JIACRA

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

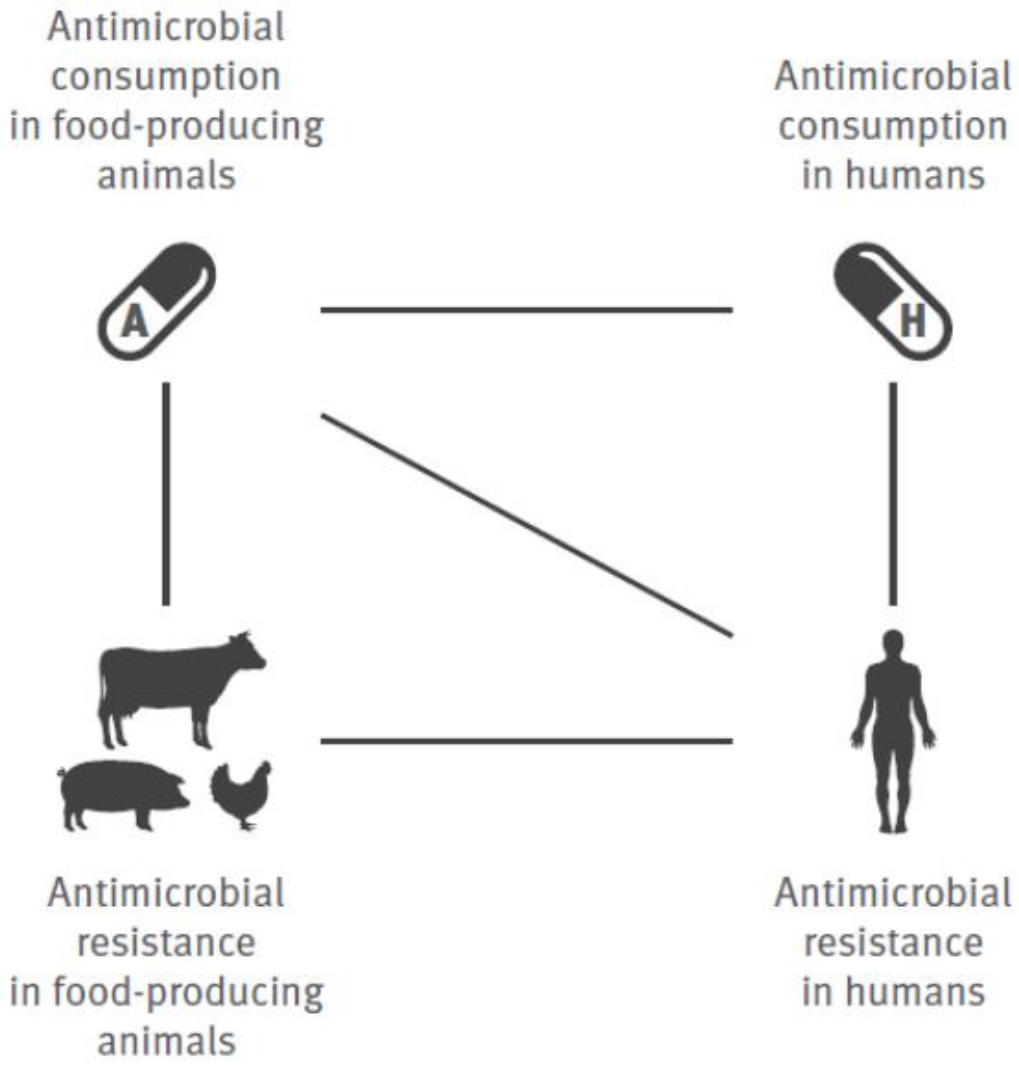
AMR One Health Network meeting, 29 February 2024

Introduction

The 4th report was published on 21 February 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.**



Mandate from the European Commission

ECDC, EFSA and EMA were requested by the EC to provide a JIACRA IV report on 2019-2021 period with:

a) Data on the consumption of antimicrobials in human and veterinary medicine as well as on AMR in the Union based on contributions received by Member States, as an overview of the situation

b) An integrated analysis of possible relationships between AMC in humans and food-producing animals and the occurrence of AMR in bacteria from humans and food-producing animals focusing on relevant EU outcome indicators

c) An integrated analysis of relevant trends at EU and national level in AMC and AMR in humans and food-producing animals

d) Advice for policy makers on trends that require for policy measures to be taken in priority, based on the outputs of the integrated analyses of trends in AMC and AMR

e) Simplified summary of the conclusions that could be easily used by Member States for policy making purposes.

Analysis performed

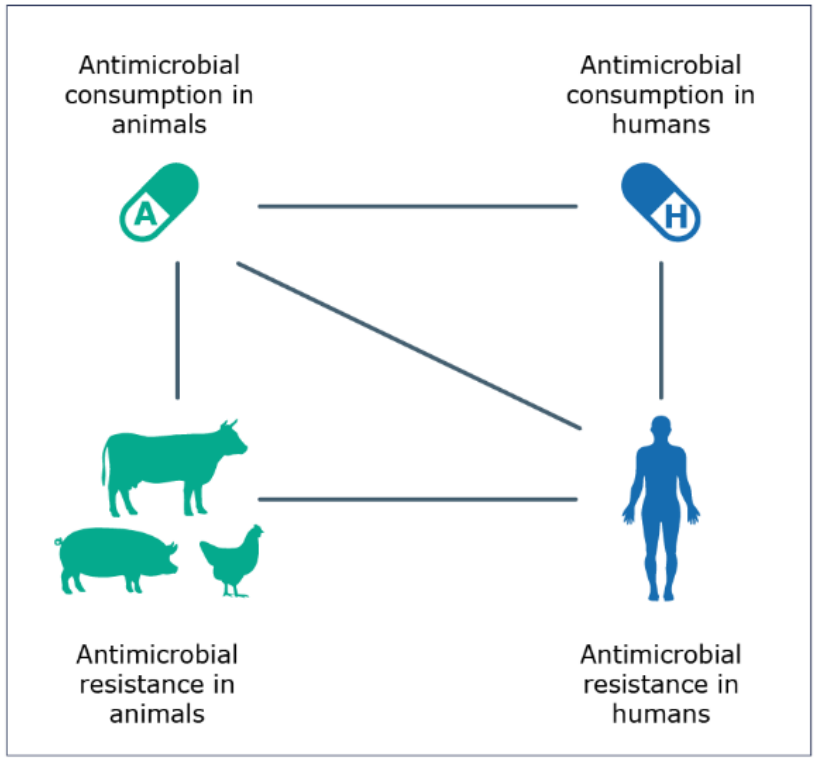
EUROPEAN MEDICINES AGENCY
SCIENCE MEDICINES HEALTH

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**)

