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Public Health Wales

Healthcare Associated Infection, Antimicrobial Resistance and Prescribing Programme

Antimicrobial Resistance in Urinary Coliforms Wales in 2016-2023

Version 1

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The Healthcare Associated Infection, Antimicrobial Resistance and Prescribing (HARP) Programme can be accessed via the Public Health Wales website at: https://phw.nhs.wales/

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Introduction

In 2014, Lord O'Neill was commissioned by the UK Prime Minister to review the global impact of antimicrobial resistance. He estimated that by 2050, 10 million lives a year and a cumulative 100 trillion USD of economic output would be at risk due to the rise of drug resistant infections if no proactive solutions were found to slow down the rise of drug resistance.

In response to Lord O'Neill's report and recommendations, in January 2019, the UK Government published its 20-year vision for antimicrobial resistance, and its five-year national action plan to tackle antimicrobial resistance. The vision is that stakeholders at local, national, and global levels collectively strengthen policy and practice, improve research and surveillance, and develop effective regulation to contain and control resistance.

Antimicrobial resistance is an increasing problem in Wales and has already led to a small number of difficult to treat infections, leading to failed therapy and potential complications. Treatment for most infections is started empirically before antimicrobial susceptibilities are known. A particular problem with the spread of antimicrobial resistance is that it becomes more difficult to select empirical therapy that will have reliable activity.

The aim of this report from the HARP team at Public Health Wales is to provide surveillance data that can be used to develop empirical treatment guidance, and to track antimicrobial resistance trends in Wales.

Key Points of Interest

Escherichia coli (the commonest cause of urinary tract infections in Wales)

- Resistance to co-amoxiclav has increased significantly in *E. coli* from urine samples between 2016 and 2023.
- There has been a significant decrease in trimethoprim resistance in *E. coli* from urine samples between 2016 and 2021; this is may be linked to reduced use of trimethoprim for the treatment of UTI.
- Fluoroquinolone and nitrofurantoin resistance has generally decreased across the settings in Wales.

Non-*Escherichia coli* coliforms (Non-ECOL)

- Data for non-*Escherichia coli* coliforms is presented in the second part of this report and shows similar changes in resistance trends for co-amoxiclav and trimethoprim as *E. coli*.

Methodology

Resistance data

Data Sources

Antimicrobial susceptibility testing data was extracted from the Public Health Wales DataStore system.

Antimicrobial Groups

In 2012/2013 the European Committee on Antimicrobial Susceptibility Testing (EUCAST) methodology for antimicrobial susceptibility testing (AST) was implemented across the laboratories in Wales (https://eucast.org/clinical_breakpoints).

Organisms

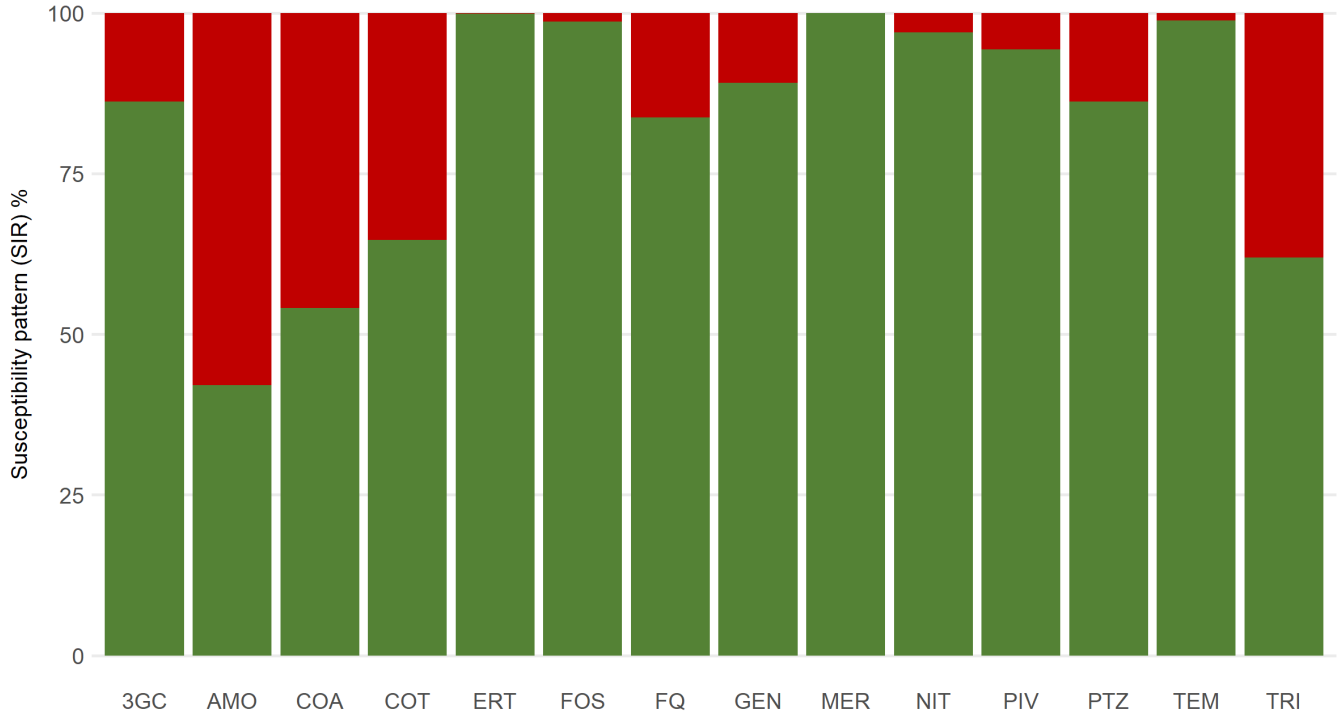
The urinary organisms are split into two groups in this report (1) *Escherichia coli* and (2) non-ECOL. The Non-ECOL group comprised:

- *Citrobacter* spp.
- Coliform
- *Cronobacter* spp.
- *Enterobacter* spp.
- *Escherichia* spp.
- *Hafnia* spp.
- *Klebsiella* spp.
- *Kluyvera* spp.
- *Leclercia* spp.
- *Morganella* spp.
- *Pantoea* spp.
- *Proteus* spp.
- *Providencia* spp.
- *Rahnella* spp.
- *Raoultella* spp.
- *Salmonella* spp.
- *Serratia* spp.
- *Yersinia* spp.

Escherichia coli

E. coli from inpatient urine samples (n = 10,539 in 2023)

The **All-Wales** patterns of susceptibility (**S/I/R**) for *E. coli* from inpatient urine samples in 2023 are shown in **Figure 1**. Trends in the resistance rates for the period 2016 to 2023 are shown in **Figure 2**.



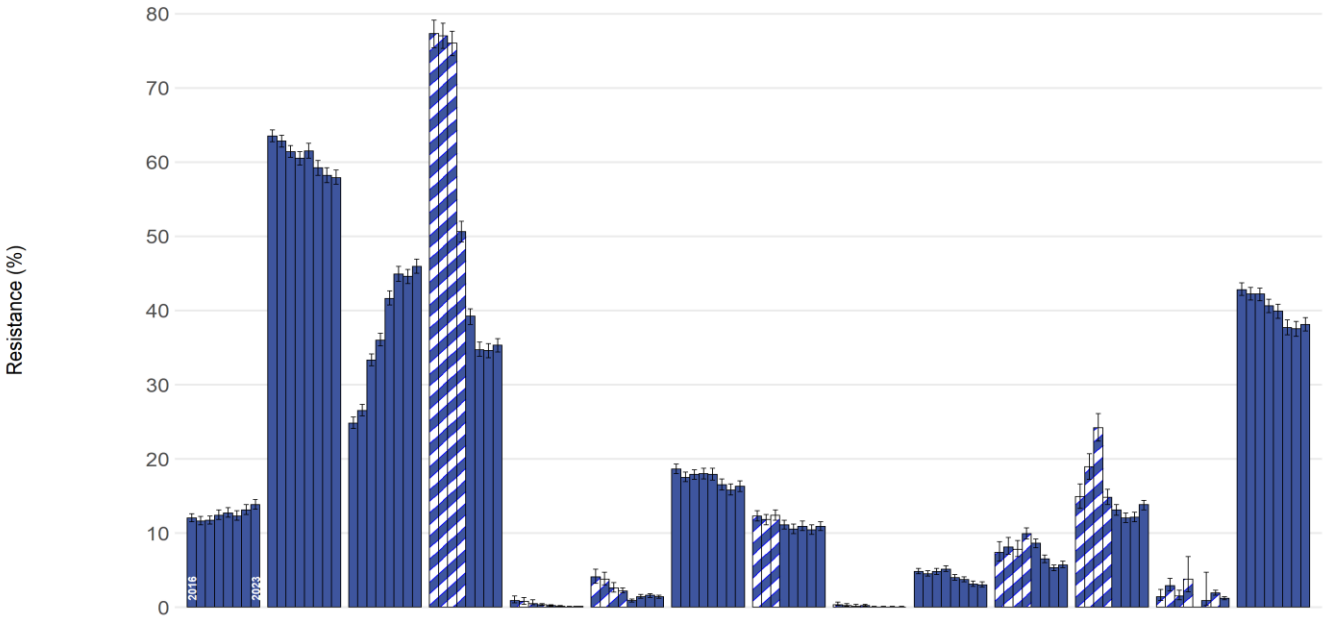
	3GC	AMO	COA	COT	ERT	FOS	FQ	GEN	MER	NIT	PIV	PTZ	TEM	TRI
%R	13.8	57.9	45.9	35.3	0.06	1.4	16.3	10.9	0.01	3.0	5.7	13.8	1.2	38.1
%S	86.2	42.1	54.1	64.7	99.9	98.6	83.7	89.1	100	97.0	94.3	86.2	98.8	61.9

