22.1	21.1	16.1	15.9
		AMC Animals**	40.6	34.5	35.4	35.1	33.6	29.0	29.0	27.1
	AMR	3GCR Ecoli Humans	12.0	12.7	13.6	9.7	12.5	12.6	11.4	11.3
		MRSA Humans	12.0	8.9	9.6	9.5	7.7	6.2	3.1	5.5
		Complete S EC Animals†					49.4	37.3		
Malta	AMC	AMC Humans*	22.4	21.2	20.9	22.6	20.2	20.7	16.6	15.8
		AMC Animals**				129.3	153.4	110.3	116.1	110.5
	AMR	3GCR Ecoli Humans	10.8	11.8	14.6	15.6	15.4	17.5	12.3	13.7
		MRSA Humans	43.6	49.4	37.1	42.1	36.4	24.0	19.6	20.4
		Complete S EC Animals†					18.2	16.8		

Country		Indicator	2014	2015	2016	2017	2018	2019	2020	2021
Netherlands	AMC	AMC Humans*	10.3	10.4	10.1	9.8	9.7	9.5	8.5	8.3
		AMC Animals**	68.4	64.4	52.7	56.2	57.4	48.2	50.2	47.6
	AMR	3GCR Ecoli Humans	6.1	6.1	6.6	6.4	7.3	7.5	6.6	6.6
		MRSA Humans	0.9	1.6	1.2	1.6	1.2	1.5	1.5	1.5
		Complete S EC Animals†	38.1		40.0	39.2	41.1	43.9	42.6	47.5
Norway	AMC	AMC Humans*	16.9	16.8	16.2	15.7	15.3	14.9	13.9	14.0
		AMC Animals**	3.0	2.8	2.8	3.0	2.9	2.3	2.3	2.5
	AMR	3GCR Ecoli Humans	5.8	6.0	5.6	5.9	6.8	6.2	5.8	5.5
		MRSA Humans	1.0	1.1	1.2	1.0	0.9	1.0	1.6	0.9
		Complete S EC Animals†	82.4		80.0	82.9	83.4	87.9	87.4	83.7
Poland	AMC	AMC Humans*	21.2	24.1	22.0	25.4	24.4	23.6	18.5	20.2
		AMC Animals**	139.5	137.9	128.4	163.9	168.3	185.2	187.9	175.5
	AMR	3GCR Ecoli Humans	10.5	11.9	13.7	16.7	17.6	17.1	17.4	18.7
		MRSA Humans	22.2	15.8	16.4	15.2	15.9	14.9	13.8	16.5
		Complete S EC Animals†	26.4		23.6	15.5	16.4	17.1	17.9	21.1
Portugal	AMC	AMC Humans*	18.0	18.8	19.0	18.3	19.1	19.3	15.2	15.3
		AMC Animals**	198.6	168.4	206.4	132.1	183.4	143.8	172.5	149.9
	AMR	3GCR Ecoli Humans	16.4	16.1	16.1	15.6	14.7	16.1	14.4	13.1
		MRSA Humans	47.4	46.8	43.6	39.2	38.1	34.8	29.7	25.1
		Complete S EC Animals†	6.3		5.9	6.6	7.7	6.3	8.2	13.1
Romania	AMC	AMC Humans*	26.6	28.0	24.4	24.5	25.1	25.8	25.2	25.7
		AMC Animals**	109.0	100.5	85.2	90.1	82.7	53.9	57.8	59.0
	AMR	3GCR Ecoli Humans	29.4	26.8	23.4	18.7	20.2	20.3	19.7	18.8
		MRSA Humans	56.0	57.2	50.7	45.4	43.0	46.9	47.3	41.0
		Complete S EC Animals†	7.4		8.6	12.9	12.7	8.5	8.8	11.7
Slovakia	AMC	AMC Humans*	21.2	24.2	23.6	20.0	22.0	19.3	14.4	16.0
		AMC Animals**	65.6	50.8	50.3	61.8	49.2	42.3	51.9	41.7
	AMR	3GCR Ecoli Humans	31.8	30.0	29.7	30.9	30.1	23.0	27.1	23.1
		MRSA Humans	28.0	28.1	27.1	29.2	26.6	27.2	24.8	22.3
		Complete S EC Animals†	23.5		26.1	19.9	19.8	14.6	12.4	19.0
Slovenia	AMC	AMC Humans*	13.1	13.3	13.0	13.1	13.2	13.0	10.2	10.2
		AMC Animals**	33.3	26.3	30.3	36.6	43.2	44.9	33.3	31.8
	AMR	3GCR Ecoli Humans	12.7	13.7	12.5	12.5	11.3	9.8	10.6	9.3
		MRSA Humans	13.1	9.2	11.0	9.0	11.7	7.5	9.8	7.8
		Complete S EC Animals†	24.8		20.2	18.7	20.7	21.2	27.2	30.5
Spain	AMC	AMC Humans*			27.5	26.8	26.3	24.9	19.8	20.0
		AMC Animals**	418.8	402.0	362.4	230.3	219.0	126.7	154.3	157.2
	AMR	3GCR Ecoli Humans	12.3	11.6	15.0	12.8	13.8	14.1	14.1	13.2
		MRSA Humans	21.7	25.3	25.8	25.2	24.7	23.3	23.1	24.2
		Complete S EC Animals†	3.9		3.3	6.2	7.1	7.4	9.2	10.0
Sweden	AMC	AMC Humans*	14.0	13.5	13.2	12.8	12.4	11.8	10.3	10.1
		AMC Animals**	11.1	11.4	11.7	11.3	12.1	11.1	11.1	10.9
	AMR	3GCR Ecoli Humans	5.6	6.2	8.3	7.4	8.3	7.8	7.9	7.1
		MRSA Humans	0.9	0.8	2.3	1.2	1.9	1.8	2.3	2.0
		Complete S EC Animals†	69.9		68.9	71.2	70.7	70.6	71.4	89.7

