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Healthcare Associated Infection, Antimicrobial Resistance and Prescribing Programme

Antimicrobial Resistance in Urinary Coliforms Wales 2016-2022



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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 now 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 design empirical therapy 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 2021.
- There has been a significant decrease in trimethoprim resistance in *E. coli* from urine samples between 2016 and 2022; 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

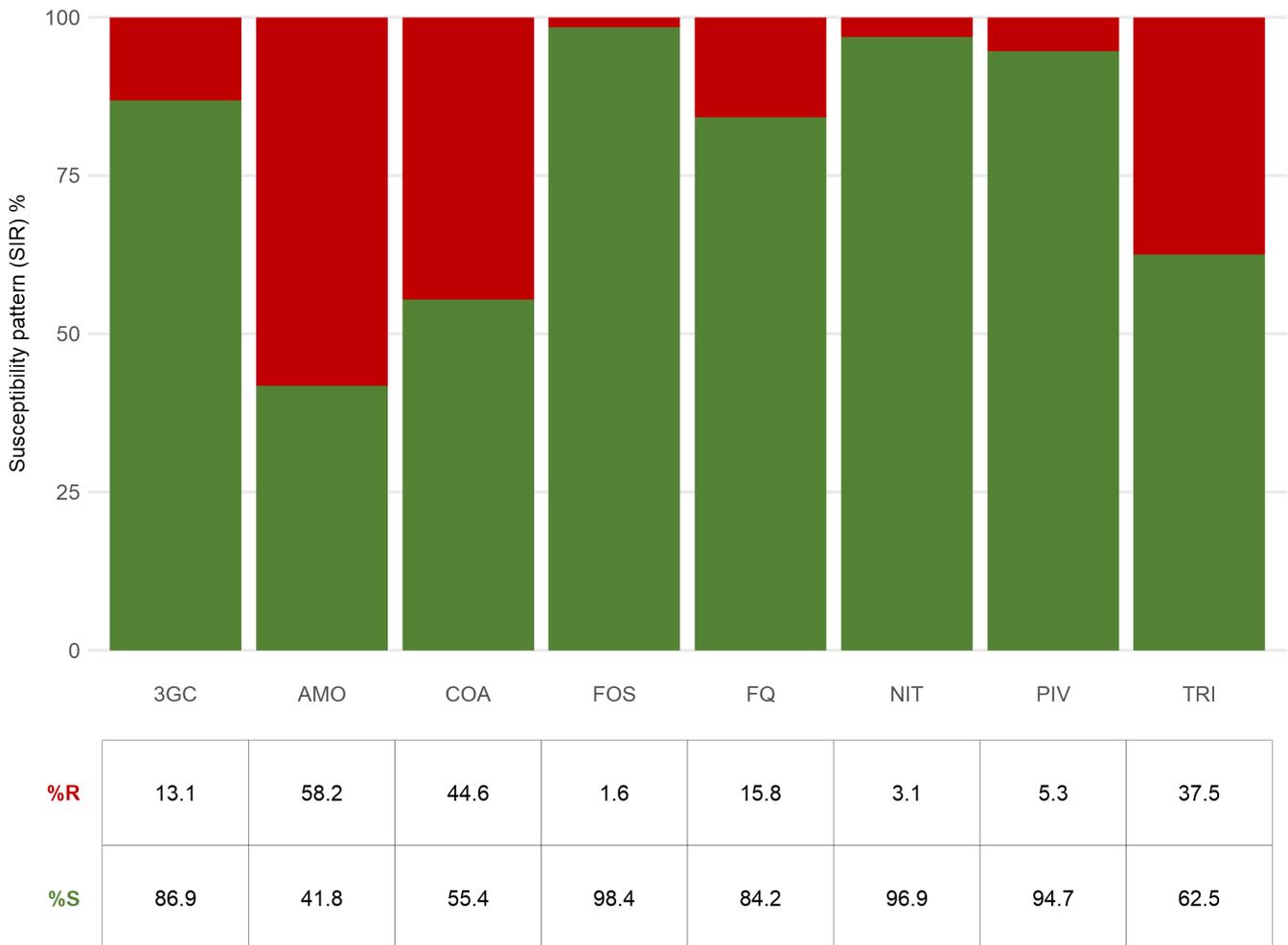
The urinary organisms are split into two groups in this report (1) *Escherichia coli* and (2) non-ECOL. The Non-ECOL group comprised:

- *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 = 9,784 in 2022)

The **All-Wales** patterns of susceptibility (**S/I/R**) for *E. coli* from inpatient urine samples in 2022 are shown in **Figure 1**. Trends in the resistance rates for the period 2016 to 2022 are shown in **Figure 2**.