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, GEN = gentamicin, MER = meropenem, NIT = nitrofurantoin, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TEM = temocillin, TRI = trimethoprim

Figure 1: All-Wales susceptibility patterns for *E. coli* from inpatient urine samples (2023)

What the data shows

- Third generation cephalosporin (3GC) resistance was **13.8%** [13.2, 14.5].
- Amoxicillin (AMO) resistance was **57.9%** [57.0, 58.9].
- Co-amoxiclav (COA) resistance was **45.9%** [45.0, 46.9].
- Co-trimoxazole (COT) resistance was **35.3%** [34.4, 36.2].
- Fluoroquinolone (FQ) resistance was **16.3%** [15.6, 17.0].
- Gentamicin (GEN) resistance was **10.9%** [10.3, 11.5].
- Piperacillin/tazobactam (PTZ) resistance was **13.8%** [13.1, 14.4].
- Trimethoprim (TRI) resistance was **38.1%** [37.2, 39.0].
- Resistance to fosfomycin (FOS), nitrofurantoin (NIT), pivmecillinam (PIV) and temocillin (TEM) was **1.4%**, **3.0%**, **5.7%** and **1.2%** respectively.
- Resistance to ertapenem (ERT), and meropenem was **<0.1%**



	3GC	AMO	COA	COT	ERT	FOS	FQ	GEN	MER	NIT	PIV	PTZ	TEM	TRI
2016 (n = 13,789)	12.0	63.5	24.8	77.3	0.91	4.1	18.6	12.3	0.34	4.8	7.4	14.9	1.4	42.8
2017 (n = 13,648)	11.6	62.8	26.5	77.0	0.75	3.8	17.5	11.8	0.21	4.5	8.1	18.9	2.9	42.2
2018 (n = 12,718)	11.7	61.4	33.3	76.0	0.55	2.6	17.9	12.4	0.15	4.8	7.8	24.2	1.5	42.2
2019 (n = 11,473)	12.4	60.5	36.0	50.6	0.28	2.2	18.0	11.1	0.17	5.1	9.9	14.8	3.8	40.6
2020 (n = 9,773)	12.7	61.5	41.6	39.2	0.16	0.9	17.9	10.5	0.05	4.0	8.6	13.1	*	39.9
2021 (n = 9,722)	12.3	59.2	44.9	34.7	0.09	1.4	16.5	10.9	0.02	3.7	6.5	12.0	0.9	37.7
2022 (n = 9,784)	13.1	58.2	44.6	34.6	0.02	1.6	15.8	10.4	0.02	3.1	5.3	12.1	1.9	37.5
2023 (n = 10,539)	13.8	57.9	45.9	35.3	0.06	1.4	16.3	10.9	0.01	3.0	5.7	13.8	1.2	38.1

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, GEN = gentamicin, MER = meropenem, NIT = nitrofurantoin, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TEM = temocillin, TRI = trimethoprim

Figure 2: All-Wales antimicrobial resistance rates for *E. coli* from inpatient urine samples (2016 to 2023)

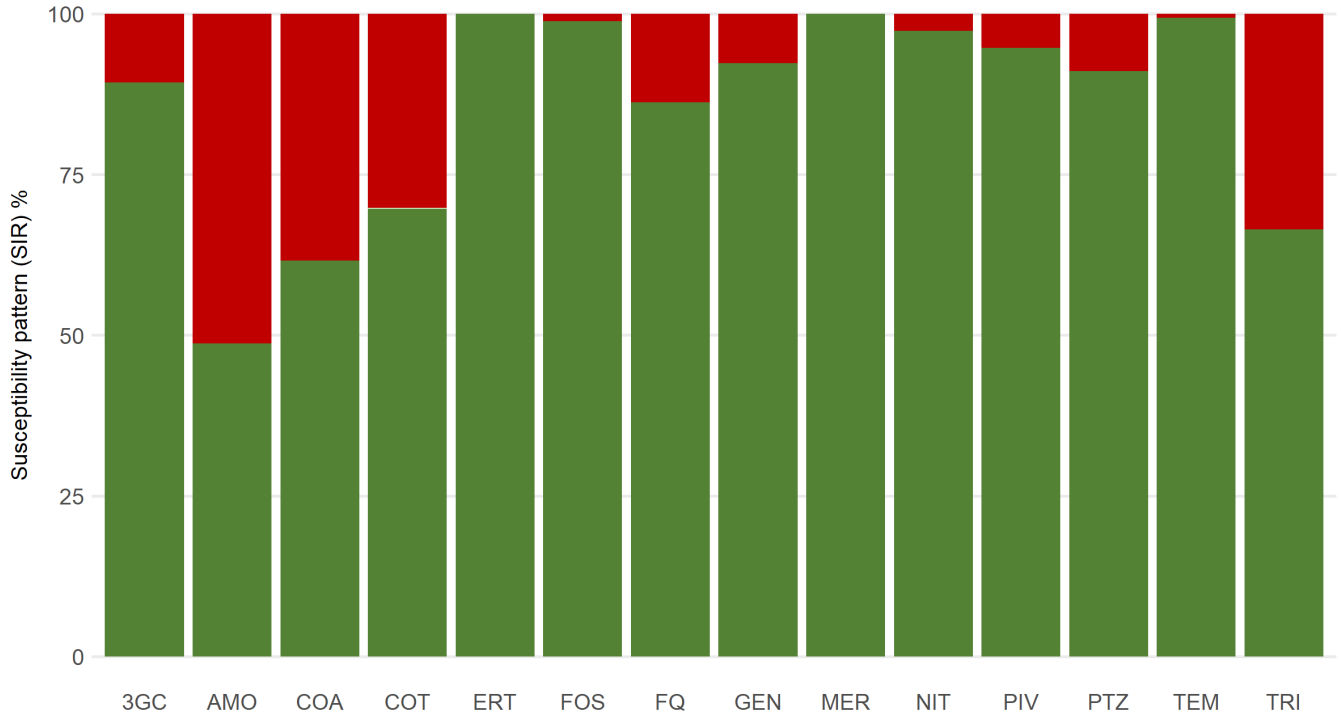
What the data shows

- There has been an increase in the number of *E. coli* with AST results for inpatient urine samples from **9,784** isolates in 2022 to **10,539** in 2023.

- An increase in resistance to third generation cephalosporins to **13.8%** in 2023.
- A decrease in amoxicillin resistance to **57.9%** in 2023.
- An increase in co-amoxiclav resistance to **45.9%** in 2023.
- No significant change in co-trimoxazole resistance from 2021 onwards, with resistance at **35.3%** in 2023.
- No significant change in fosfomycin resistance from 2021 onwards, with resistance at **1.4%** in 2023.
- A general decrease in fluoroquinolones resistance, with resistance at **16.3%** in 2023.
- No significant change in gentamicin resistance, with resistance at **10.9%** in 2023.
- A decrease in nitrofurantoin resistance to **3.0%** in 2023.
- Variability in pivmecillinam resistance, with resistance at **5.7%** in 2023.
- No significant change in piperacillin/tazobactam resistance from 2020 onwards, with resistance at **13.8%** in 2023.
- Selective AST testing only for temocillin until 2023, trends cannot be inferred. *The resistance rates for temocillin for 2020 are not presented as <10 isolates were tested.
- A general decrease in trimethoprim resistance, with resistance at **38.1%** in 2023.
- Ertapenem and meropenem resistance remains **<1%**.