2019	2020	2021	Country		Indicator	2014	2015	2016	2017	2018	2019	2020	2021	Country
11.6	8.8	8.8	Germany	AMC	AMC Humans*									Netherlands
42.6	46.3	41.3			AMC Animals**	149.3	98.2	89.2	89.1	88.4	78.6	83.8	73.2	
9.3	9.5	8.3		AMR	3GCR Ecoli Humans	10.5	10.3	11.1	12.3	12.2	11.5	10.4	9.1	
5.2	4.4	3.1			MRSA Humans	12.9	11.5	10.2	9.1	7.7	6.7	5.5	4.9	
8.0	38.5	37.4			Complete S EC Animals†	34.9	34.4	43.3	42.5	40.2	41.0	42.7		
21.4	16.7	17.4	Greece	AMC	AMC Humans*	31.0	33.2	33.1	34.2	34.1	34.1	28.1	23.5	Norway
101.9	103.4	95.3			AMC Animals**		58.2	64.8	95.7	93.6	84.8	96.4	108.8	
10.0	9.9	8.3		AMR	3GCR Ecoli Humans	21.0	19.8	17.6	18.3	19.3	18.9	21.9	21.7	
6.7	6.9	4.1			MRSA Humans	37.1	39.4	38.8	38.4	36.4	37.6	40.2	41.9	
2.9	31.7	33.1			Complete S EC Animals†		10.0	4.9	4.4	7.2	11.5	14.1		
20.7	22.7	24.4	Hungary	AMC	AMC Humans*	15.2	15.8	14.4	14.6	14.8	14.4	11.2	11.9	Poland
112.7	120.9	124.5			AMC Animals**	193.0	211.4	187.0	190.9	180.5	184.8	163.4	155.6	
38.6	41.4	37.3		AMR	3GCR Ecoli Humans	16.4	16.7	16.7	20.1	22.6	20.6	20.1	20.4	
14.8	11.8	15.2			MRSA Humans	23.1	24.7	25.2	23.6	23.1	19.4	21.0	19.3	
1.0	8.4	8.2			Complete S EC Animals†	22.5	21.5	20.2	20.4	22.9	21.5	22.3		
18.8	15.7	18.2	Iceland	AMC	AMC Humans*				20.7	20.4	19.3	16.5	16.8	Portugal
62.8	68.6	62.7			AMC Animals**	4.8	4.7	4.5	4.4	4.8	3.5	3.8	3.6	
15.9	16.6	18.6		AMR	3GCR Ecoli Humans	3.3	1.7	4.2	6.1	8.1	7.0	11.0	10.4	
24.9	29.2	34.8			MRSA Humans	3.3	0.0	1.3	1.4	0.0	5.8	5.2	1.1	
4.7	38.2	34.6			Complete S EC Animals†			76.3	71.7	69.5	71.7	61.1		
30.1	28.9	25.0	Ireland	AMC	AMC Humans*	21.0	23.0	22.0	20.9	22.4	22.8	18.6	17.8	Romania
350.0	344.2	296.5			AMC Animals**	47.5	50.8	52.0	46.5	45.9	40.8	47.0	42.4	
20.7	29.8	32.8		AMR	3GCR Ecoli Humans	10.7	11.4	11.4	12.0	12.9	12.1	11.8	10.0	
36.2	49.1	42.9			MRSA Humans	19.4	18.1	14.3	16.3	12.4	12.6	11.6	10.6	
.5	1.1	7.9			Complete S EC Animals†	27.7	27.6	25.7	30.3	33.5	32.2	36.6		