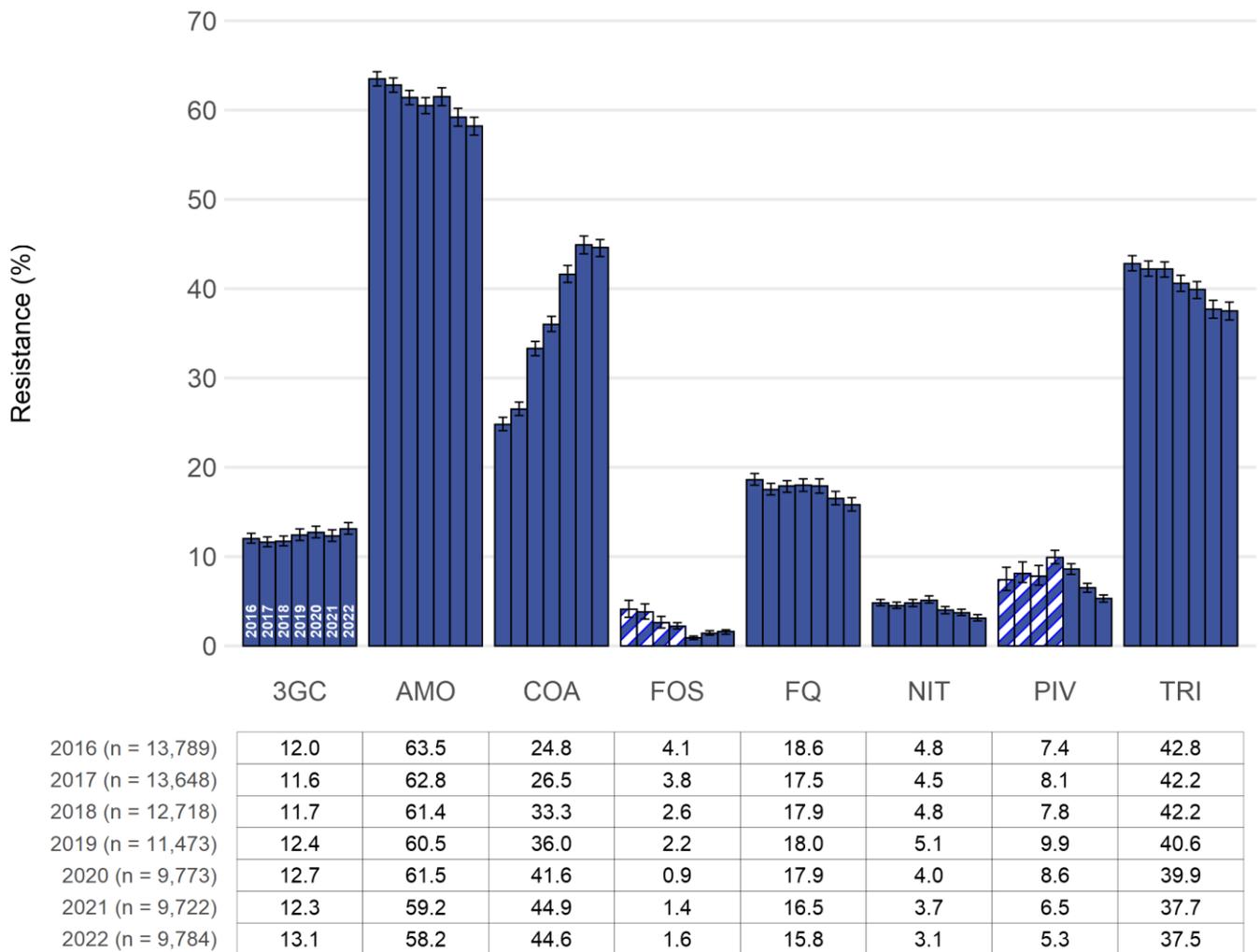


Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, NIT = nitrofurantoin, PIV = pivmecillinam, TRI = trimethoprim

Figure 1: All-Wales susceptibility patterns for *E. coli* from inpatient urine samples (2022)

What the data shows

- Third generation cephalosporin resistance was relatively low at **13.1%** [12.5, 13.8].
- Amoxicillin resistance remains high at **58.2%** [57.2, 59.2].
- Co-amoxiclav resistance was **44.6%** [43.6, 45.5].
- Fluoroquinolone resistance was relatively low at **15.8%** [15.1, 16.6].
- Trimethoprim resistance was **37.5%** [36.5, 38.5].
- Resistance to fosfomycin, nitrofurantoin, and pivmecillinam was less than **10%**.



Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, NIT = nitrofurantoin, PIV = pivmecillinam, TRI = trimethoprim

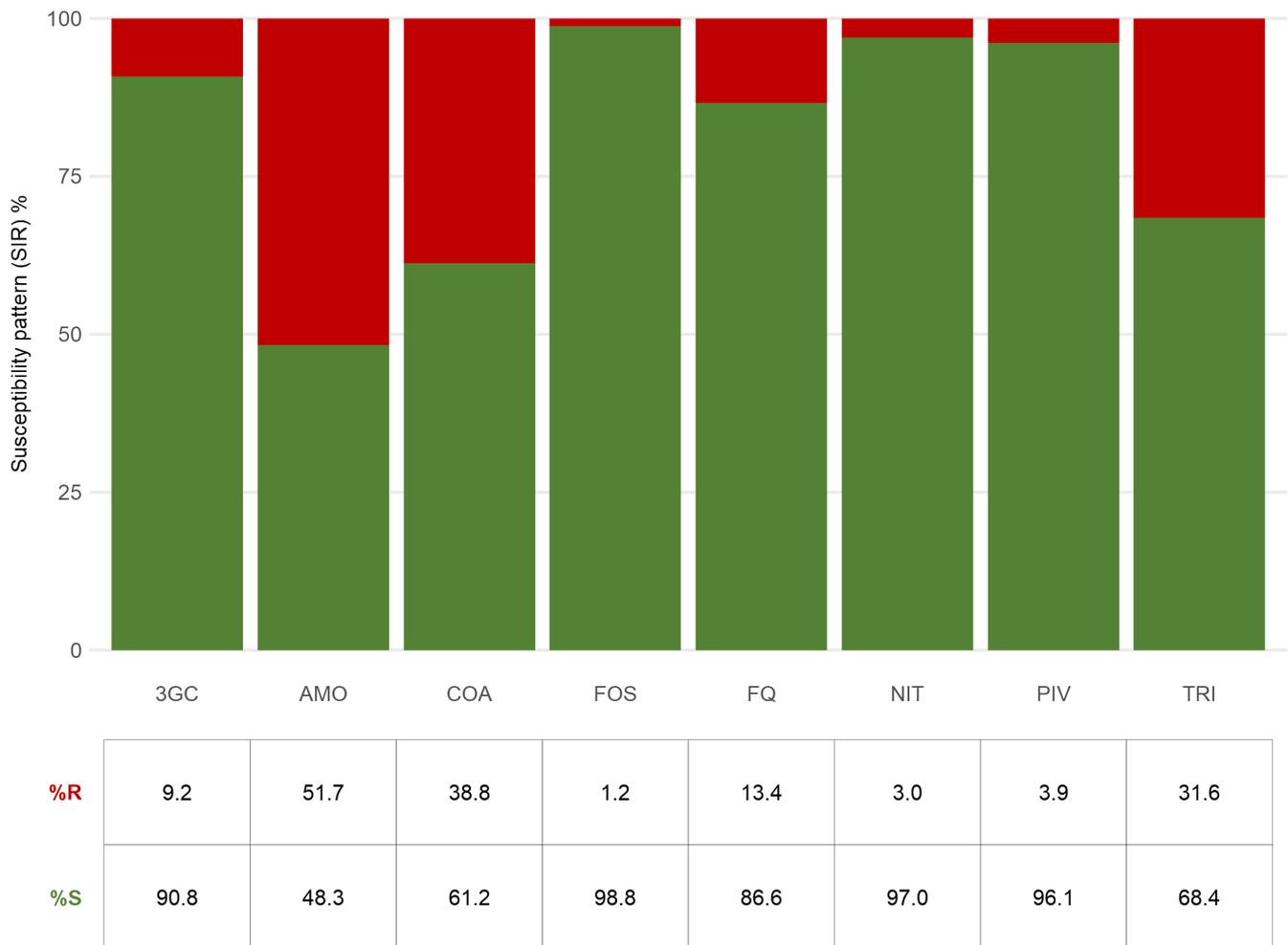
Figure 2: All-Wales antimicrobial resistance rates for *E. coli* from inpatient urine samples (2016 to 2022)

What the data shows

- There has been no significant change in resistance for third generation cephalosporins.
- There has been a statistically significant decrease in amoxicillin resistance from 2016-2022, but resistance remains high in 2022 at **58.2%**.
- There has been a statistically significant increase in co-amoxiclav resistance from 2016-2021, which levelled off in 2022 at **44.6%**.
- Data for fosfomycin and pivmecillinam for 2016-2019 are presented as striped bars in the graph, signifying that <80% of isolates were tested against these agents. This suggests selective testing, and indicates the data should be interpreted with caution.
- There appears to be a small downward trend in resistance for the fluoroquinolone group and nitrofurantoin.
- There has been a statistically significant decrease in trimethoprim resistance from 2016-2022, probably linked to changes in the guidance for treatment of UTI.

E. coli from outpatient urine samples (n = 3,808 in 2022)

The **All-Wales** patterns of susceptibility (**S/I/R**) for *E. coli* from outpatient urine samples in 2022 are shown in **Figure 3**. Trends in the resistance rates for the period 2016 to 2022 are shown in **Figure 4**.



Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, NIT = nitrofurantoin, PIV = pivmecillinam, TRI = trimethoprim

Figure 3: All-Wales susceptibility patterns for *E. coli* from outpatient urine samples (2022)

What the data shows

- Third generation cephalosporin resistance was relatively low at **9.2%** [8.3, 10.1].
- Amoxicillin resistance remains high at **51.7%** [50.1, 53.3].
- Co-amoxiclav resistance was **38.8%** [37.2, 40.3].
- Fluoroquinolone resistance was relatively low at **13.4%** [12.4, 14.6].
- Trimethoprim resistance was **31.6%** [30.1, 33.1].
- Resistance to fosfomycin, nitrofurantoin, and pivmecillinam was less than **5%**.

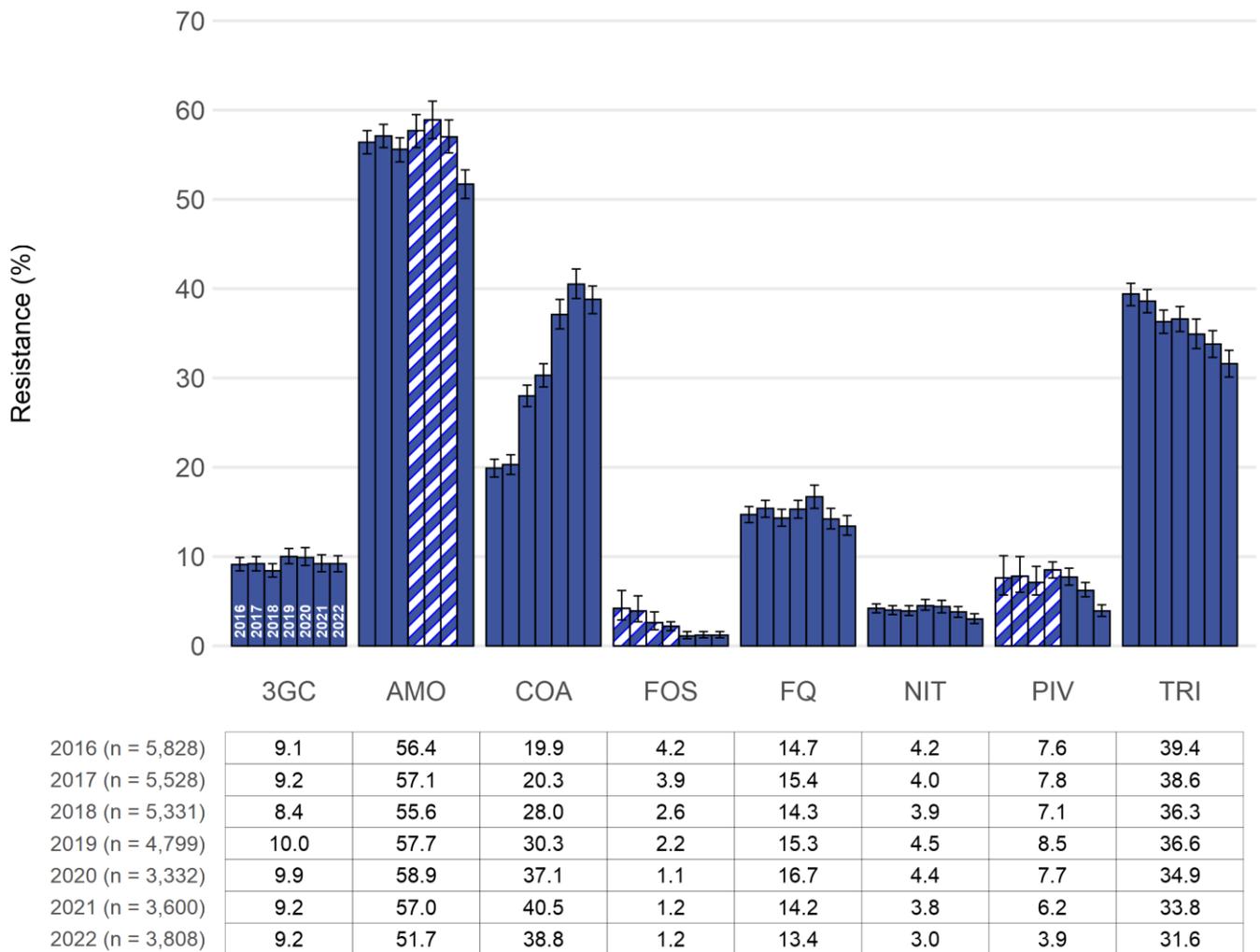


Figure 4: All-Wales antimicrobial resistance rates for *E. coli* from outpatient urine samples (2016 to 2022)

What the data shows

- There has been no significant change in resistance for third generation cephalosporins.
- There has been a statistically significant decrease in amoxicillin resistance from 2016-2022, but resistance remains high in 2022 at **51.7%**.
- There has been a statistically significant increase in co-amoxiclav resistance from 2016-2021, which levelled off in 2022 at **38.8%**.
- Data for amoxicillin, fosfomycin and pivmecillinam are presented as striped bars in the graph, signifying that <80% of isolates were tested against these agents. This suggests selective testing, and indicates the data should be interpreted with caution.
- There has been no significant change in resistance for the fluoroquinolone group or nitrofurantoin.
- There has been a statistically significant decrease in trimethoprim resistance from 2016-2022, probably linked to changes in the guidance for treatment of UTI.

E. coli from community urine samples (n = 58,407 in 2022)

The **All-Wales** patterns of susceptibility (**S/I/R**) for *E. coli* from community urine samples in 2022 are shown in **Figure 5**. Trends in the resistance rates for the period 2016 to 2022 are shown in **Figure 6**.