E. coli from outpatient urine samples (n = 4,424 in 2023)

The **All-Wales** patterns of susceptibility (**S/I/R**) for *E. coli* from outpatient urine samples in 2023 are shown in **Figure 3**. Trends in the resistance rates for the period 2016 to 2023 are shown in **Figure 4**.



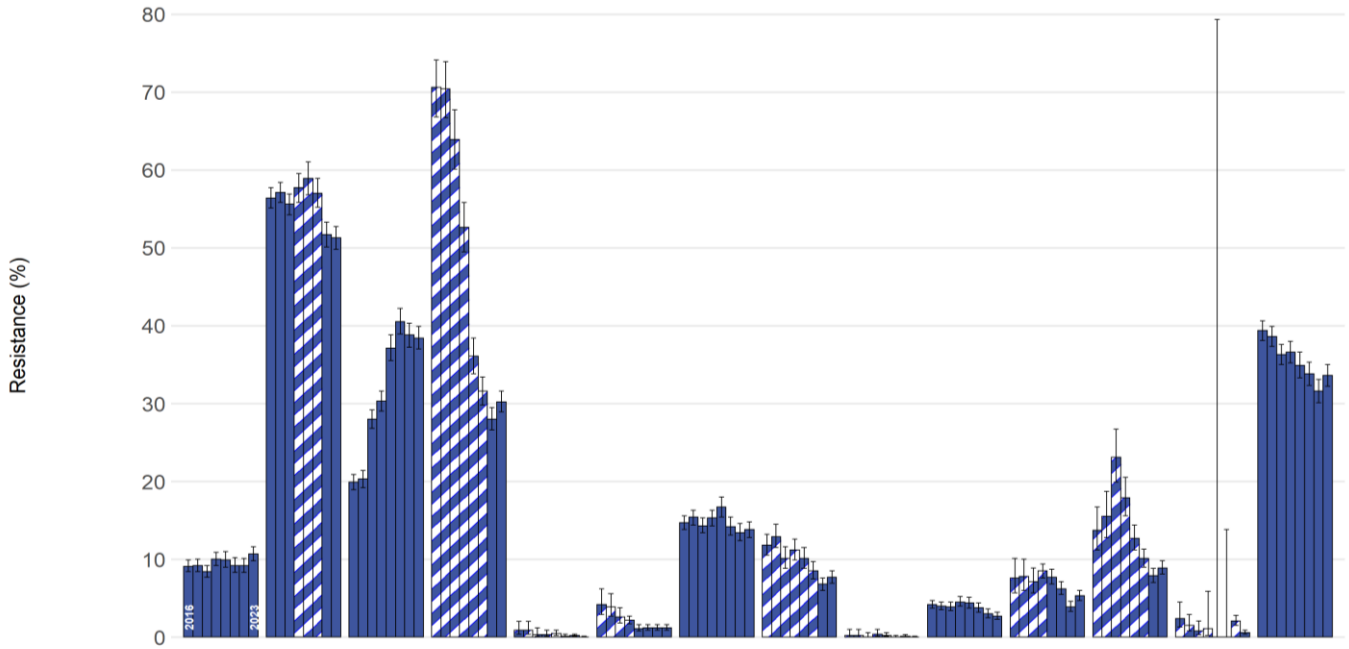
	3GC	AMO	COA	COT	ERT	FOS	FQ	GEN	MER	NIT	PIV	PTZ	TEM	TRI
%R	10.7	51.3	38.4	30.2	0.00	1.2	13.8	7.7	0.02	2.7	5.3	8.9	0.6	33.6
%I	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-
%S	89.3	48.7	61.6	69.6	100	98.8	86.2	92.3	100	97.3	94.7	91.1	99.4	66.4

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, GEN = gentamicin, MER = meropenem, NIT = nitrofurantoin, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TEM = temocillin, TRI = trimethoprim

Figure 3: All-Wales susceptibility patterns for *E. coli* from outpatient urine samples (2023)

What the data shows

- Third generation cephalosporin (3GC) resistance was **10.7%** [9.8, 11.6].
- Amoxicillin (AMO) resistance was **51.3%** [49.8, 52.7].
- Co-amoxiclav (COA) resistance was **38.4%** [37.0, 39.9].
- Co-trimoxazole (COT) resistance was **30.2%** [28.9, 31.6].
- Fluoroquinolone (FQ) resistance was relatively low at **13.8%** [12.8, 14.8].
- Gentamicin (GEN) resistance was **7.7%** [6.9, 8.5].
- Piperacillin/tazobactam (PTZ) resistance was **8.9%** [8.1, 9.8].
- Trimethoprim (TRI) resistance was **33.6%** [32.2, 35.0].
- Resistance to fosfomycin (FOS), nitrofurantoin (NIT), pivmecillinam (PIV) and temocillin (TEM) was **1.2%**, **2.7%**, **5.3%** and **0.6%** respectively.
- Resistance to ertapenem (ERT), and meropenem was **≤0.02%**.



	3GC	AMO	COA	COT	ERT	FOS	FQ	GEN	MER	NIT	PIV	PTZ	TEM	TRI
2016 (n = 5,828)	9.1	56.4	19.9	70.6	0.86	4.2	14.7	11.8	0.17	4.2	7.6	13.7	2.4	39.4
2017 (n = 5,528)	9.2	57.1	20.3	70.4	0.86	3.9	15.4	12.9	0.17	4.0	7.8	15.5	1.5	38.6
2018 (n = 5,331)	8.4	55.6	28.0	63.9	0.34	2.6	14.3	10.1	0.00	3.9	7.1	23.1	0.8	36.3
2019 (n = 4,799)	10.0	57.7	30.3	52.6	0.32	2.2	15.3	11.2	0.35	4.5	8.5	17.9	1.1	36.6
2020 (n = 3,332)	9.9	58.9	37.1	36.1	0.48	1.1	16.7	10.1	0.24	4.4	7.7	12.7	0.0	34.9
2021 (n = 3,600)	9.2	57.0	40.5	31.6	0.12	1.2	14.2	8.5	0.00	3.8	6.2	10.1	0.0	33.8
2022 (n = 3,808)	9.2	51.7	38.8	28.0	0.17	1.2	13.4	6.8	0.11	3.0	3.9	7.9	2.1	31.6
2023 (n = 4,424)	10.7	51.3	38.4	30.2	0.00	1.2	13.8	7.7	0.02	2.7	5.3	8.9	0.6	33.6

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, GEN = gentamicin, MER = meropenem, NIT = nitrofurantoin, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TEM = temocillin, TRI = trimethoprim

Figure 4: All-Wales antimicrobial resistance rates for *E. coli* from outpatient urine samples (2016 to 2023)