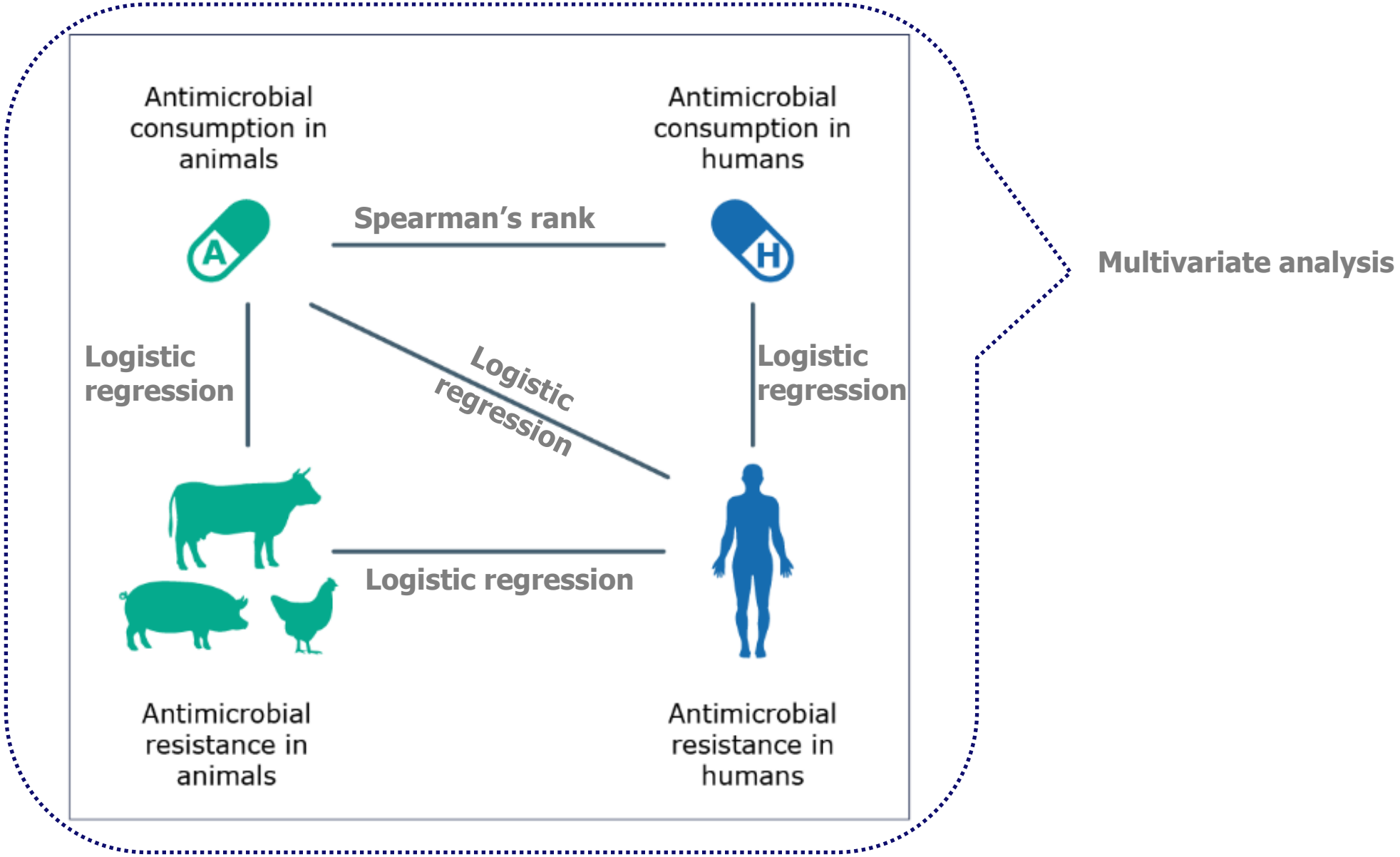
ecdc
EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