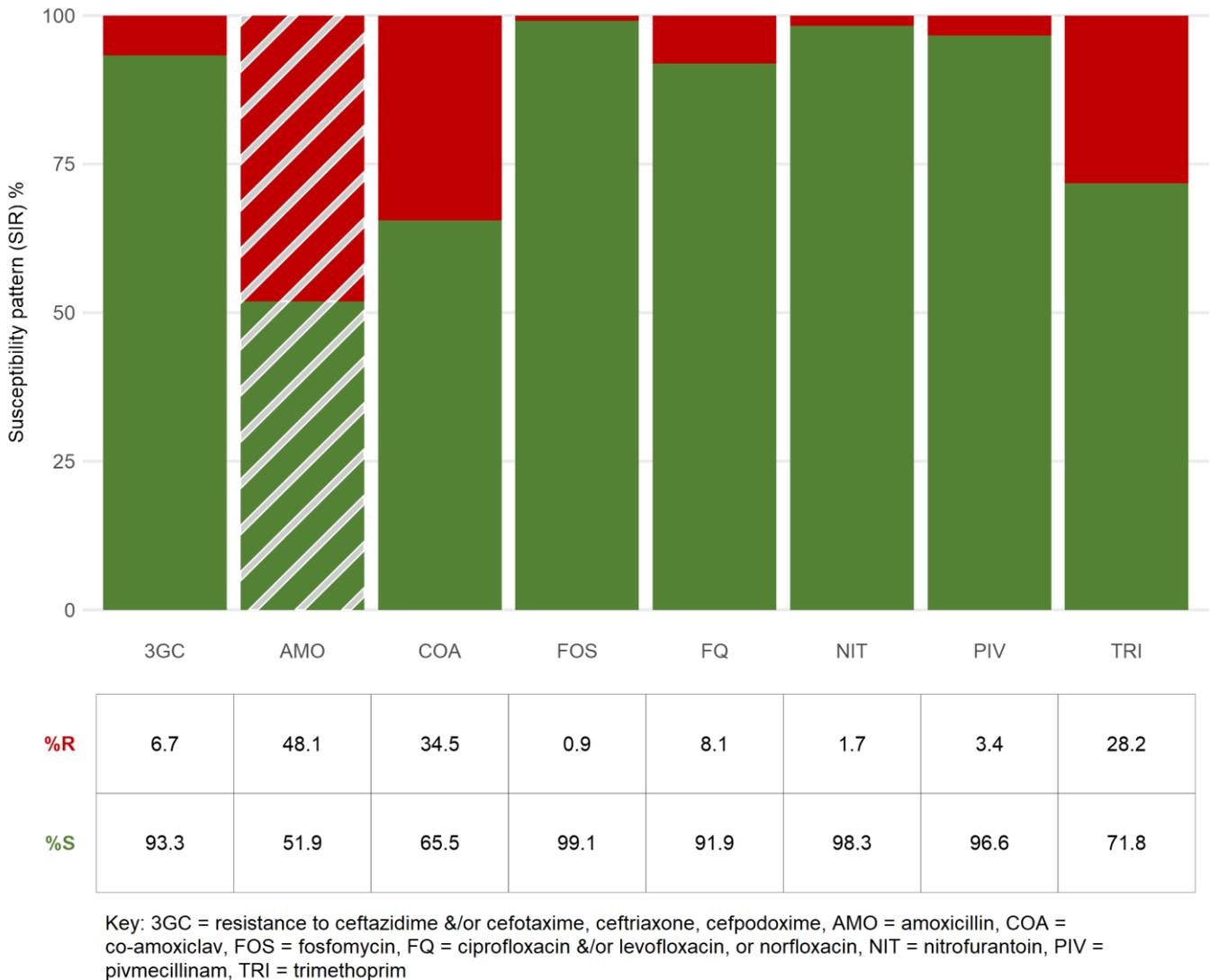
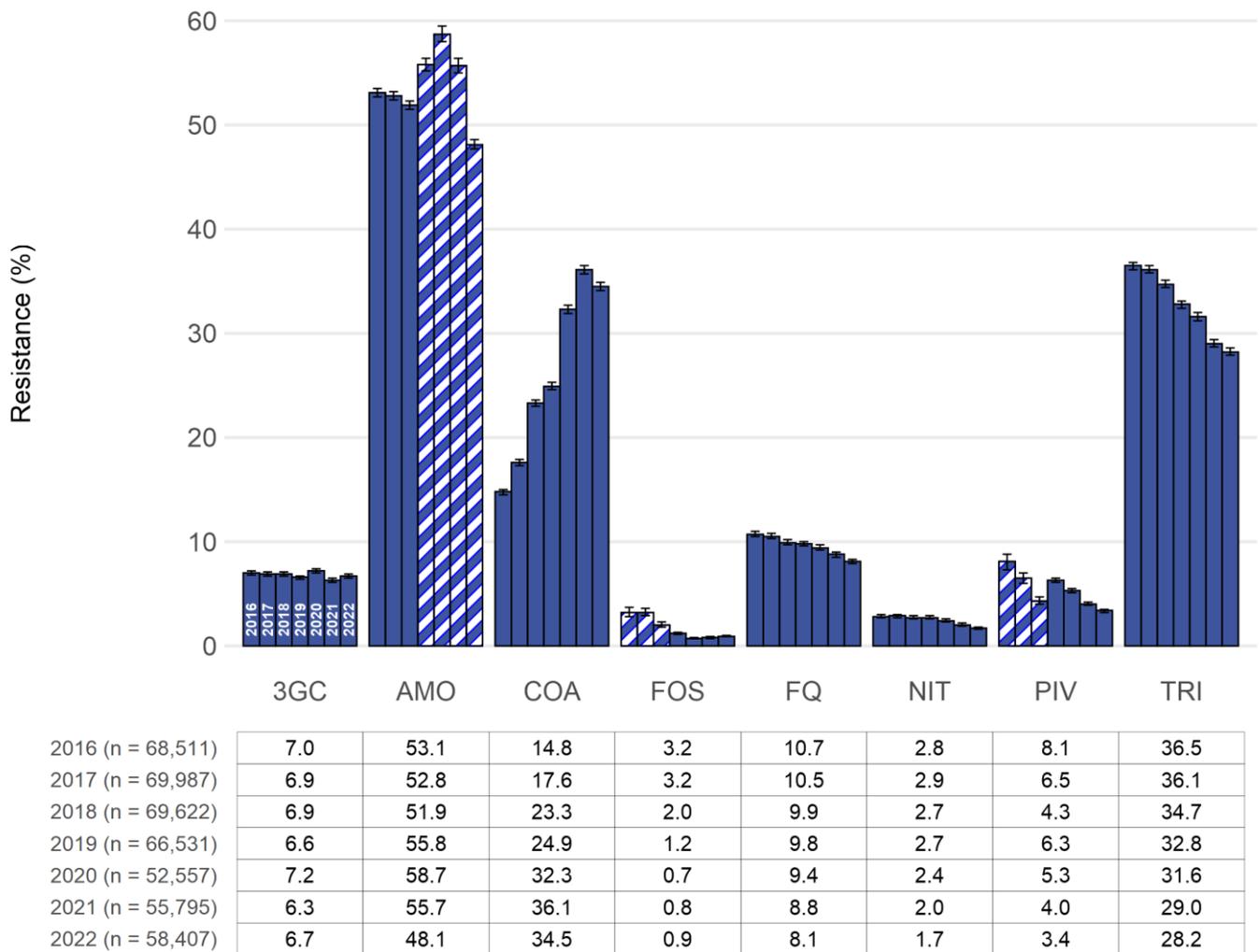


Figure 5: All-Wales susceptibility patterns for *E. coli* from community urine samples (2022)

What the data shows

- Third generation cephalosporin resistance was relatively low at **6.7%** [6.5, 6.9].
- Amoxicillin data is presented as a striped bar which indicates that <80% of isolates were tested against this agent: This suggests selective testing, and this data should be interpreted with caution.
- Co-amoxiclav resistance was **34.5%** [34.1, 34.9].
- Fluoroquinolone resistance was relatively low at **8.1%** [7.9, 8.3].
- Trimethoprim resistance was **28.2%** [27.9, 28.6].
- Resistance to fosfomycin, nitrofurantoin, and pivmecillinam was less than **5%**.



Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FOS = fosfomycin, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, NIT = nitrofurantoin, PIV = pivmecillinam, TRI = trimethoprim

Figure 6: All-Wales antimicrobial resistance rates for *E. coli* from community urine samples (2016 to 2022)

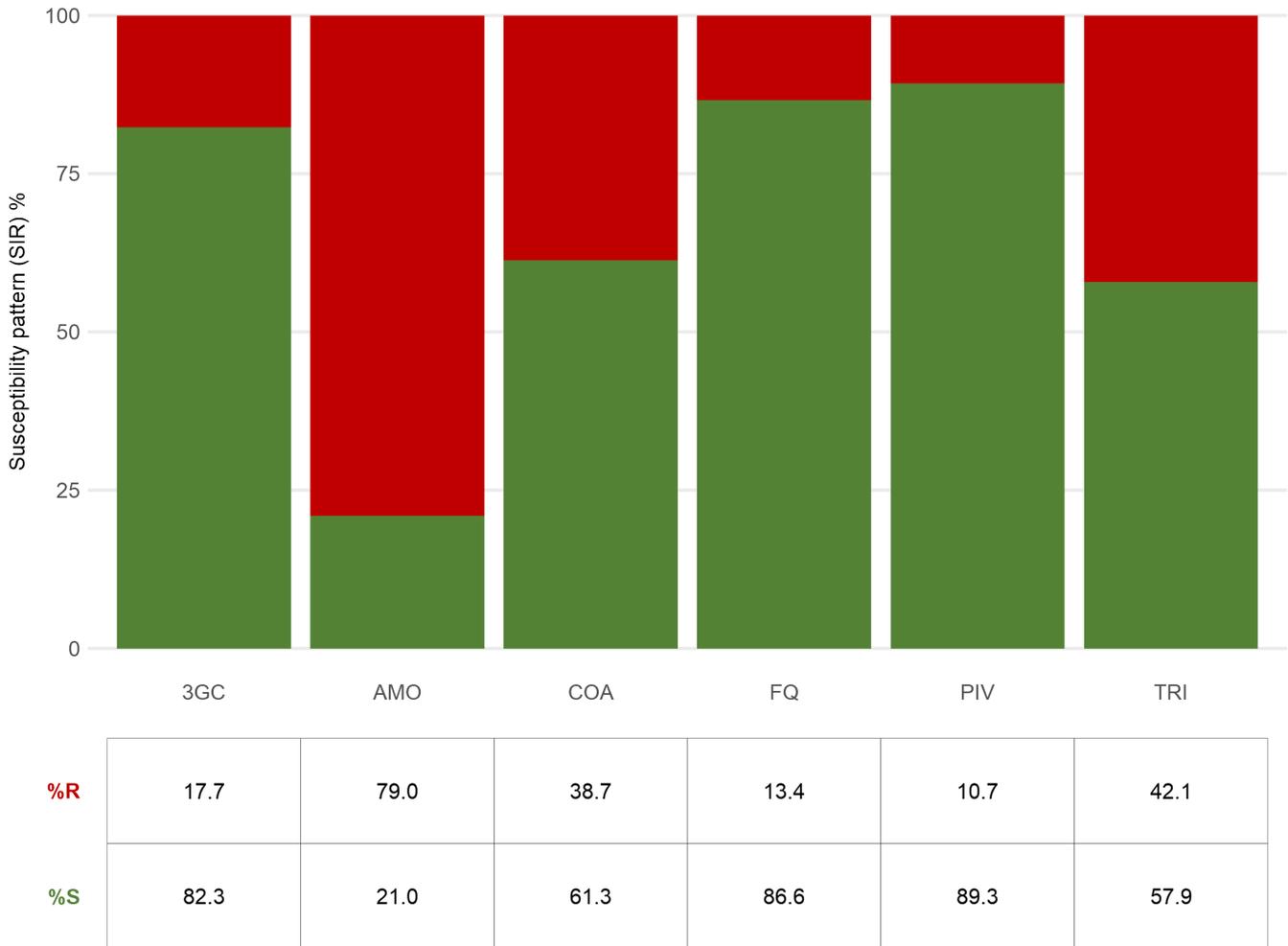
What the data shows

- There has been no significant change in resistance for third generation cephalosporins.
- There has been a statistically significant increase in co-amoxiclav resistance from 2016-2021, which levelled off in 2022 at **34.5%**.
- Data for amoxicillin, fosfomycin and pivmecillinam are presented as striped bars in the graph for some years, signifying that <80% of isolates were tested against these agents. This suggests selective testing, and indicates the data should be interpreted with caution.
- There appears to be a small downward trend in resistance for the fluoroquinolone group and nitrofurantoin.
- There has been a statistically significant decrease in trimethoprim resistance from 2016-2022, probably linked to changes in the guidance for treatment of UTI.

Non-*Escherichia coli* coliforms

Non-ECOL from inpatient urine samples (n = 5,438 in 2022)

The **All-Wales** patterns of susceptibility (**S/I/R**) for Non-ECOL from inpatient urine samples in 2022 are shown in **Figure 7**. Trends in the resistance rates for the period 2016 to 2022 are shown in **Figure 8**.

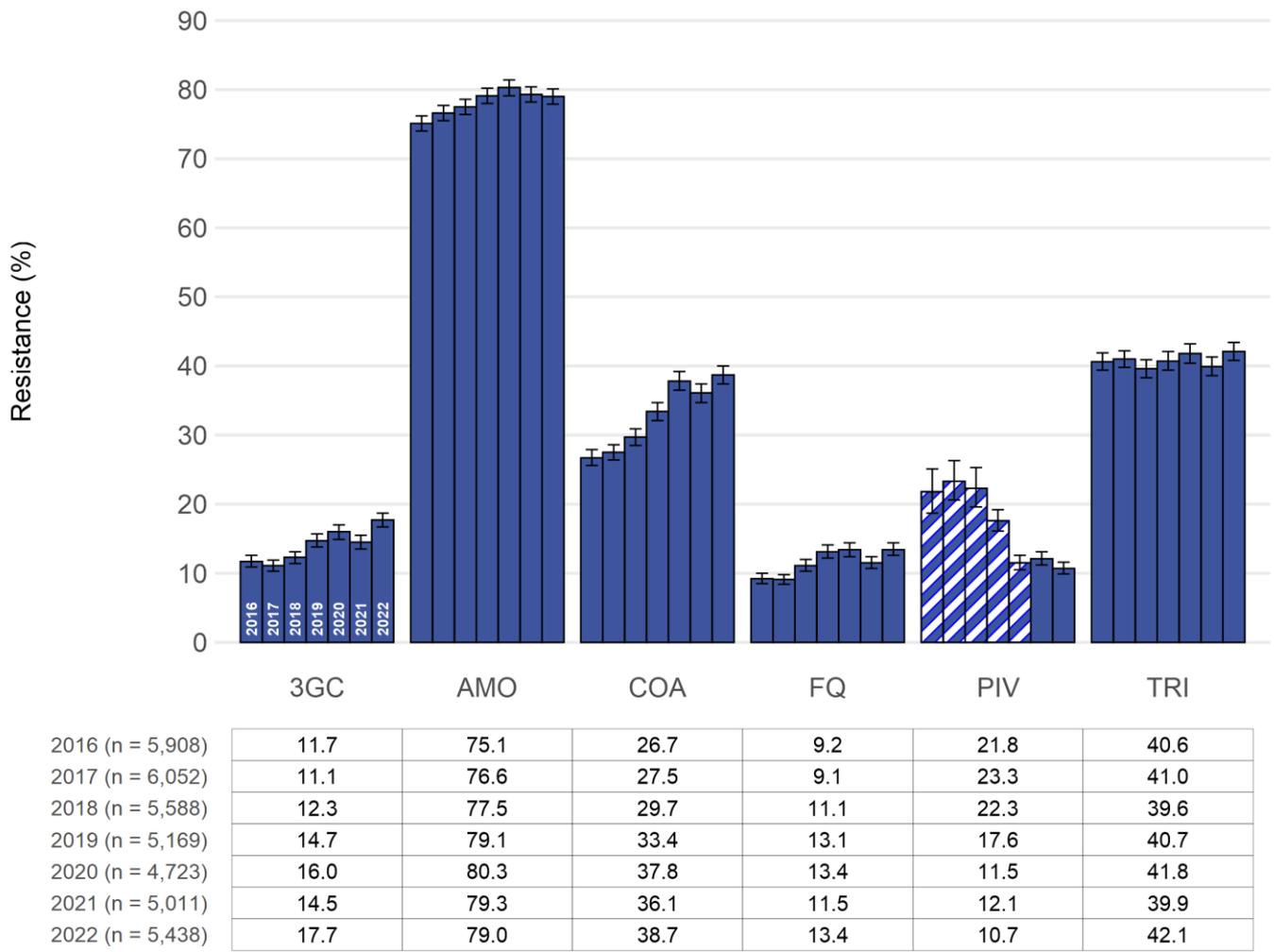


Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, PIV = pivmecillinam, TRI = trimethoprim