Key recommendations

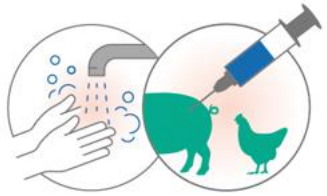


Reduction in the use of antimicrobials

Overall reduction of 20% in humans and 50% in animals

Responsible and prudent use of antimicrobials

Availability of diagnostic tests for selective use of antimicrobials and adherence top treatment guidelines



Increased focus on infection prevention and control

Vaccination and better hygiene

Complementary data for future analysis of links between antimicrobial consumption and resistance

Targeted studies for understanding the transmission of antimicrobial resistance

Read more

Approved: 26 January 2024
DOI: 10.2903/j.efsa.2024.8589

SCIENTIFIC REPORT

Antimicrobial consumption and resistance in bacteria from humans and food-producing animals

Fourth joint inter-agency report on integrated analysis of antimicrobial agent consumption and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals in the EU/EEA

JIACRA IV – 2019–2021

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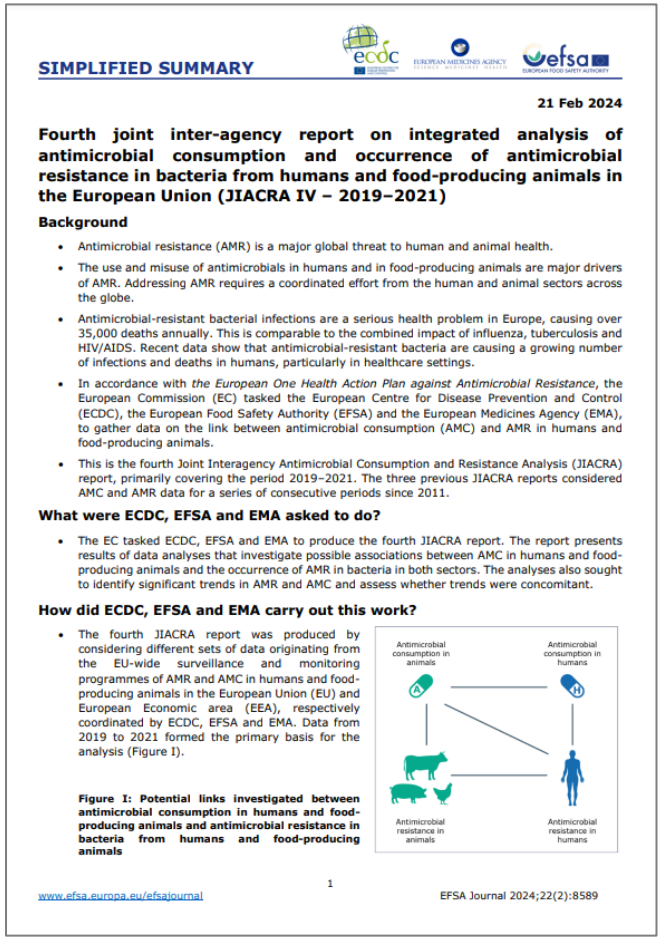
Abstract
The fourth joint inter-agency report on integrated analysis of antimicrobial consumption (AMC) and the occurrence of antimicrobial resistance (AMR) in bacteria from humans and food-producing animals (JIACRA) addressed data obtained by the Agencies' EU-wide surveillance networks for 2019–2021. The analysis also sought to identify whether significant trends in AMR and AMC were concomitant over 2014–2021. AMC in both human and animal sectors, expressed in mg/kg of estimated biomass, was compared at country and European level. In 2021, the total AMC was assessed at 125.0 mg/kg of biomass for humans (28 EU/EEA countries, range 44.3–160.1) and 92.6 mg/kg of biomass for food-producing animals (29 EU/EEA countries, range 2.5–296.5). Between 2014 and 2021, total AMC in food-producing animals decreased by 44%, while in humans, it remained relatively stable. Univariate and multivariate analyses were performed to study associations between AMC and AMR for selected combinations of bacteria and antimicrobials. Positive associations between consumption of certain antimicrobials and resistance to those substances in bacteria from both humans and food-producing animals were observed. For certain combinations of bacteria and antimicrobials, AMR in bacteria from humans was associated with AMR in bacteria from food-producing animals which, in turn, was related to AMC in animals. The relative strength of these associations differed markedly between antimicrobial class, microorganism and sector. For certain antimicrobials, statistically significant decreasing trends in AMC and AMR were concomitant for food-producing animals and humans in several countries over 2014-2021. Similarly, a proportion of countries that significantly reduced total AMC also registered increasing susceptibility to antimicrobials in indicator *E. coli* from food-producing animals and *E. coli* originating from human invasive infections (i.e., exhibited 'complete susceptibility' or 'zero resistance' to a harmonised set of antimicrobials). Overall, the findings suggest that measures implemented to reduce AMC in food-producing animals and in humans have been effective in many countries. Nevertheless, these measures need to be reinforced so that reductions in AMC are retained and further continued, where necessary. This also highlights the importance of measures that promote human and animal health, such as vaccination and better hygiene, thereby reducing the need for use of antimicrobials.