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

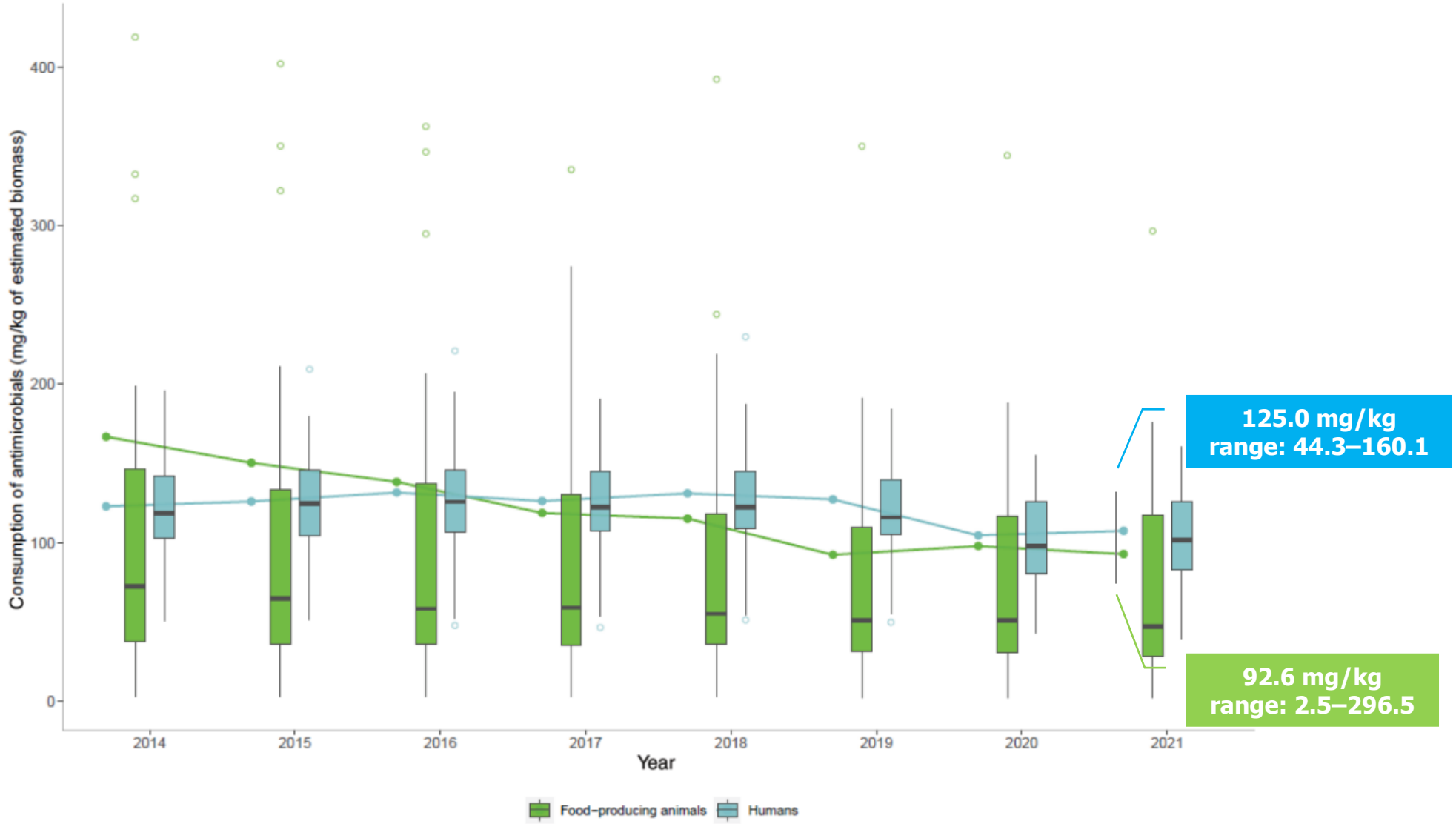
Food- and Water-borne Disease Network (**FWD-Net**)