Figure 7: All-Wales susceptibility patterns for Non-ECOL from inpatient urine samples (2022)

What the data shows

- Third generation cephalosporin resistance was **17.7%** [16.7, 18.7].
- Amoxicillin resistance remains high at **79.0%** [77.9, 80.1].
- Co-amoxiclav resistance was **38.7%** [37.4, 40.0].
- Fluoroquinolone resistance was relatively low at **13.4%** [12.6, 14.4].
- Pivmecillinam resistance was relatively low at **10.7%** [9.9, 11.6].
- Trimethoprim resistance was **42.1%** [40.8, 43.4].



Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, PIV = pivmecillinam, TRI = trimethoprim

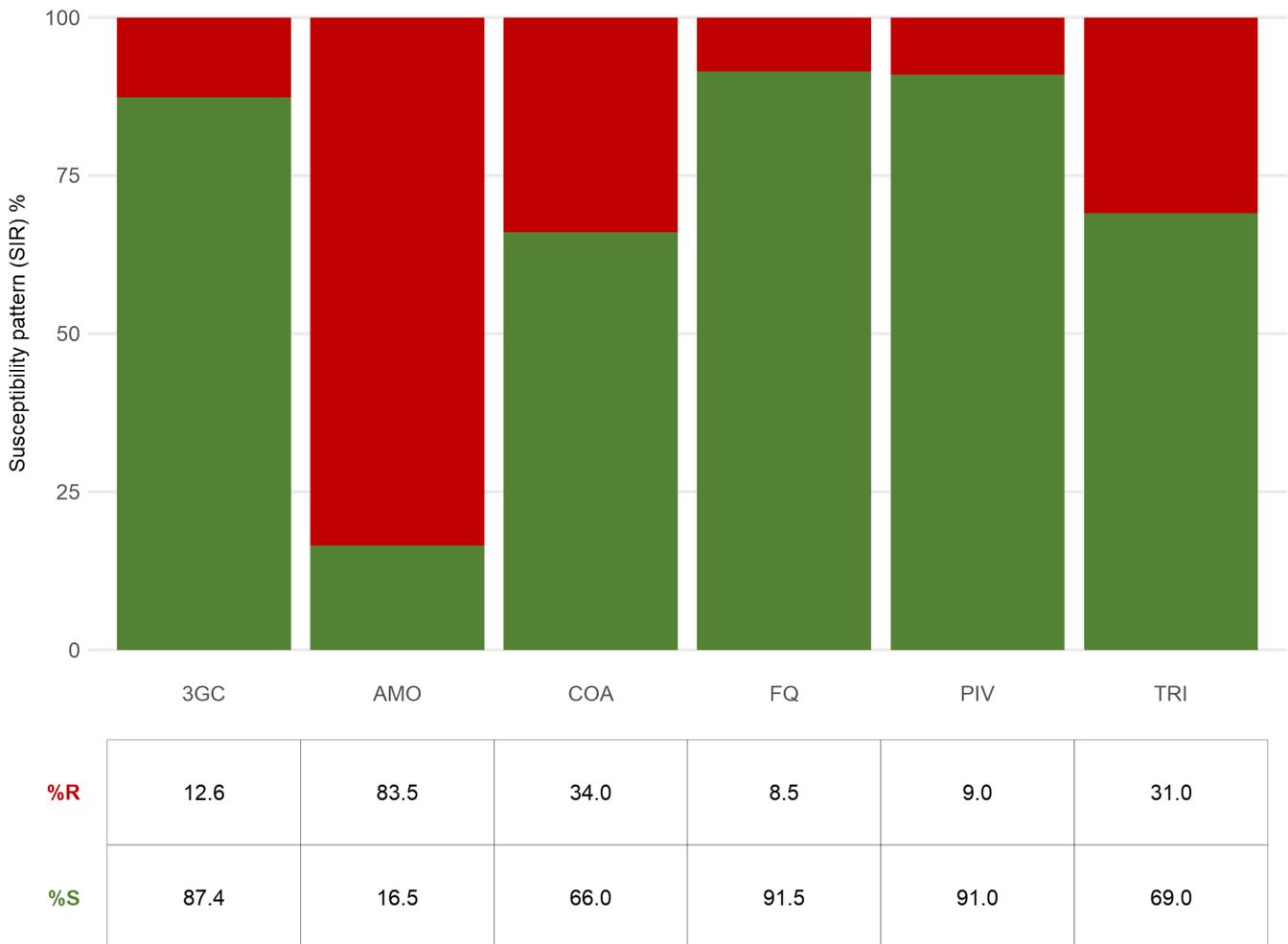
Figure 8: All-Wales antimicrobial resistance rates for Non-ECOL from inpatient urine samples (2016 to 2022)

What the data shows

- There has been an upward trend in third generation cephalosporin resistance to **17.7%** [16.7, 18.7] in 2022.
- Amoxicillin resistance remains high in 2022 at **79.0%** [77.9, 80.1]
- There has been a statistically significant increase in co-amoxiclav resistance from 2016-2020, which levelled off in 2022 at **38.7%** [37.4, 40.0].
- There has been little change in fluoroquinolone resistance rates from 2019-2022.
- Data for pivmecillinam for 2016-2020 is presented as striped bars in the graph, signifying that <80% of isolates were tested against this agent. This suggests selective testing, and indicates the data should be interpreted with caution.
- There has been no change in trimethoprim resistance from 2016-2022.

Non-ECOL from outpatient urine samples (n = 1,838 in 2022)

The **All-Wales** patterns of susceptibility (**S/I/R**) for Non-ECOL from outpatient urine samples in 2022 are shown in **Figure 9**. Trends in the resistance rates for the period 2016 to 2022 are shown in **Figure 10**.