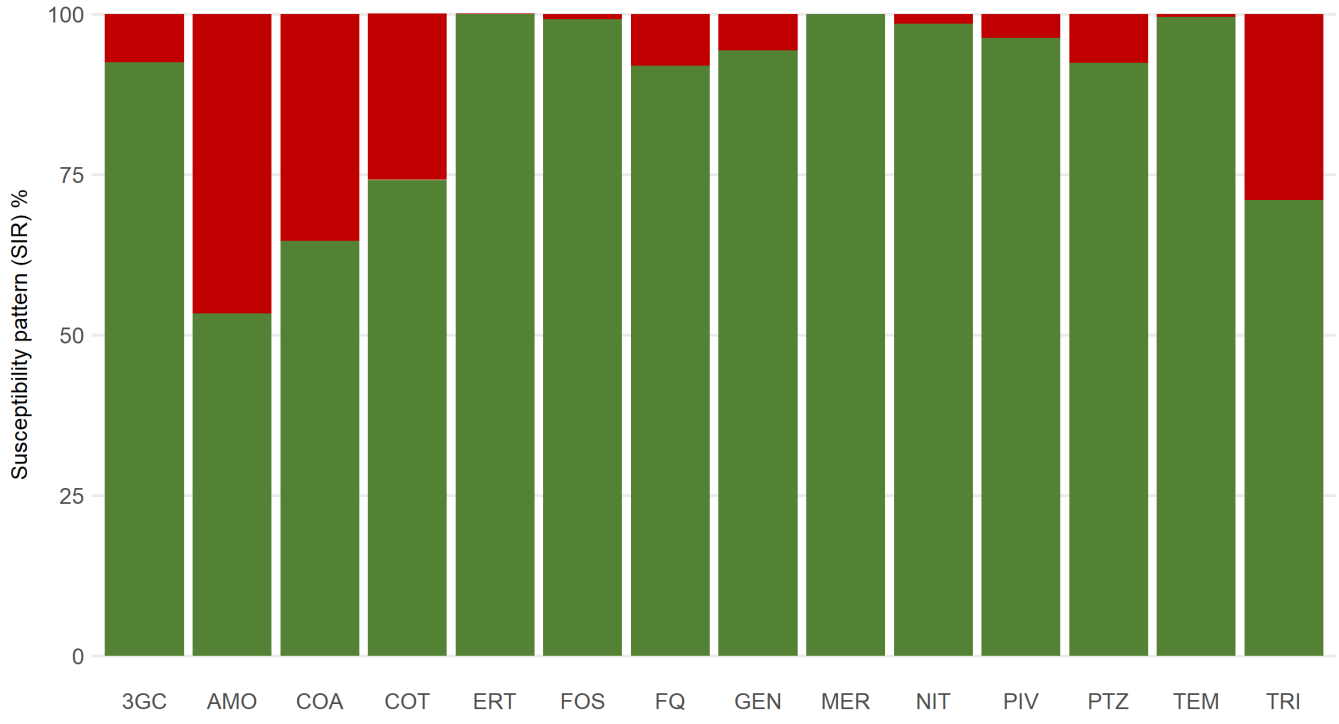
What the data shows

- There has been an increase in the number of *E. coli* with AST results for outpatient urine samples from **3,808** isolates in 2022 to **4,424** in 2023.

- A general increase in third generation cephalosporins resistance to **10.7%** in 2023.
- A decrease in amoxicillin resistance to **51.3%** in 2023.
- A levelling off in co-amoxiclav resistance at **38.4%** in 2023.
- No significant change in co-trimoxazole resistance compared to the 2022 rate, with resistance at **30.2%** in 2023.
- No significant change in fosfomycin resistance from 2020 onwards, with resistance at **1.2%** in 2023.
- A general decrease in fluoroquinolones resistance to **13.8%** in 2023.
- No significant change in gentamicin resistance compared to the 2022 rate, with resistance at **7.7%** in 2023.
- A decrease in nitrofurantoin resistance to **2.7%** in 2023.
- Variability in pivmecillinam resistance, with resistance at **5.3%** in 2023.
- No significant change in piperacillin/tazobactam resistance compared to the 2022 rate, with resistance at **8.9%** in 2023.
- Selective AST testing only for temocillin until 2023, trends cannot be inferred.
- A general decrease in trimethoprim resistance to **33.6%** in 2023.
- Ertapenem and meropenem resistance remains **≤0.02%**.

E. coli from community urine samples (n = 62,924 in 2023)

The **All-Wales** patterns of susceptibility (**S/I/R**) for *E. coli* from community urine samples in 2023 are shown in **Figure 5**. Trends in the resistance rates for the period 2016 to 2023 are shown in **Figure 6**.



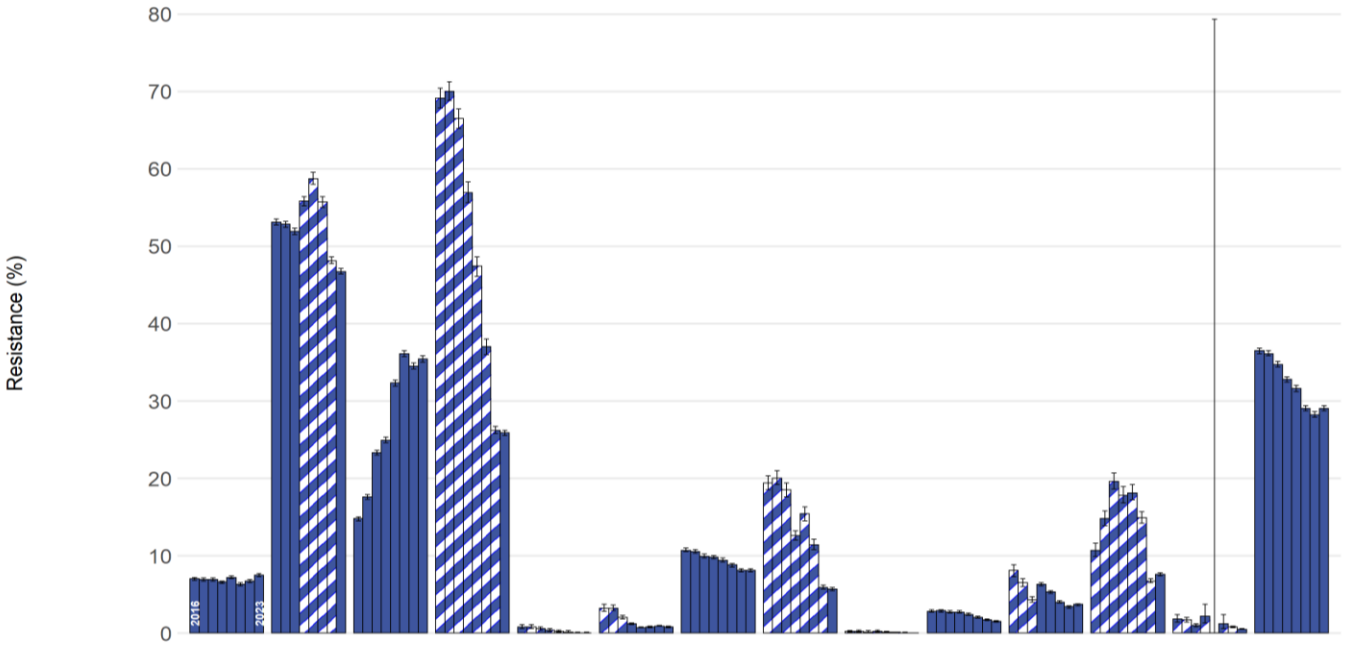
	3GC	AMO	COA	COT	ERT	FOS	FQ	GEN	MER	NIT	PIV	PTZ	TEM	TRI
%R	7.5	46.7	35.4	25.9	0.04	0.8	8.1	5.7	0.00	1.5	3.7	7.6	0.5	29.0
%I	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
%S	92.5	53.3	64.6	74.1	100	99.2	91.9	94.3	100	98.5	96.3	92.4	99.5	71.0

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, GEN = gentamicin, MER = meropenem, NIT = nitrofurantoin, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TEM = temocillin, TRI = trimethoprim

Figure 5: All-Wales susceptibility patterns for *E. coli* from community urine samples (2023)

What the data shows

- Third generation cephalosporin (3GC) resistance was **7.5%** [7.3, 7.7].
- Amoxicillin (AMO) resistance was **46.7%** [46.4, 47.1].
- Co-amoxiclav (COA) resistance was **35.4%** [35.0, 35.8].
- Co-trimoxazole (COT) resistance was **25.9%** [25.5, 26.2].
- Fluoroquinolone (FQ) resistance was **8.1%** [7.9, 8.3].
- Gentamicin (GEN) resistance was **5.7%** [5.5, 5.9].
- Piperacillin/tazobactam (PTZ) resistance was **7.6%** [7.4, 7.8].
- Trimethoprim (TRI) resistance was **29.0%** [28.7, 29.4].
- Resistance to fosfomycin (FOS), nitrofurantoin (NIT), pivmecillinam (PIV) and temocillin (TEM) was **0.8%**, **1.5%**, **3.7%** and **0.5%** respectively.
- Resistance to ertapenem (ERT), and meropenem was **≤0.04%**



	3GC	AMO	COA	COT	ERT	FOS	FQ	GEN	MER	NIT	PIV	PTZ	TEM	TRI
2016 (n = 68,511)	7.0	53.1	14.8	69.1	0.83	3.2	10.7	19.4	0.15	2.8	8.1	10.7	1.8	36.5
2017 (n = 69,987)	6.9	52.8	17.6	70.0	0.81	3.2	10.5	20.0	0.20	2.9	6.5	14.8	1.7	36.1
2018 (n = 69,622)	6.9	51.9	23.3	66.5	0.57	2.0	9.9	18.5	0.15	2.7	4.3	19.6	1.0	34.7
2019 (n = 66,531)	6.6	55.8	24.9	56.9	0.36	1.2	9.8	12.6	0.21	2.7	6.3	17.8	2.2	32.8
2020 (n = 52,557)	7.2	58.7	32.3	47.4	0.24	0.7	9.4	15.4	0.12	2.4	5.3	18.1	0.0	31.6
2021 (n = 55,795)	6.3	55.7	36.1	37.0	0.15	0.8	8.8	11.4	0.06	2.0	4.0	14.9	1.2	29.0
2022 (n = 58,407)	6.7	48.1	34.5	26.2	0.04	0.9	8.1	5.9	0.03	1.7	3.4	6.7	0.8	28.2
2023 (n = 62,924)	7.5	46.7	35.4	25.9	0.04	0.8	8.1	5.7	0.00	1.5	3.7	7.6	0.5	29.0