Years: 2019, 2020 and 2021

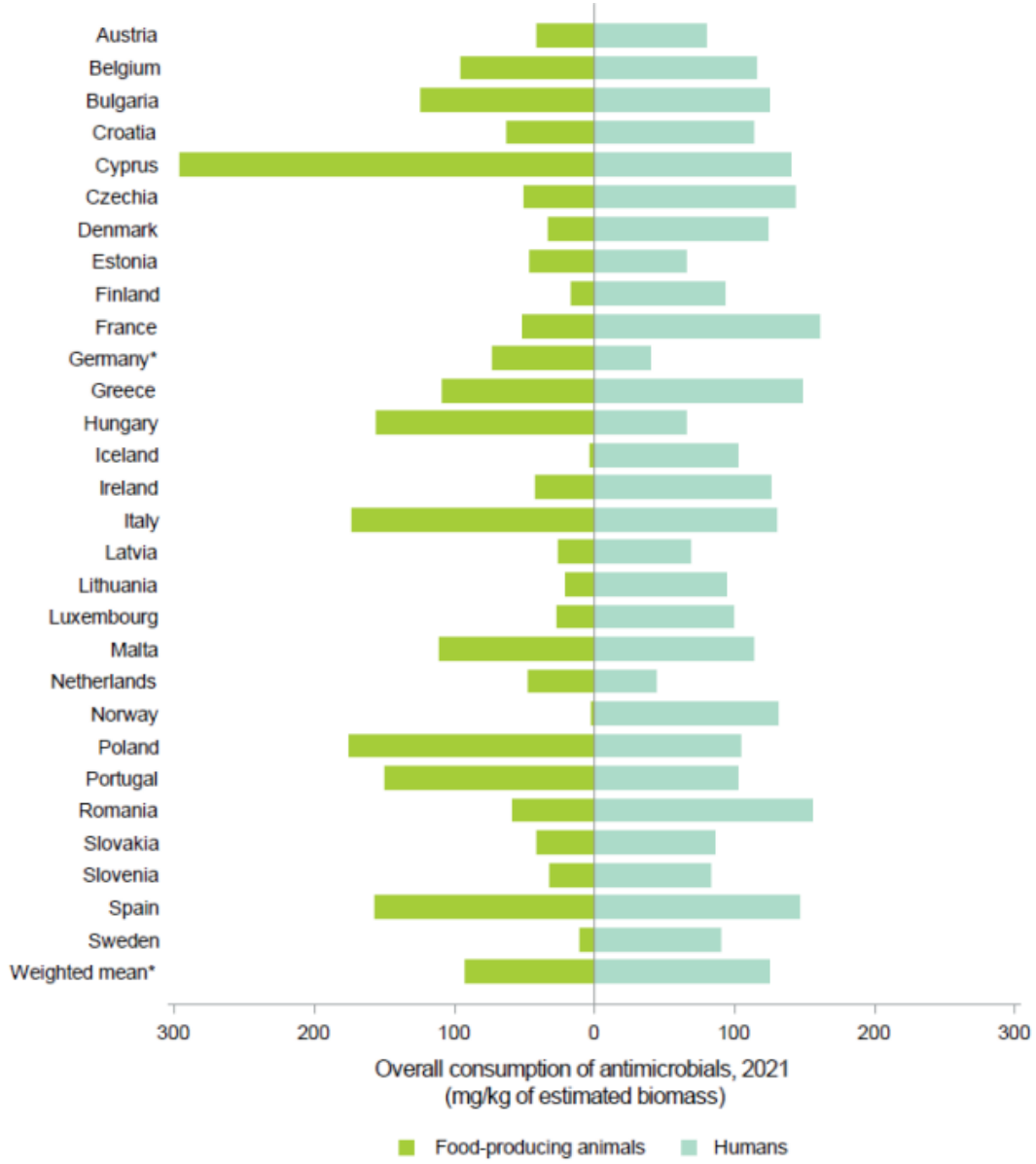
Analysis performed



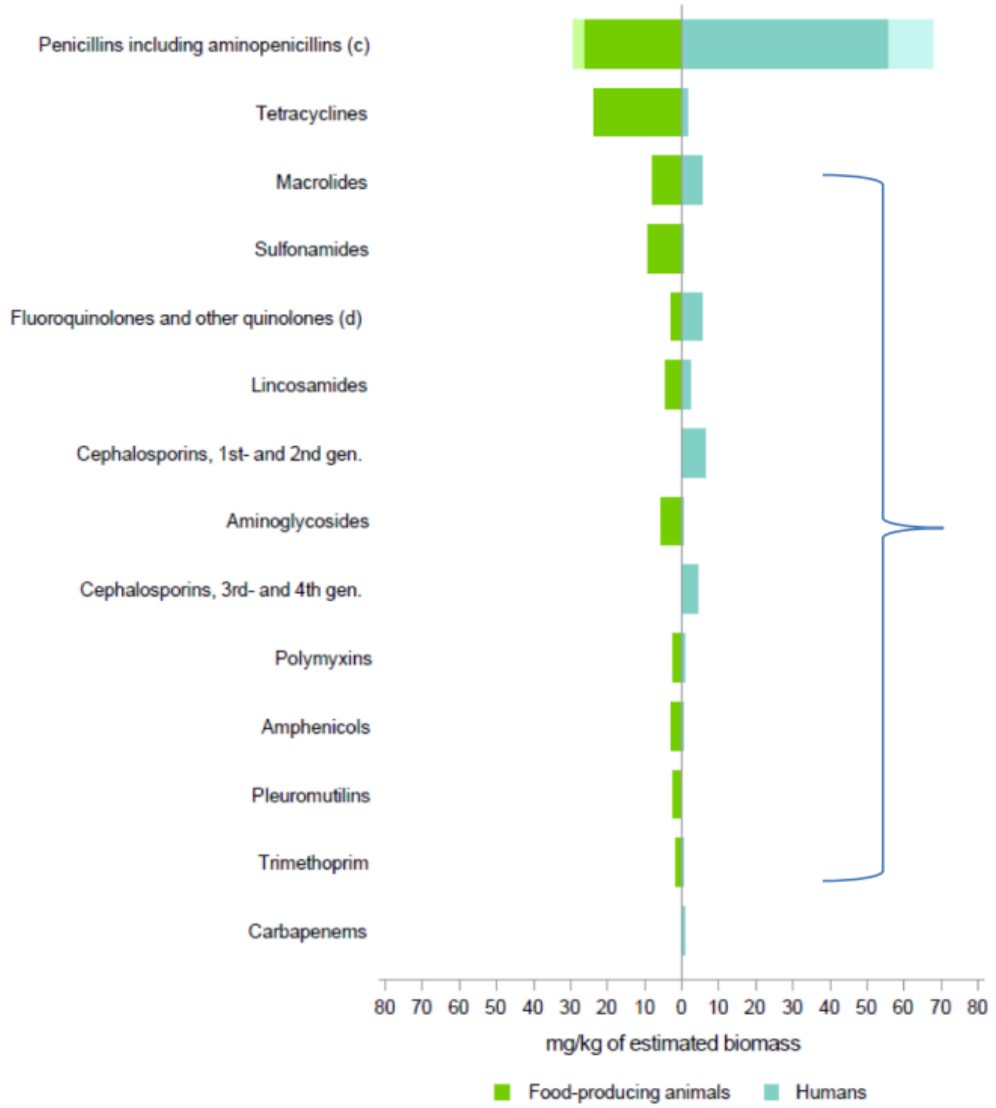
Total EU/EEA population weighted mean antimicrobial consumption in humans and food-producing animals