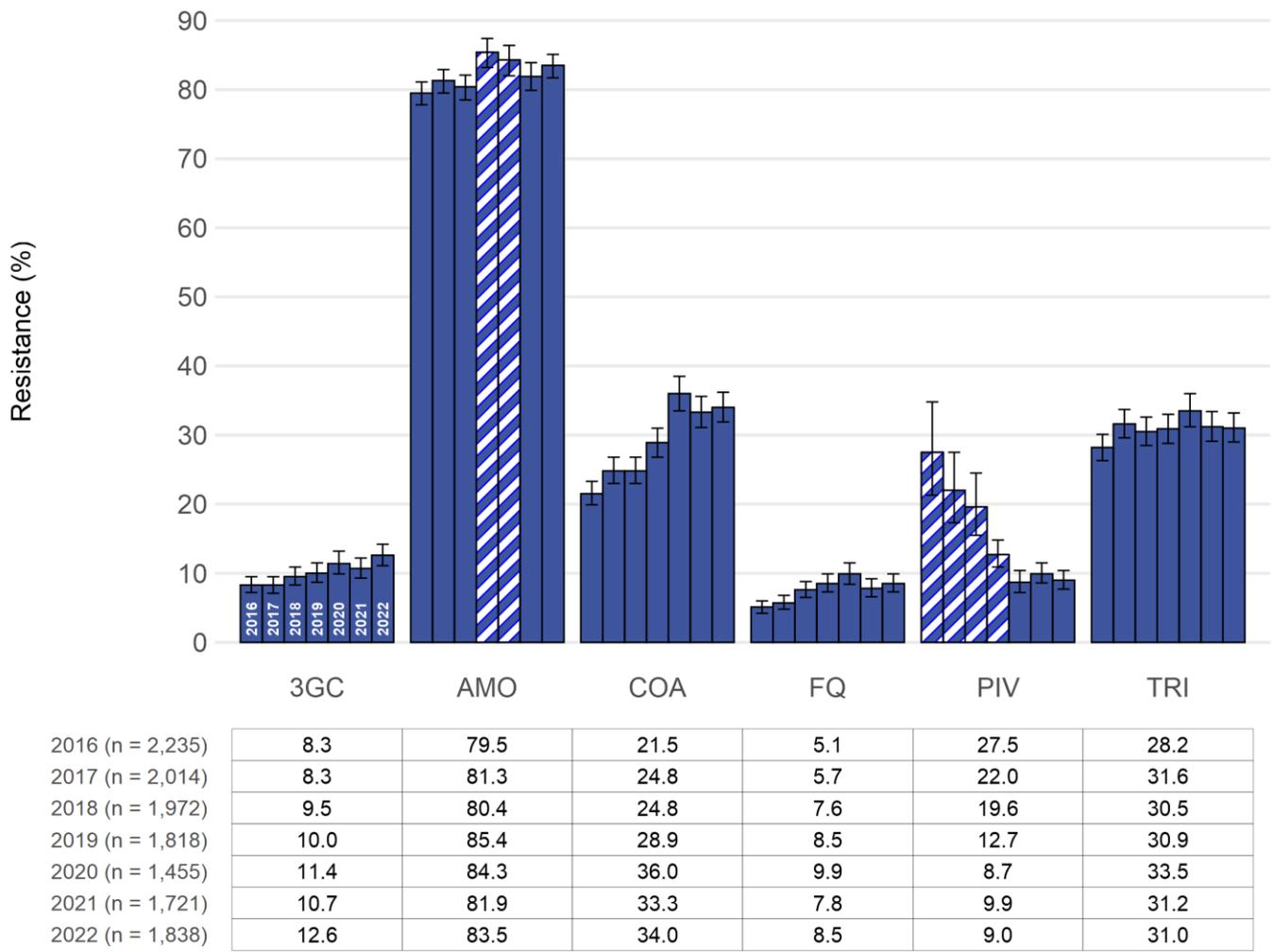


Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FQ = ciprofloxacin &/or levofloxacin, PIV = pivmecillinam, TRI = trimethoprim

Figure 9: All-Wales susceptibility patterns for Non-ECOL from outpatient urine samples (2022)

What the data shows

- Third generation cephalosporin resistance was relatively low at **12.6%** [11.1, 14.2]
- Amoxicillin resistance remains high at **83.5%** [81.7, 85.1]
- Co-amoxiclav resistance was **34.0%** [31.9, 36.2]
- Fluoroquinolone resistance was relatively low at **8.5%** [7.3, 9.9]
- Pivmecillinam resistance was relatively low at **9.0%** [7.7, 10.4]
- Trimethoprim resistance was **31.0%** [29.0, 33.2]



Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, PIV = pivmecillinam, TRI = trimethoprim

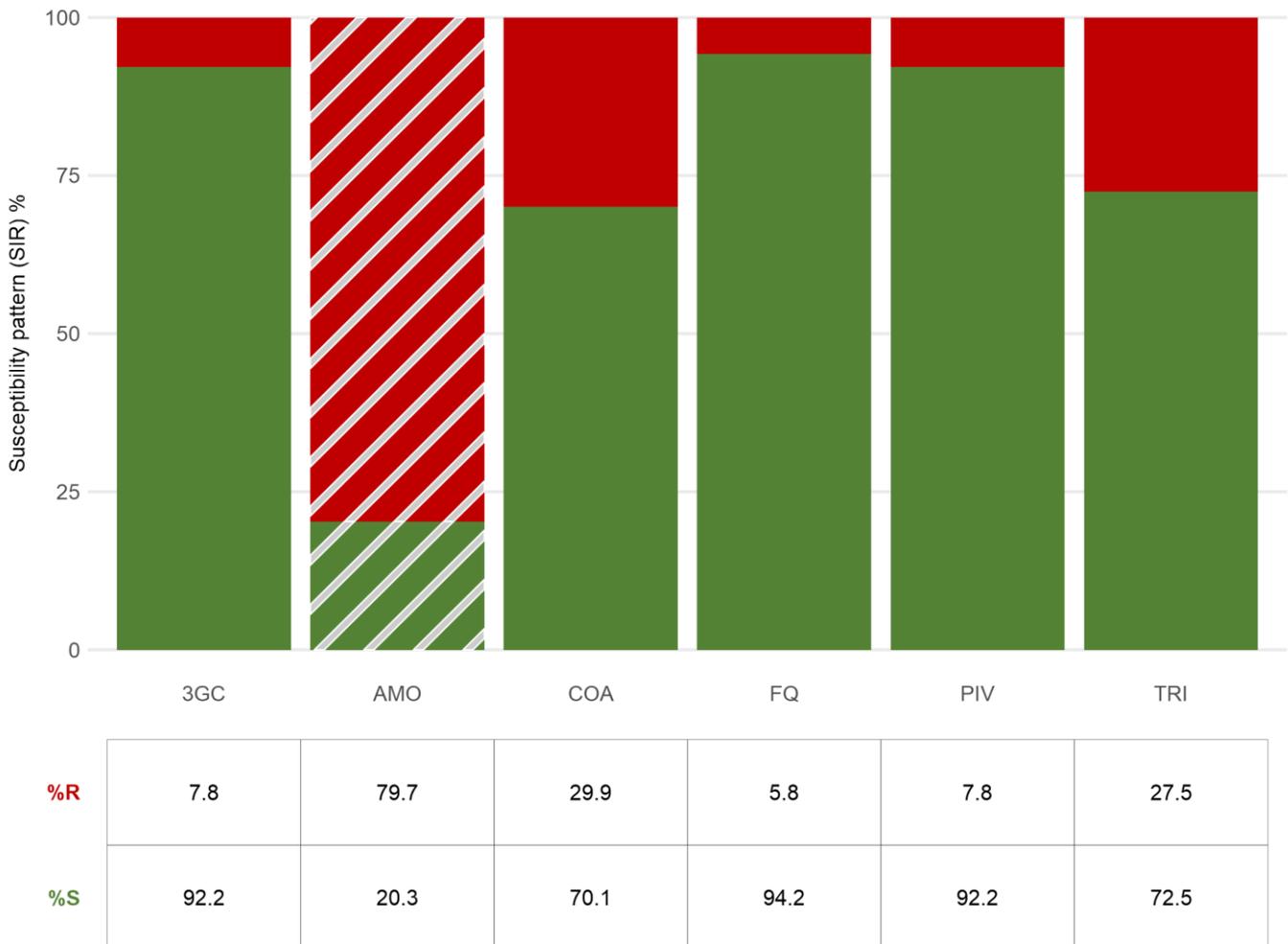
Figure 10: All-Wales antimicrobial resistance rates for Non-ECOL from outpatient urine samples (2016 to 2022)