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, GEN = gentamicin, MER = meropenem, NIT = nitrofurantoin, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TEM = temocillin, TRI = trimethoprim

Figure 6: All-Wales antimicrobial resistance rates for *E. coli* from community urine samples (2016 to 2023)

What the data shows

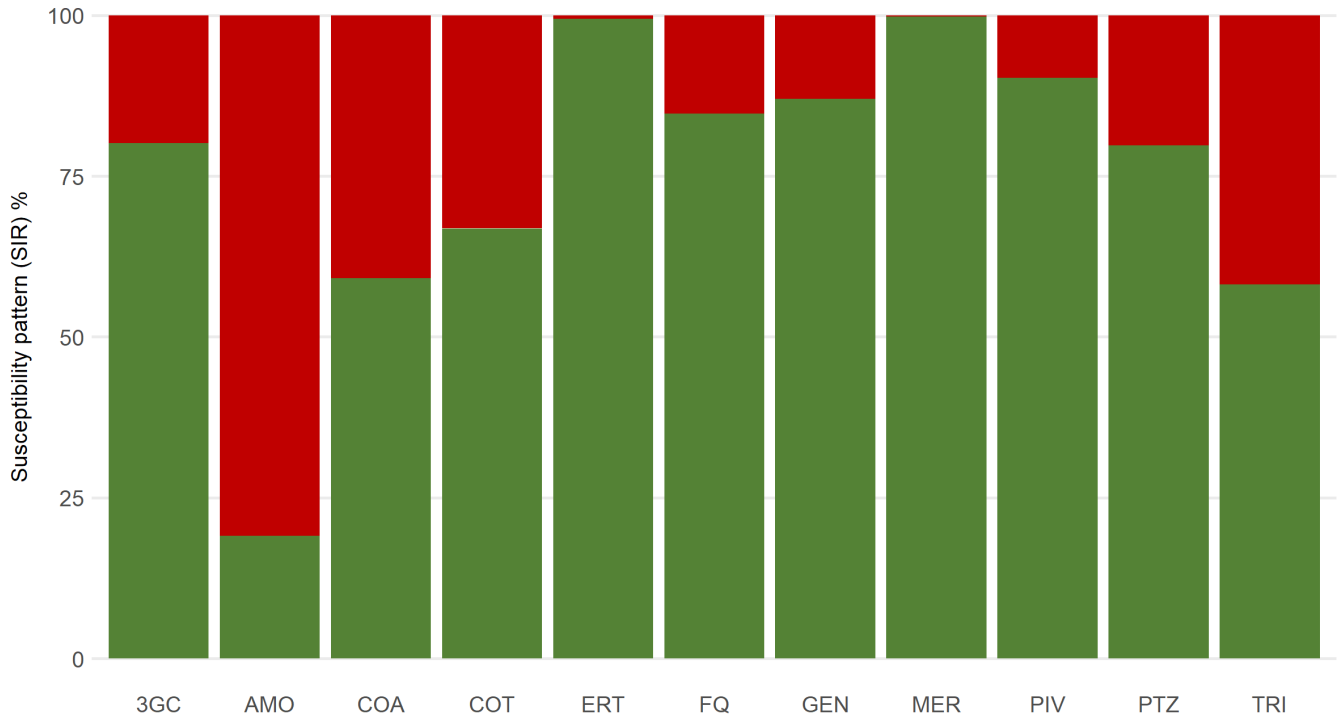
- There has been an increase in the number of *E. coli* with AST results from community urine samples from **58,407** isolates in 2022 to **62,924** in 2023.

- A general increase in third generation cephalosporins resistance, with resistance at **7.5%** in 2023.
- A decrease in amoxicillin resistance to **46.7%** in 2023.
- A levelling off in co-amoxiclav resistance at **35.4%** in 2023.
- No significant change in fosfomycin resistance from 2020 onwards, with resistance at **0.8%** in 2023.
- A decrease in fluoroquinolones resistance to **8.1%** in 2023.
- A decrease in nitrofurantoin resistance to **1.5%** in 2023.
- A general decrease in pivmecillinam resistance, with resistance at **3.7%** in 2023.
- Selective AST testing for co-trimoxazole, ertapenem, gentamicin, meropenem, temocillin and piperacillin/ tazobactam until 2023, trends cannot be inferred.

Non-*Escherichia coli* coliforms

Non-ECOL from inpatient urine samples (n = 5,992 in 2023)

The **All-Wales** patterns of susceptibility (**S/I/R**) for Non-ECOL from inpatient urine samples in 2023 are shown in **Figure 7**. Trends in the resistance rates for the period 2016 to 2023 are shown in **Figure 8**.



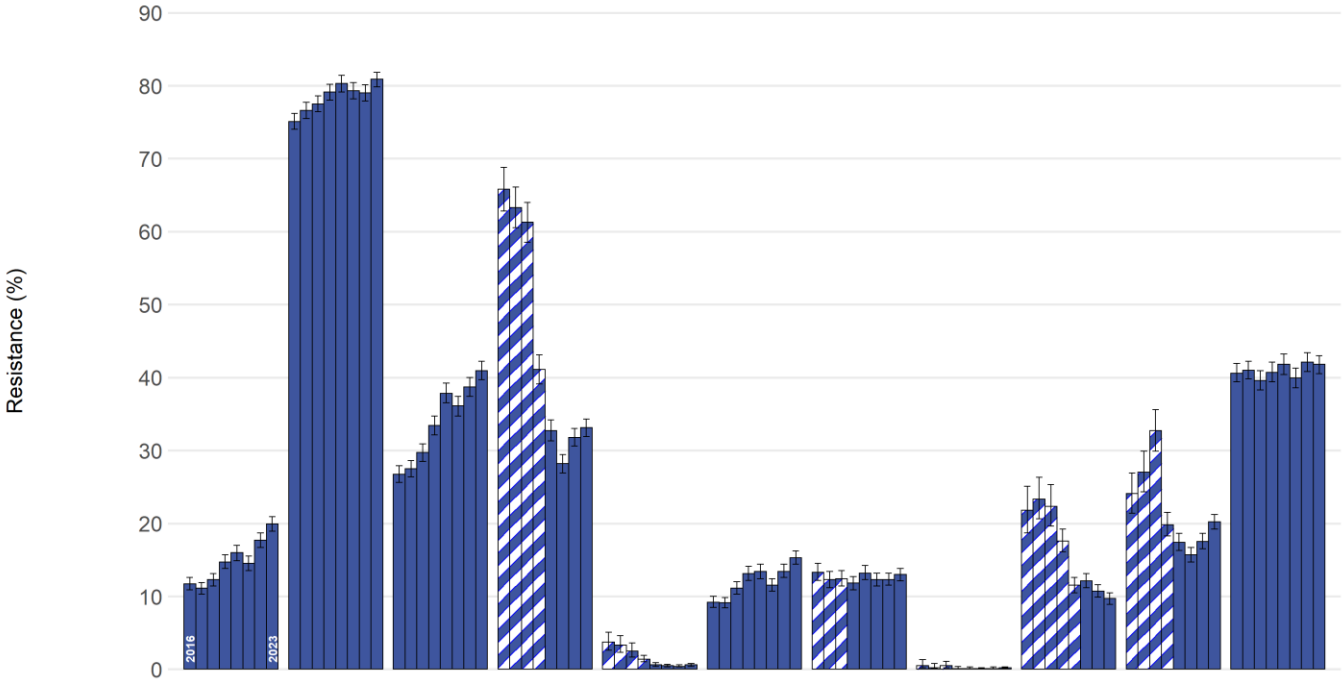
	3GC	AMO	COA	COT	ERT	FQ	GEN	MER	PIV	PTZ	TRI
%R	19.9	80.9	40.9	33.1	0.57	15.3	13.0	0.17	9.7	20.2	41.8
%I	-	-	-	0.1	-	-	-	-	-	-	-
%S	80.1	19.1	59.1	66.8	99.4	84.7	87.0	99.8	90.3	79.8	58.2

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, GEN = gentamicin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, MER = meropenem, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TRI = trimethoprim

Figure 7: All-Wales susceptibility patterns for Non-ECOL from inpatient urine samples (2023)

What the data shows

- Third generation cephalosporin (3GC) resistance was **19.9%** [18.9, 20.9].
- Amoxicillin (AMO) resistance was **80.9%** [79.8, 81.8].
- Co-amoxiclav (COA) resistance was **40.9%** [39.7, 42.2].
- Co-trimoxazole (COT) resistance was **33.1%** [31.9, 34.3].
- Fluoroquinolone (FQ) resistance was relatively low at **15.3%** [14.4, 16.2].
- Gentamicin (GEN) resistance was **13.0%** [12.1, 13.8].
- Pivmecillinam (PIV) resistance was **9.7%** [8.9, 10.5].
- Piperacillin/tazobactam (PTZ) resistance was **20.2%** [19.2, 21.2].
- Trimethoprim (TRI) resistance was **41.8%** [40.5, 43.0].
- Ertapenem (ERT) and meropenem (MER) resistance was **<1%**.