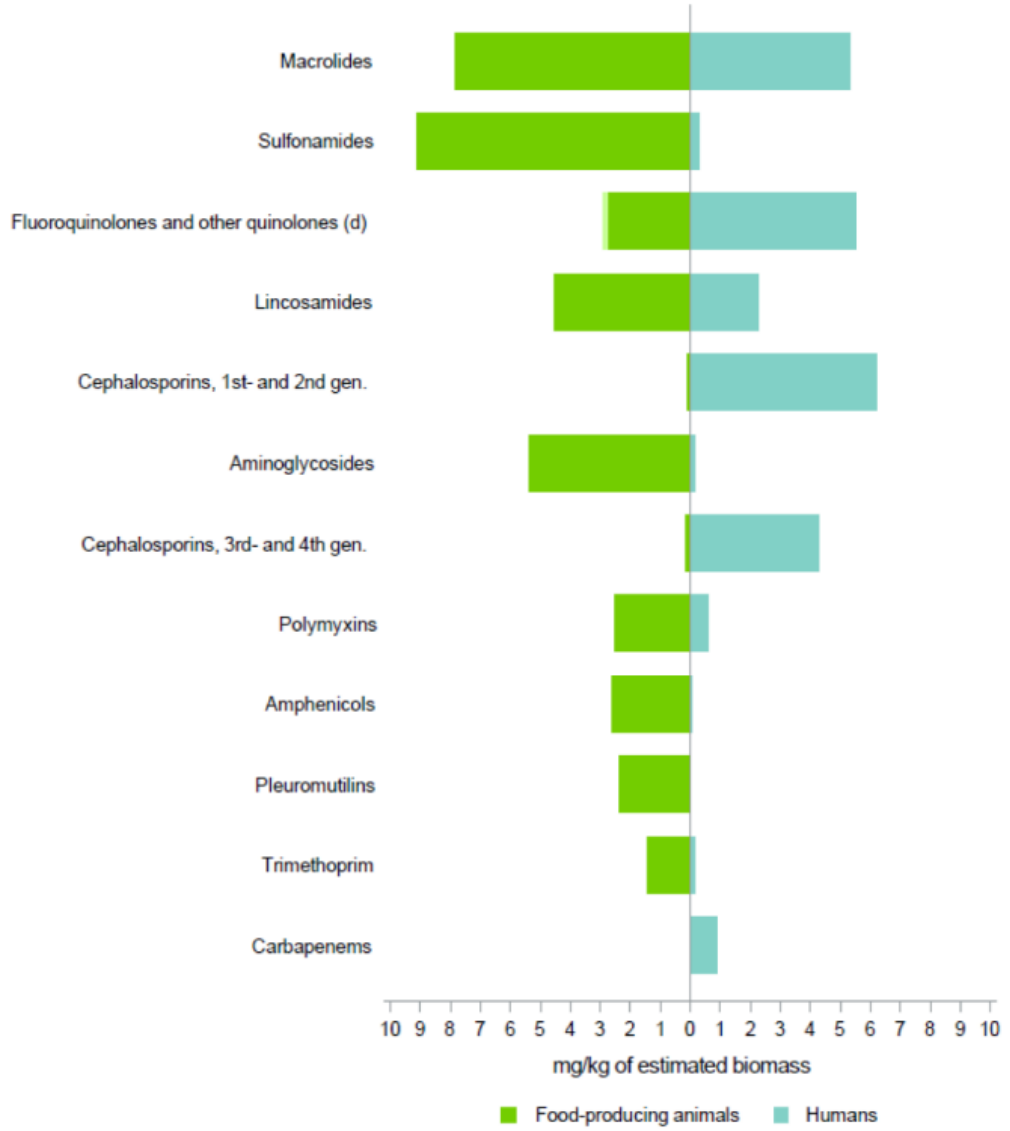


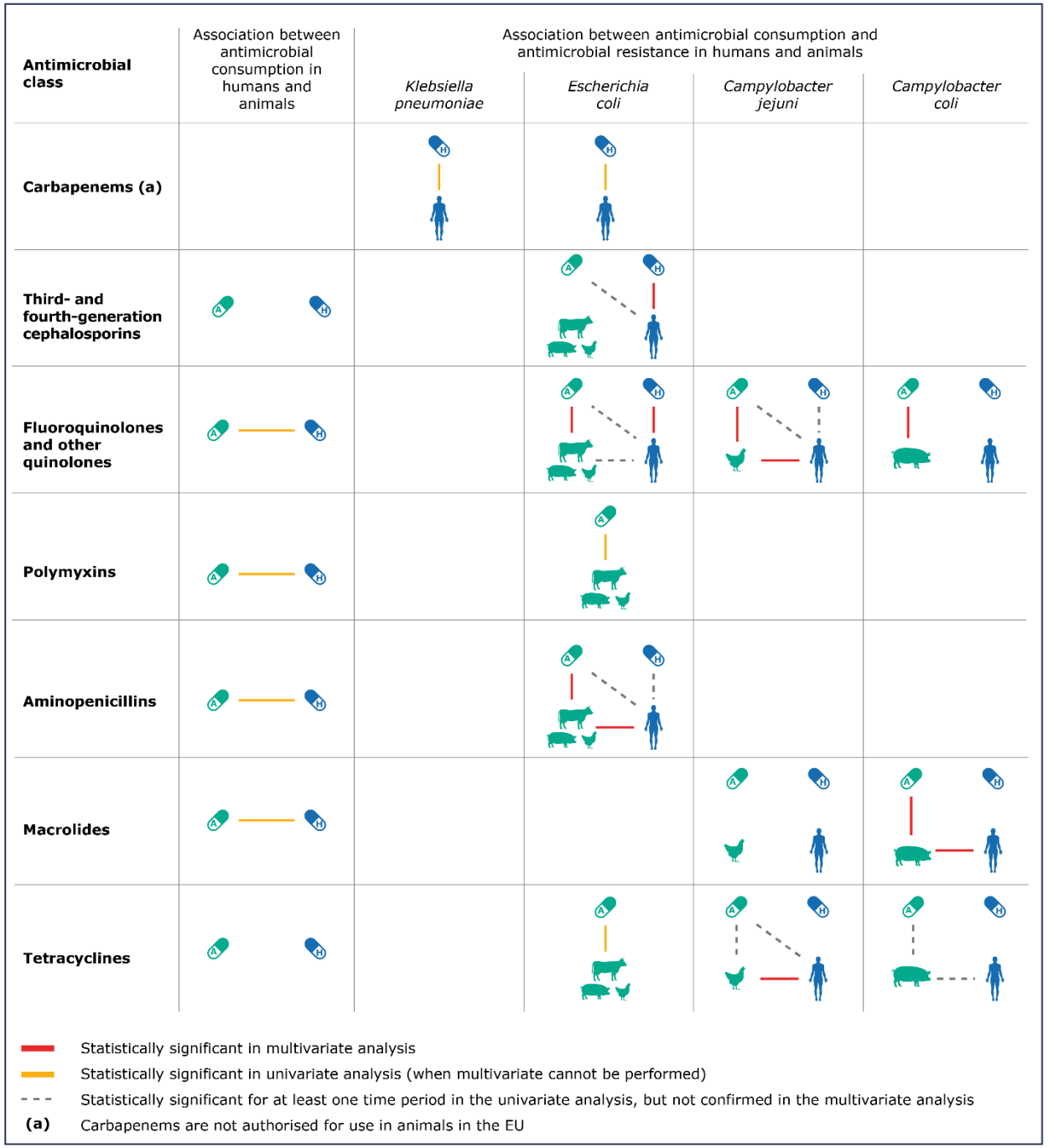
Consumption of antimicrobials in humans and food-producing animals

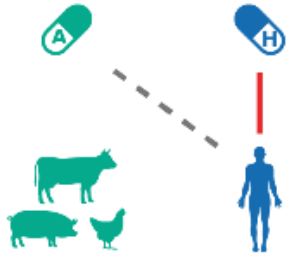
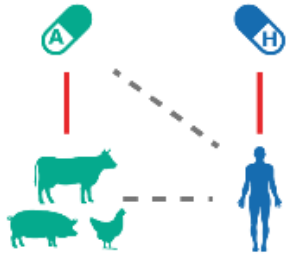
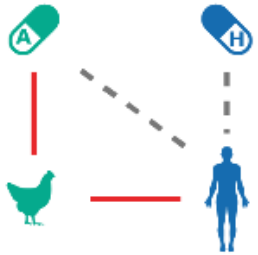