What the data shows

- There has been an upward trend in third generation cephalosporin resistance to **12.6%** in 2022.
- Amoxicillin resistance remains high in 2022 at **83.5%**.
- There has been a statistically significant increase in co-amoxiclav resistance from 2016-2020, which levelled off in 2022 at **34.0%**.
- There has been little change in fluoroquinolone resistance rates from 2019-2022.
- Data for amoxicillin and pivmecillinam for 2016-2019 is presented as striped bars in the graph, signifying that <80% of isolates were tested against this agent. This suggests selective testing, and indicates the data should be interpreted with caution.
- There has been no change in trimethoprim resistance from 2016-2022.

Non-ECOL from community urine samples (n = 17,441 in 2022)

The **All-Wales** patterns of susceptibility (**S/I/R**) for Non-ECOL from community urine samples in 2022 are shown in **Figure 11**. Trends in the resistance rates for the period 2016 to 2022 are shown in **Figure 12**.

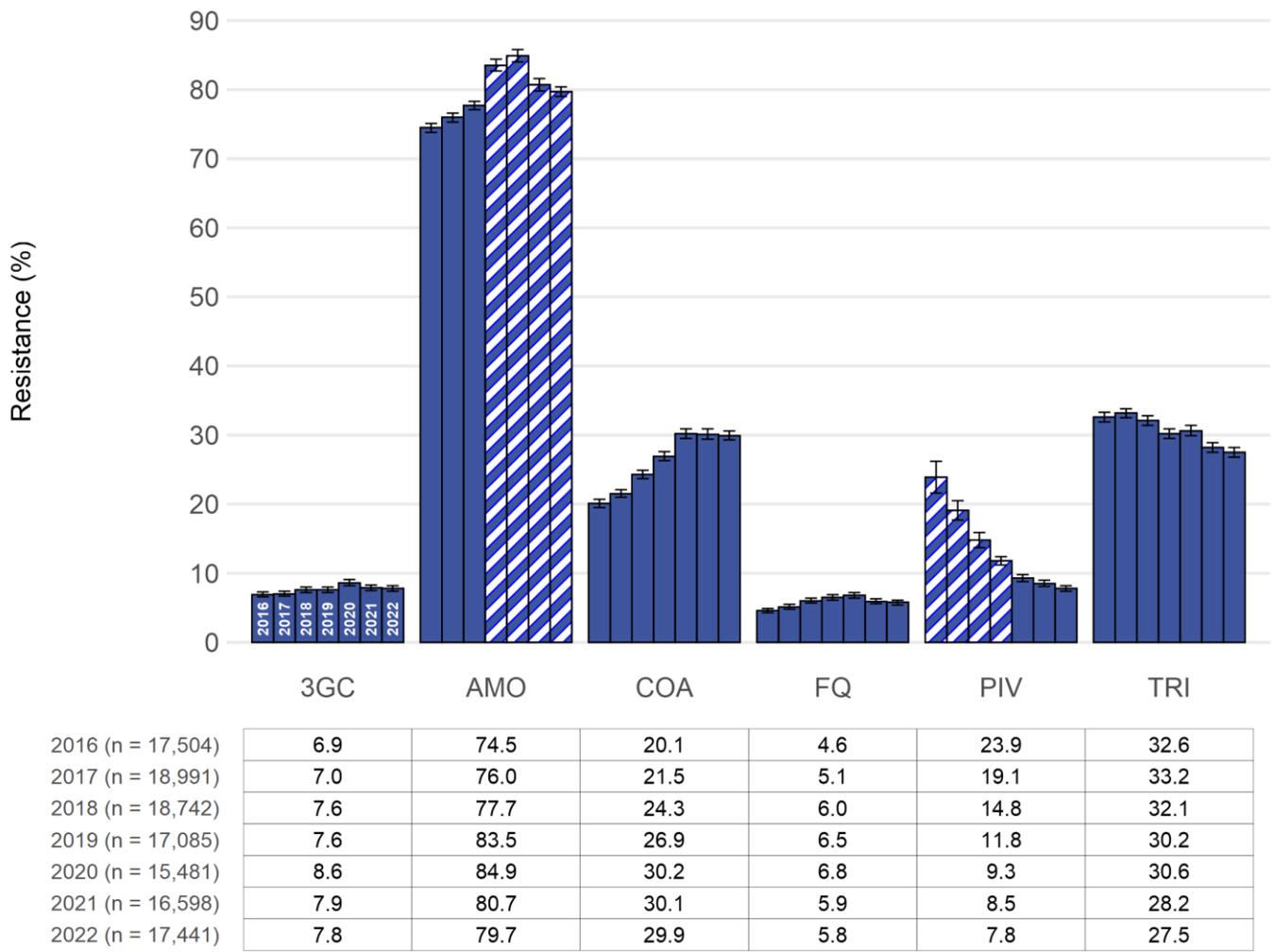


Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, PIV = pivmecillinam, TRI = trimethoprim

Figure 11: All-Wales susceptibility patterns for Non-ECOL from community urine samples (2022)

What the data shows

- Third generation cephalosporin resistance was relatively low at **7.8%** [7.4, 8.2]
- Data for amoxicillin is presented as a striped bar in the graph, signifying that <80% of isolates were tested against these agents. This suggests selective testing, and indicates the data should be interpreted with caution.
- Co-amoxiclav resistance was **29.9%** [29.3, 30.6]
- Fluoroquinolone resistance was relatively low at **5.8%** [5.4, 6.1]
- Pivmecillinam resistance was relatively low at **7.8%** [7.4, 8.2]
- Trimethoprim resistance was **27.5%** [26.8, 28.2]



Key: 3GC = resistance to ceftazidime &/or cefotaxime, ceftriaxone, cefpodoxime, AMO = amoxicillin, COA = co-amoxiclav, FQ = ciprofloxacin &/or levofloxacin, or norfloxacin, PIV = pivmecillinam, TRI = trimethoprim

Figure 12: All-Wales antimicrobial resistance rates for Non-ECOL from community urine samples (2016 to 2022)

What the data shows

- There has been no significant change in third generation cephalosporin resistance between 2016 and 2022.
- Data for amoxicillin for 2019-2022 and pivmecillinam for 2016-2019 is presented as striped bars in the graph, signifying that <80% of isolates were tested against these agents. This suggests selective testing, and indicates the data should be interpreted with caution.
- There has been a statistically significant increase in co-amoxiclav resistance from 2016-2020, which levelled off in 2022 at **29.9%**.
- There has been little change in fluoroquinolone resistance rates from 2018-2022.
- There has been a statistically significant decrease in trimethoprim resistance from 2016-2022, probably linked to changes in the guidance for treatment of UTI.

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>



https://eucast.org/clinical_breakpoints