	3GC	AMO	COA	COT	ERT	FQ	GEN	MER	PIV	PTZ	TRI
2016 (n = 5,908)	11.7	75.1	26.7	65.8	3.67	9.2	13.3	0.55	21.8	24.1	40.6
2017 (n = 6,052)	11.1	76.6	27.5	63.3	3.25	9.1	12.3	0.21	23.3	27.0	41.0
2018 (n = 5,588)	12.3	77.5	29.7	61.3	2.46	11.1	12.4	0.49	22.3	32.7	39.6
2019 (n = 5,169)	14.7	79.1	33.4	41.1	1.36	13.1	11.8	0.14	17.6	19.8	40.7
2020 (n = 4,723)	16.0	80.3	37.8	32.7	0.65	13.4	13.2	0.12	11.5	17.4	41.8
2021 (n = 5,011)	14.5	79.3	36.1	28.2	0.49	11.5	12.3	0.06	12.1	15.7	39.9
2022 (n = 5,438)	17.7	79.0	38.7	31.8	0.39	13.4	12.3	0.15	10.7	17.5	42.1
2023 (n = 5,992)	19.9	80.9	40.9	33.1	0.57	15.3	13.0	0.17	9.7	20.2	41.8

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, GEN = gentamicin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, MER = meropenem, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TRI = trimethoprim

Figure 8: All-Wales antimicrobial resistance rates for Non-ECOL from inpatient urine samples (2016 to 2023)

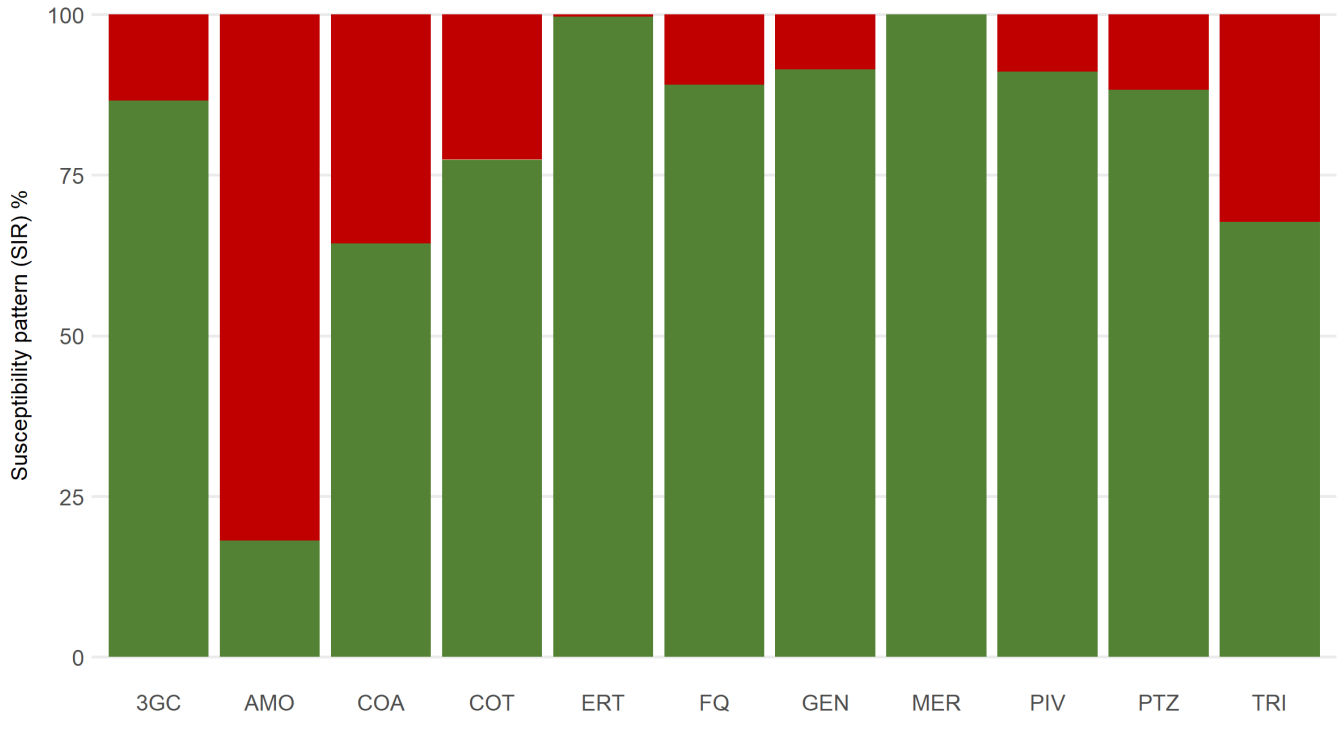
What the data shows

- There has been an increase in the number of non-*Escherichia coli* with AST results for inpatient urine samples from **5,438** isolates in 2022 to **5,992** in 2023.

- An increase in third generation cephalosporins resistance to **19.9%** in 2023.
- An increase in amoxicillin resistance to **80.9%** in 2023.
- An increase in co-amoxiclav resistance to **40.9%** in 2023.
- No significant change in co-trimoxazole resistance from 2020 onwards, with resistance at **33.1%** in 2023.
- An increase in fluoroquinolones resistance to **15.3%** in 2023.
- No significant change in gentamicin resistance, with resistance at **13.0%** in 2023.
- A decrease in pivmecillinam resistance from 2020 onwards, with resistance at **9.7%** in 2023.
- An increase in piperacillin/tazobactam resistance from 2021 onwards, with resistance at **20.2%** in 2023.
- No significant change in trimethoprim resistance, with resistance at **41.8%** in 2023.
- There has been an increase in ertapenem and meropenem resistance from 2021 onwards (when routine testing began). Resistance to both agents remains **<1%** at an All-Wales level.

Non-ECOL from outpatient urine samples (n = 2,128 in 2023)

The **All-Wales** patterns of susceptibility (**S/I/R**) for Non-ECOL from outpatient urine samples in 2023 are shown in **Figure 9**. Trends in the resistance rates for the period 2016 to 2023 are shown in **Figure 10**.