Comparison of consumption of antimicrobial classes in humans and animals






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

	antimicrobial consumption in humans and animals	antimicrobial resistance in humans and animals			
		Klebsiella pneumoniae	*Escherichia coli*	*Campylobacter jejuni*	*Campylobacter coli*
hems (a)					
d eneration porins					
inolones r es					
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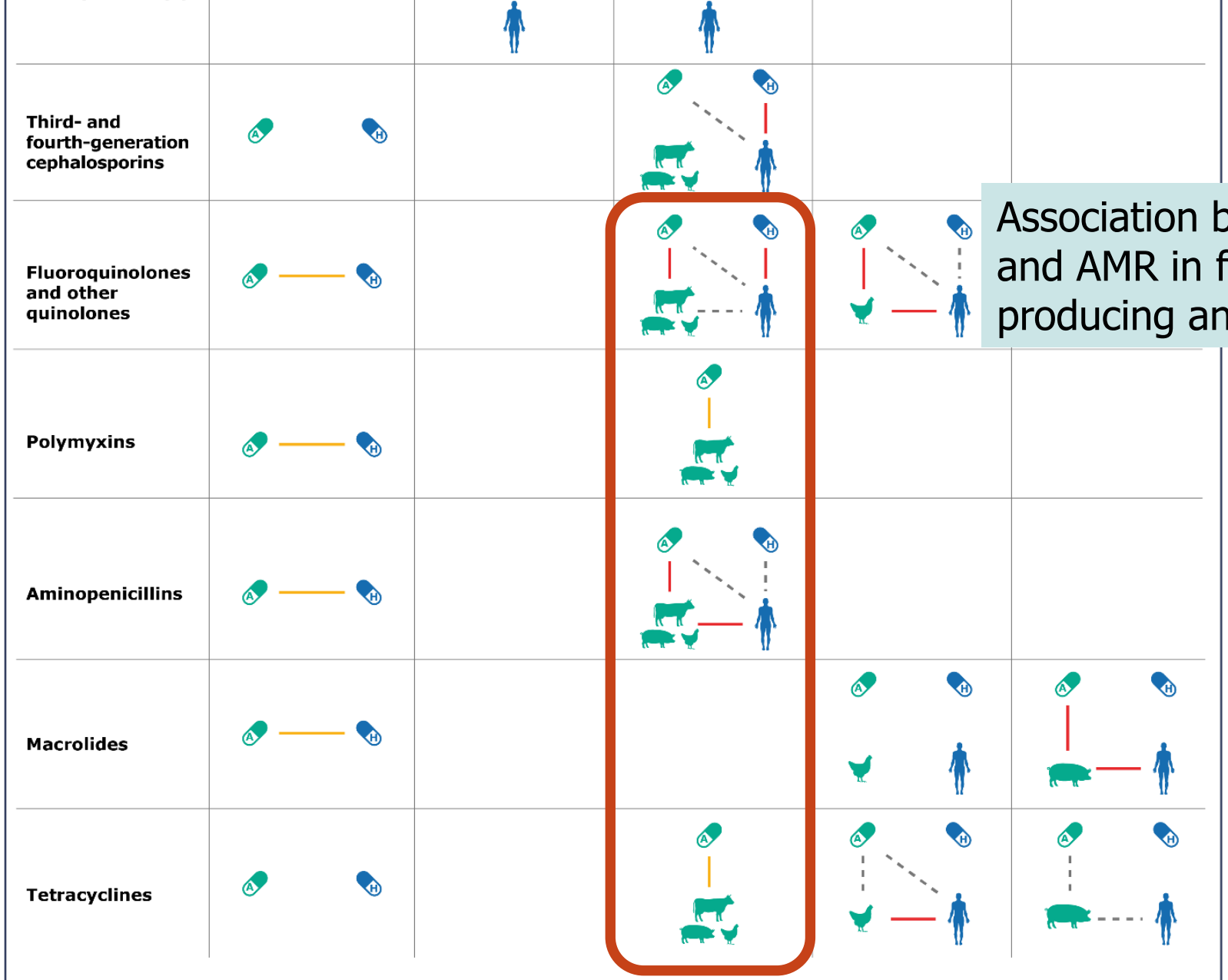
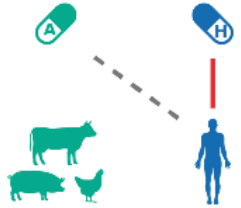
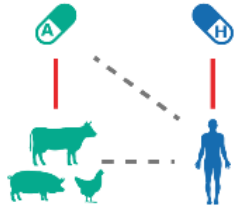
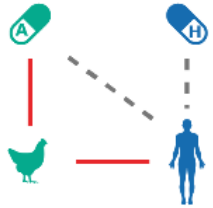
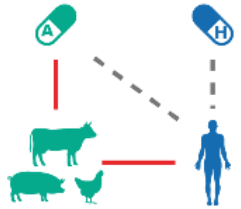
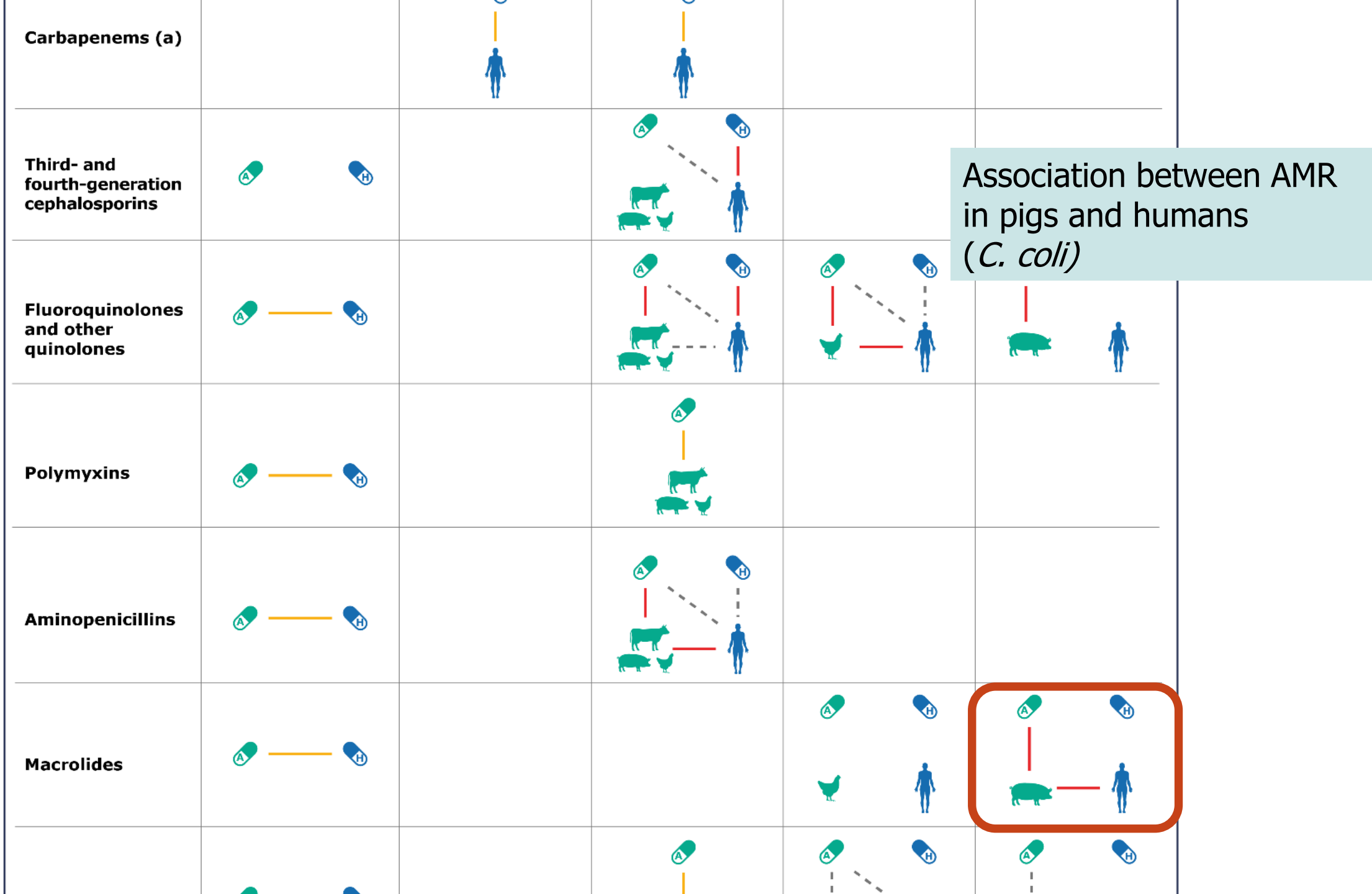
Association between AMC and AMR in humans (*E. coli*)