KEYWORDS
antimicrobial consumption, antimicrobial resistance, comparative trend analysis, ecological analysis, food-producing animals, logistic regression, partial least square path modelling, public health

[JIACRA IV report]



SIMPLIFIED SUMMARY

21 Feb 2024

Fourth joint inter-agency report on integrated analysis of antimicrobial consumption and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals in the European Union (JIACRA IV – 2019–2021)

Background

- Antimicrobial resistance (AMR) is a major global threat to human and animal health.
- The use and misuse of antimicrobials in humans and in food-producing animals are major drivers of AMR. Addressing AMR requires a coordinated effort from the human and animal sectors across the globe.
- Antimicrobial-resistant bacterial infections are a serious health problem in Europe, causing over 35,000 deaths annually. This is comparable to the combined impact of influenza, tuberculosis and HIV/AIDS. Recent data show that antimicrobial-resistant bacteria are causing a growing number of infections and deaths in humans, particularly in healthcare settings.
- In accordance with *the European One Health Action Plan against Antimicrobial Resistance*, the European Commission (EC) tasked the European Centre for Disease Prevention and Control (ECDC), the European Food Safety Authority (EFSA) and the European Medicines Agency (EMA), to gather data on the link between antimicrobial consumption (AMC) and AMR in humans and food-producing animals.
- This is the fourth Joint Interagency Antimicrobial Consumption and Resistance Analysis (JIACRA) report, primarily covering the period 2019–2021. The three previous JIACRA reports considered AMC and AMR data for a series of consecutive periods since 2011.

What were ECDC, EFSA and EMA asked to do?

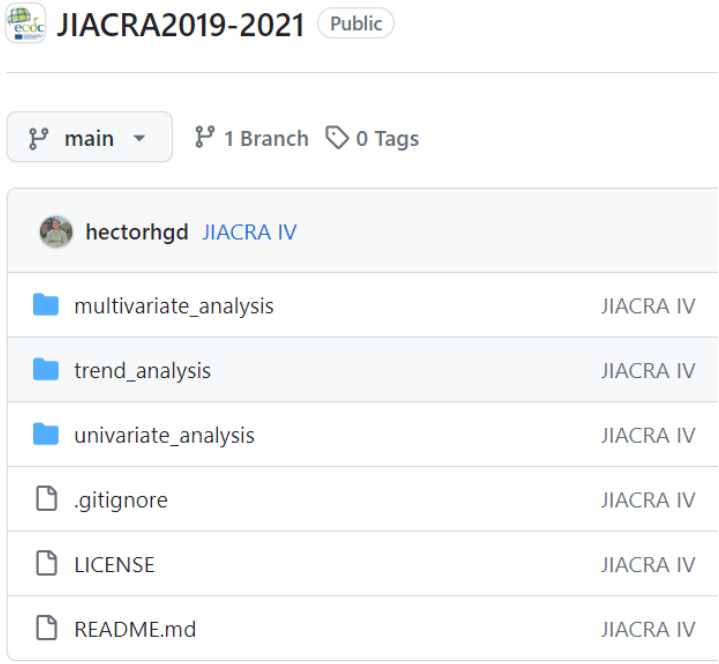
- The EC tasked ECDC, EFSA and EMA to produce the fourth JIACRA report. The report presents results of data analyses that investigate possible associations between AMC in humans and food-producing animals and the occurrence of AMR in bacteria in both sectors. The analyses also sought to identify significant trends in AMR and AMC and assess whether trends were concomitant.

How did ECDC, EFSA and EMA carry out this work?

- The fourth JIACRA report was produced by considering different sets of data originating from the EU-wide surveillance and monitoring programmes of AMR and AMC in humans and food-producing animals in the European Union (EU) and European Economic area (EEA), respectively coordinated by ECDC, EFSA and EMA. Data from 2019 to 2021 formed the primary basis for the analysis (Figure I).

Figure I: Potential links investigated between antimicrobial consumption in humans and food-producing animals and antimicrobial resistance in bacteria from humans and food-producing animals

[Simplified summary]



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