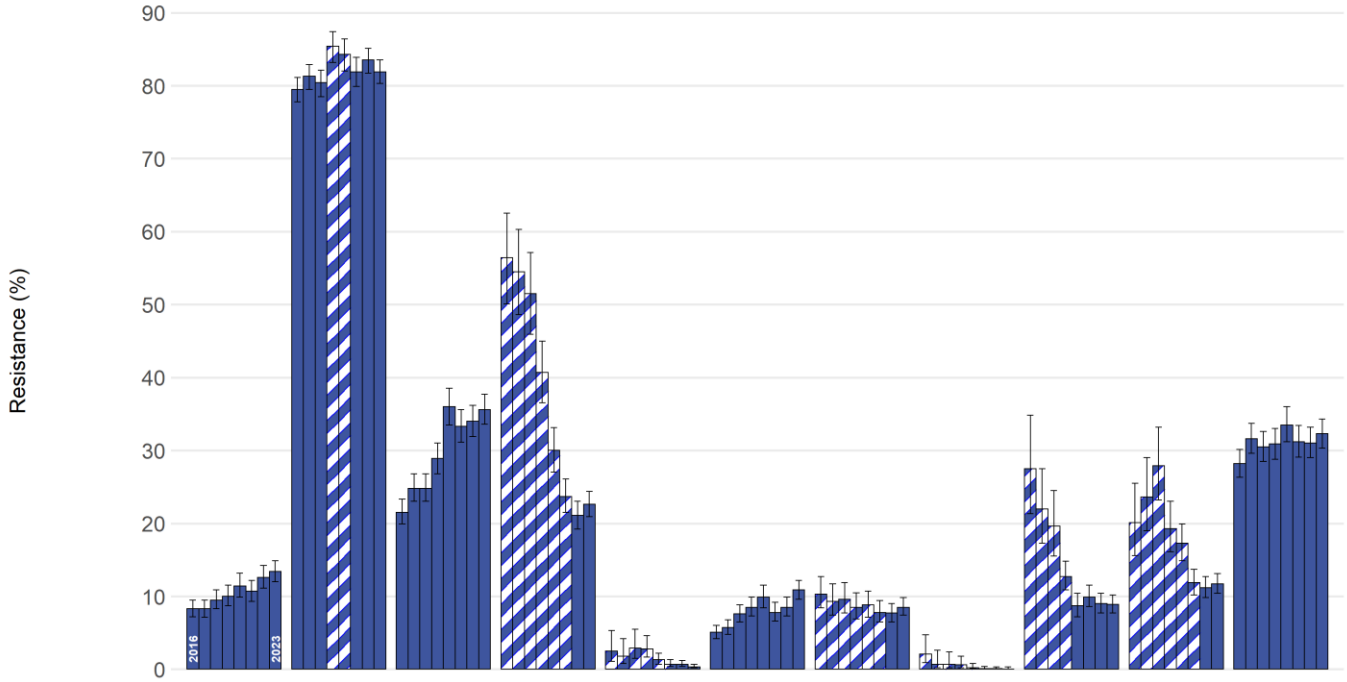
	3GC	AMO	COA	COT	ERT	FQ	GEN	MER	PIV	PTZ	TRI
%R	13.4	81.9	35.6	22.6	0.33	10.9	8.5	0.05	8.9	11.7	32.3
%I	-	-	-	0.1	-	-	-	-	-	-	-
%S	86.6	18.1	64.4	77.3	99.7	89.1	91.5	100	91.1	88.3	67.7

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, GEN = gentamicin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, MER = meropenem, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TRI = trimethoprim

Figure 9: All-Wales susceptibility patterns for Non-ECOL from outpatient urine samples (2023)

What the data shows

- Third generation cephalosporin (3GC) resistance was **13.4%** [12.0, 14.9].
- Amoxicillin (AMO) resistance was **81.9%** [80.3, 83.5].
- Co-amoxiclav (COA) resistance was **35.6%** [33.6, 37.7].
- Co-trimoxazole (COT) resistance was **22.6%** [20.9, 24.4].
- Fluoroquinolone (FQ) resistance was **10.9%** [9.6, 12.2].
- Gentamicin (GEN) resistance was **8.5%** [7.4, 9.8].
- Pivmecillinam (PIV) resistance was **8.9%** [7.7, 10.2].
- Piperacillin/tazobactam (PTZ) resistance was **11.7%** [10.4, 13.1].
- Trimethoprim (TRI) resistance was **32.3%** [30.3, 34.3].
- Ertapenem (ERT) and meropenem (MER) resistance was **<1%**.



	3GC	AMO	COA	COT	ERT	FQ	GEN	MER	PIV	PTZ	TRI
2016 (n = 2,235)	8.3	79.5	21.5	56.4	2.46	5.1	10.3	2.06	27.5	20.1	28.2
2017 (n = 2,014)	8.3	81.3	24.8	54.5	1.85	5.7	9.3	0.74	22.0	23.6	31.6
2018 (n = 1,972)	9.5	80.4	24.8	51.5	2.92	7.6	9.6	0.65	19.6	27.9	30.5
2019 (n = 1,818)	10.0	85.4	28.9	40.7	2.76	8.5	8.5	0.63	12.7	19.3	30.9
2020 (n = 1,455)	11.4	84.3	36.0	30.0	1.26	9.9	8.8	0.23	8.7	17.3	33.5
2021 (n = 1,721)	10.7	81.9	33.3	23.7	0.67	7.8	7.8	0.08	9.9	11.9	31.2
2022 (n = 1,838)	12.6	83.5	34.0	21.1	0.68	8.5	7.7	0.06	9.0	11.2	31.0
2023 (n = 2,128)	13.4	81.9	35.6	22.6	0.33	10.9	8.5	0.05	8.9	11.7	32.3

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, GEN = gentamicin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, MER = meropenem, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TRI = trimethoprim

Figure 10: All-Wales antimicrobial resistance rates for Non-ECOL from outpatient urine samples (2016 to 2023)

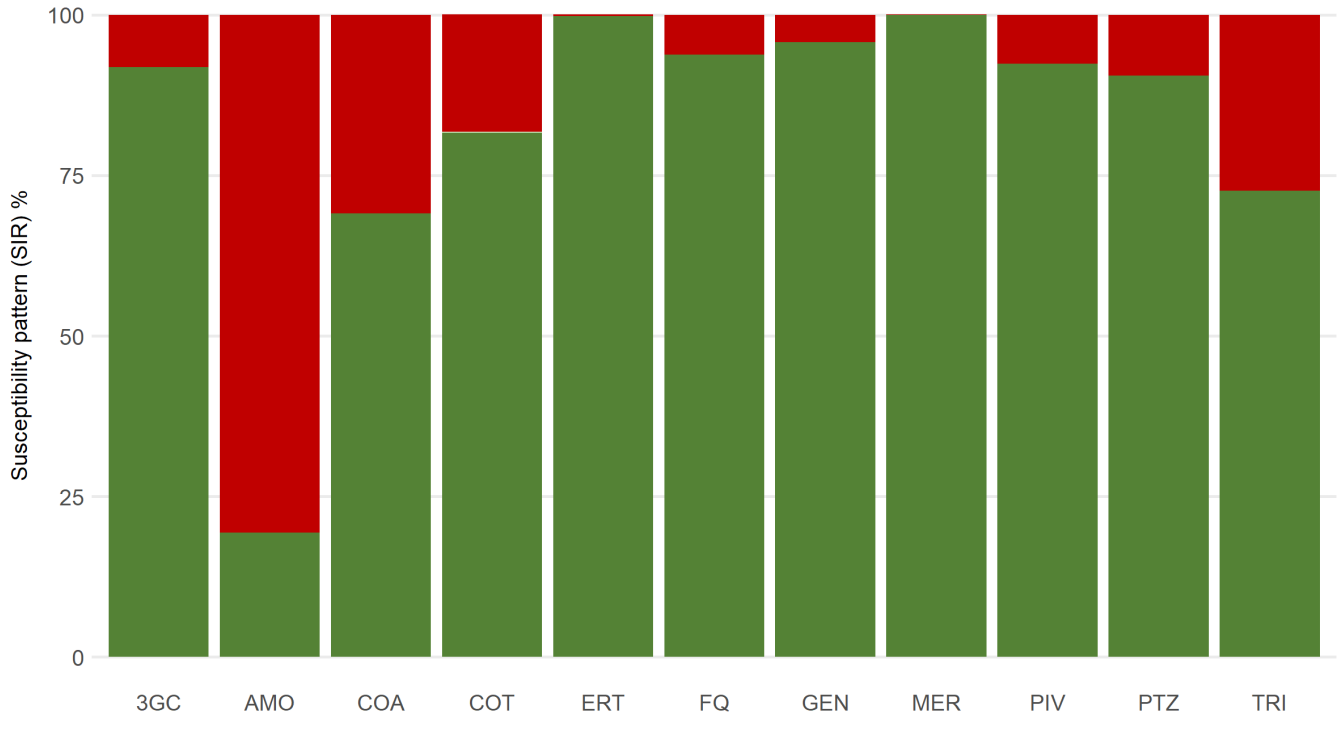
What the data shows

- There has been an increase in the number of non-*Escherichia coli* with AST results for outpatient urine samples from **1,838** isolates in 2022 to **2,128** in 2023.

- An increase in third generation cephalosporins resistance to **13.4%** in 2023.
- A general increase in amoxicillin resistance, with resistance at **81.9%** in 2023.
- An increase in co-amoxiclav resistance to **35.6%** in 2023.
- No significant change in co-trimoxazole resistance compared with the 2022 rate, with resistance at **22.6%** in 2023.
- An increase in fluoroquinolones resistance to **10.9%** in 2023.
- No significant change in gentamicin resistance compared with the 2022 rate, with resistance at **8.5%** in 2023.
- No significant change in pivmecillinam resistance from 2020 onwards, with resistance at **8.9%** in 2023.
- No significant change in piperacillin/tazobactam resistance compared with the 2022 rate, with resistance at **11.7%** in 2023.
- No significant change in trimethoprim resistance, with resistance at **32.3%** in 2023.
- A decrease in ertapenem and meropenem resistance from 2021 onwards to **0.33%** and **0.05%** respectively, at an All-Wales level.