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

Antimicrobial class	consumption in humans and animals	*Klebsiella pneumoniae*	*Escherichia coli*	*Campylobacter jejuni*	*Campylobacter coli*
Carbapenems (a)					
Third- and fourth-generation cephalosporins					
Fluoroquinolones and other quinolones					
Polymyxins					
Aminopenicillins					
					

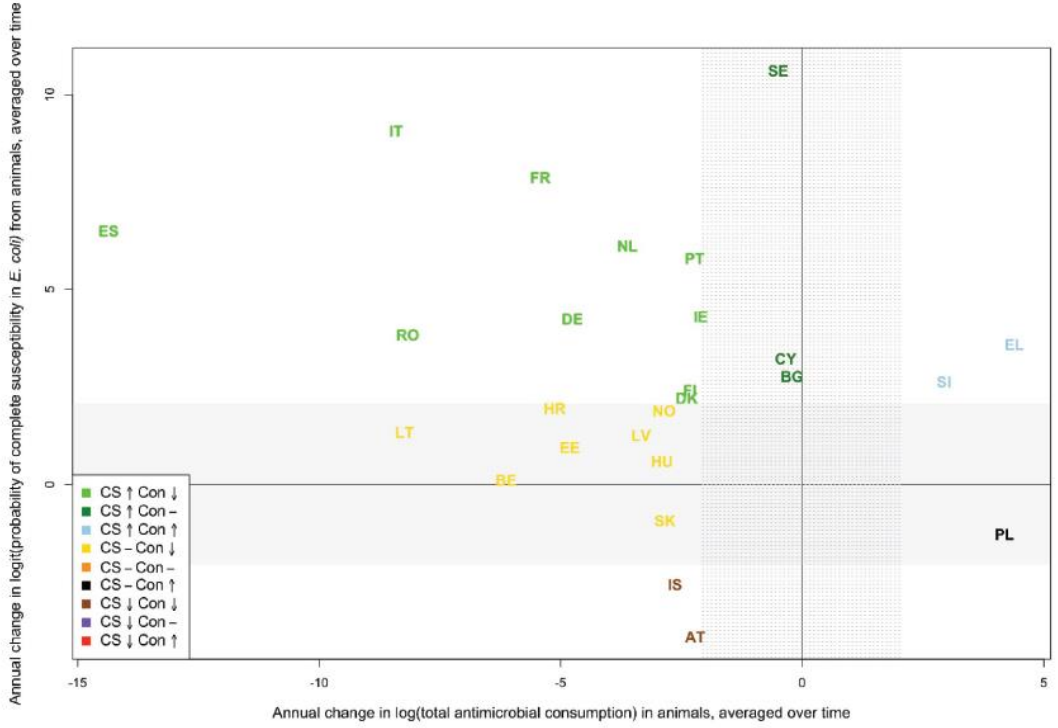
Association between AMR in poultry and humans (*C. jejuni*)


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

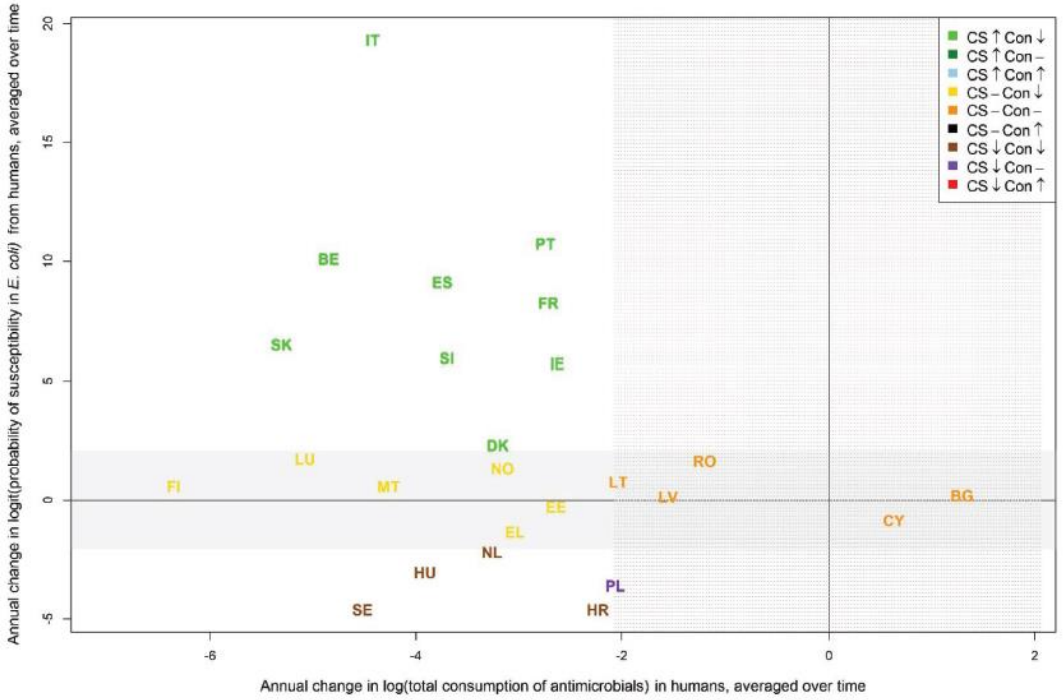
Trends in consumption and resistance from 2014 to 2021

Comparison of annual changes in total consumption in humans and complete susceptibility in *E. coli* isolates from humans, EU/EEA, 2014–2021

food-producing animals



humans



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**

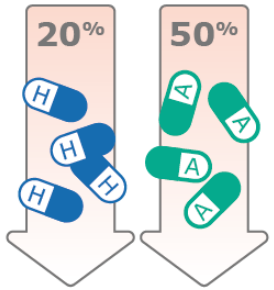
Country		Indicator	2014	2015	2016	2017	2018	2019	2020	2021
Austria	AMC	AMC Humans*						11.6	8.8	8.8
		AMC Animals**	56.3	50.7	46.1	46.7	50.2	42.6	46.3	41.3
	AMR	3GCR Ecoli Humans	9.4	9.7	10.0	9.6	10.2	9.3	9.5	8.3
		MRSA Humans	7.7	7.4	7.2	5.9	6.4	5.2	4.4	3.1
		Complete S EC Animals†	44.0		46.0	47.8	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		

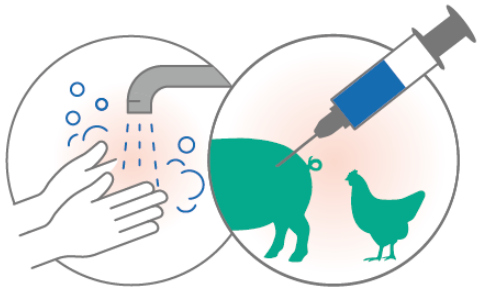
Country		Indicator	2014	2015	2016	2017	2018	2019	2020	2021
Netherlands	AMC	AMC Humans*	10.3	10.4	10.1	9.8	9.7	9.5	8.5	8.3
		AMC Animals**	68.4	64.4	52.7	56.2	57.4	48.2	50.2	47.6
	AMR	3GCR Ecoli Humans	6.1	6.1	6.6	6.4	7.3	7.5	6.6	6.6
		MRSA Humans	0.9	1.6	1.2	1.6	1.2	1.5	1.5	1.5
		Complete S EC Animals†	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		

Recommendations



Reduction in the use of antimicrobials
(overall reduction of 20% in people and 50% in animals)



Increased focus on infection prevention and control
(vaccination and better hygiene)

Responsible and prudent use of antimicrobials
(availability of diagnostic tests for selective use of antimicrobials and adherence to treatment guidelines)

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

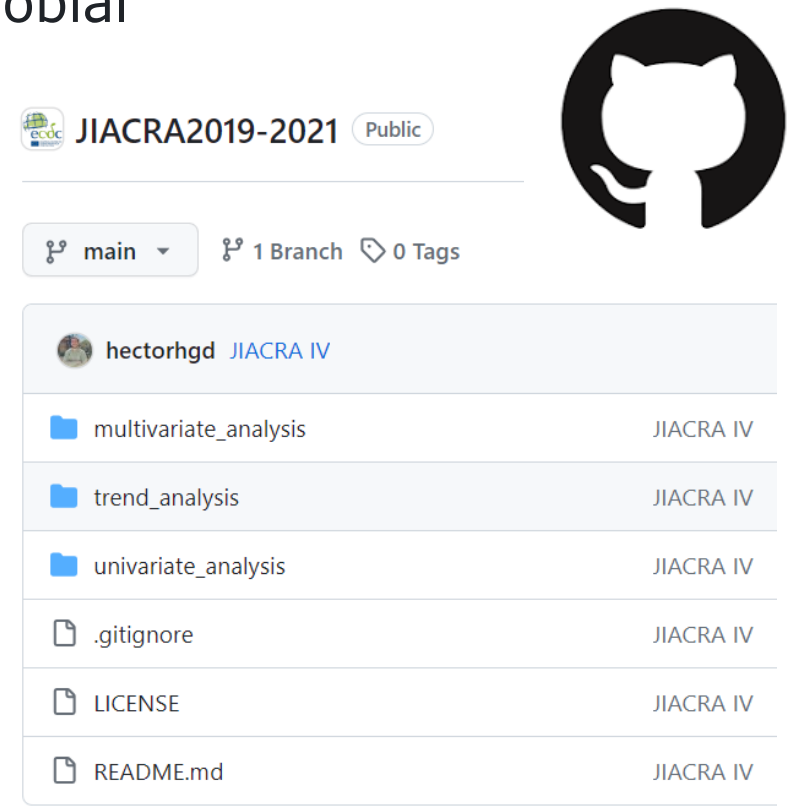
Targeted studies for understanding the transmission of antimicrobial resistance

JIACRA IV Code Repository – new feature!

- A public repository containing code and synthetic anonymised data for the Fourth Joint Inter-Agency Report on Antimicrobial Consumption and Resistance Analysis (JIACRA IV).

- The code developed used for the univariate, multivariate and time trend analyses can be found in a GitHub repository. The repository includes code written in various programming languages, such as R and SAS.

- It includes documentation files as a guide for users to **understand and reproduce the analyses** performed in the report.



The JIACRA IV report and the Simplified Summary can be downloaded from:

https://www.ema.europa.eu/en/veterinary-regulatory-overview/antimicrobial-resistance-veterinary-medicine/analysis-antimicrobial-consumption-resistance-jiacra-reports

… and from ECDC's and EFSA's websites.