Non-ECOL from community urine samples (n = 19,605 in 2023)

The **All-Wales** patterns of susceptibility (**S/I/R**) for Non-ECOL from community urine samples in 2023 are shown in **Figure 11**. Trends in the resistance rates for the period 2016 to 2023 are shown in **Figure 12**.



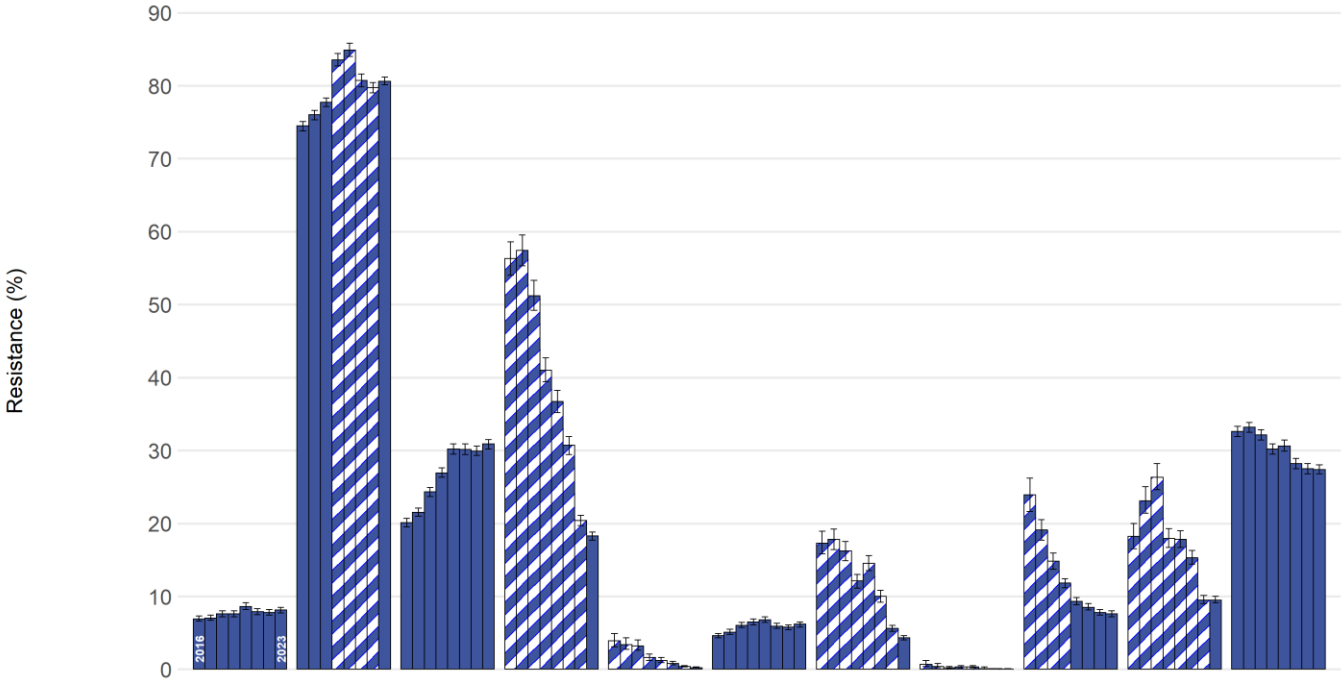
	3GC	AMO	COA	COT	ERT	FQ	GEN	MER	PIV	PTZ	TRI
%R	8.1	80.6	30.9	18.3	0.23	6.2	4.3	0.04	7.6	9.5	27.4
%I	-	-	-	0.2	-	-	-	-	-	-	-
%S	91.9	19.4	69.1	81.6	99.8	93.8	95.7	100	92.4	90.5	72.6

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, GEN = gentamicin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, MER = meropenem, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TRI = trimethoprim

Figure 11: All-Wales susceptibility patterns for Non-ECOL from community urine samples (2023)

What the data shows

- Third generation cephalosporin (3GC) resistance was **8.1%** [7.7, 8.5].
- Amoxicillin (AMO) resistance remains high at **80.6%** [80.1, 81.2].
- Co-amoxiclav (COA) resistance was **30.9%** [30.2, 31.5].
- Co-trimoxazole (COT) resistance was **18.3%** [17.7, 18.8].
- Fluoroquinolone (FQ) resistance was relatively low at **6.2%** [5.8, 6.5].
- Gentamicin (GEN) resistance was relatively low at **4.3%** [4.0, 4.6].
- Pivmecillinam (PIV) resistance was relatively low at **7.6%** [7.2, 8.0].
- Piperacillin/tazobactam (PTZ) resistance was **9.5%** [9.1, 10.0].
- Trimethoprim (TRI) resistance was **27.4%** [26.8, 28.0].
- Ertapenem (ERT) and meropenem (MER) resistance was **<1%**.



	3GC	AMO	COA	COT	ERT	FQ	GEN	MER	PIV	PTZ	TRI
2016 (n = 17,504)	6.9	74.5	20.1	56.3	3.88	4.6	17.3	0.66	23.9	18.2	32.6
2017 (n = 18,991)	7.0	76.0	21.5	57.4	3.40	5.1	17.8	0.42	19.1	23.1	33.2
2018 (n = 18,742)	7.6	77.7	24.3	51.2	3.20	6.0	16.2	0.17	14.8	26.3	32.1
2019 (n = 17,085)	7.6	83.5	26.9	41.0	1.60	6.5	12.1	0.28	11.8	17.9	30.2
2020 (n = 15,481)	8.6	84.9	30.2	36.7	1.20	6.8	14.5	0.29	9.3	17.8	30.6
2021 (n = 16,598)	7.9	80.7	30.1	30.7	0.82	5.9	10.0	0.13	8.5	15.3	28.2
2022 (n = 17,441)	7.8	79.7	29.9	20.4	0.42	5.8	5.6	0.06	7.8	9.5	27.5
2023 (n = 19,605)	8.1	80.6	30.9	18.3	0.23	6.2	4.3	0.04	7.6	9.5	27.4

Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, COT = co-trimoxazole, ERT = ertapenem, GEN = gentamicin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, MER = meropenem, PIV = pivmecillinam, PTZ = piperacillin/tazobactam, TRI = trimethoprim

Figure 12: All-Wales antimicrobial resistance rates for Non-ECOL from community urine samples (2016 to 2023)

What the data shows

- There has been an increase in the number of non-*Escherichia coli* with AST results for community urine samples from **17,441** isolates in 2022 to **19,605** in 2023.

- An increase in third generation cephalosporin resistance to **8.1%** in 2023.
- A general increase in amoxicillin resistance, with resistance at **80.6** in 2023.
- An increase in co-amoxiclav resistance to **30.9%** in 2023.
- A levelling off in fluoroquinolones resistance, with resistance at **6.2%** in 2023.
- A levelling off in pivmecillinam resistance with resistance at **7.6%** in 2023.
- A decrease in trimethoprim resistance to **27.4** in 2023.
- Selective AST testing only for co-trimoxazole, ertapenem, gentamicin, meropenem and piperacillin/ tazobactam testing until 2023, trends cannot be inferred.

Useful links:

Review on Antimicrobial Resistance May 2016
https://amr-review.org/

UK Antimicrobial Resistance Strategy 2013 – 18
https://www.gov.uk/government/publications/uk-5-year-antimicrobial-resistance-strategy-2013-to-2018

Antimicrobial Resistance Delivery Plan (Wales) 'Together for Health: Tackling antimicrobial resistance & improving antibiotic prescribing.
http://www.wales.nhs.uk/sitesplus/documents/888/Antimicrobial%20Resistance%20Delivery%20Plan.pdf

UK 20-year vision for antimicrobial resistance
https://www.gov.uk/government/publications/uk-20-year-vision-for-antimicrobial-resistance

Antimicrobial resistance: UK launches 5-year action plan and 20-year vision
https://www.gov.uk/government/news/antimicrobial-resistance-uk-launches-5-year-action-plan-and-20-year-vision

EUCAST EUROPEAN COMMITTEE ON ANTIMICROBIAL SUSCEPTIBILITY TESTING
European Society of Clinical Microbiology and Infectious Diseases

https://eucast.org/clinical_breakpoints