National AMR Committee Malta

Antimicrobial Consumption and Resistance in Malta

ANNUAL REPORT 2024

Contents

Executive summary

IN HUMAN HEALTH

- Meticillin resistance in *Staphylococcus aureus* (MRSA) continues to reduce. Hospital prevalence is now around 15% and community prevalence <10%. The trajectory matches the history of universal admission screening: steady decline while screening ran (2014-2019), a plateau during its COVID-19 suspension (2020-2021) and a renewed decline after screening resumed in 2022.
- Macrolide-resistant *Streptococcus pneumoniae* now exceed 50% and still increasing. A brief pandemic-era dip in macrolide prescribing did not persist; 2023 community use already exceeds the 2013–2016 baseline, keeping drug pressure high.
- Penicillin-resistant *pneumococcus* has dropped below 10%, edging closer to low-incidence Northern European countries.
- Carbapenem-resistant *Klebsiella pneumoniae* has doubled to about 7%. While prevalence had been reduced to ≈3–4% during the 2017-2019 CRE screening programme at Mater Dei Hospital, it began rising in connection with the suspension of the screening during the COVID-19 pandemic.
- Third-generation cephalosporin (3GC) resistance is creeping upward, not exploding: *E. coli* 11% and *K. pneumoniae* 25 % are mid-range for the EU/EEA, but both have edged up ~2% points since 2021 in parallel with flat-to-rising cephalosporin use.
- Community antibacterial volume continues to shrink (≈ 21 DDD/1000 inhabitants/day, -12 % vs 2021), yet the class mix remains sub-optimal: macrolide and co-amoxiclav prescribing have bounced back.
- Total J01 use is flat, but carbapenem and piperacillin–tazobactam keep increasing; the broad-to-narrow ratio (~2.2) is among the highest in the EU.

IN ANIMAL HEALTH

- AMR monitoring and surveillance in accordance to Commission legislation started in 2015.
- Veterinary sales have halved (42 mg/PCU vs 2017), but Category C agents still account for a quarter of tonnage and ESBL contamination of retail pork remains > 40 %.

1 Introduction

The National Antibiotic Committee has been set up since 2008 in accordance to the legal notice L.N.122 as part of the Public Health Act (Cap.465). In 2023, the format of the committee changed to capture the 'One Health' collaboration between various stakeholders from a multitude of sectors – including human healthcare specialists, veterinarians, pharmacists, educationalists, policy makers, legislative bodies, agriculture, industry and the public. This led to the establishment of the National Antimicrobial Resistance Committee in accordance to the legal notice L.N 105 of 2023.

The duties of the Committee are to:

- Advise the Superintendent of Public Health on measures necessary to minimise antimicrobial resistance.
- Develop and update the Strategy and Action Plan on Antimicrobial Resistance in Malta through a OneHealth approach.
- Coordinate strategies to ensure the continued effectiveness of antimicrobial agents used in the treatment and prevention of infectious diseases in humans and animals.
- Monitor the implementation of the National Strategy and Action Plan on Antimicrobial Resistance through a OneHealth approach and advise on implementation of actions where necessary.
- Promote effective infection prevention and control programmes within healthcare institutions.
- Ensure that the impact on safety and quality of care is considered in all decisions.
- Develop and recommend strategies to comply with EU legislation as well as draw up and disseminate guidelines and standards on appropriate antimicrobial use, optimal dosing, administration and monitoring in line with accepted best practice so as to guide antimicrobial therapy as well as infection prevention and control.
- Promote effective education on antimicrobial resistance, prudent use of antimicrobial agents and antibiotic stewardship, as well as infection prevention, to professionals in human health, animal health and the general public.
- Tender all such advice as may be requested by the Superintendent of Public Health

This report provides data on antimicrobial resistance (AMR) epidemiology and antimicrobial consumption. In the case of human health is being presented for the last 10 years. With respect to animal health, antimicrobial resistance monitoring and surveillance, in accordance to Commission legislation started in 2015, whereas data collection on antimicrobial consumption started in 2017.

Data collated for human health is being represented in this report in line with the initial list of proposed AMR and antimicrobial consumption indicators as outlined in European Centre for Disease Prevention and Control (ECDC), European Food Safety Authority (EFSA) and European Medicines Agency (EMA) Joint Scientific Opinion (2017).

2 Human Health

2.1 AMR Epidemiology

Staphylococcus aureus

Historically, Malta has registered one of the highest prevalence of meticillin-resistant *Staphylococcus aureus* (MRSA) in Europe across a decade. For many years, the proportion of MRSA isolates from blood cultures was greater than 50%. However, since 2010 several interventions undertaken by the Infection Control Department of Mater Dei Hospital, especially the introduction of universal admission screening and decolonisation, have yielded positive results.

Spanning 2013 to 2023, this dual time-series (Figure 1) plots the percentage of meticillin-resistant *Staphylococcus aureus* (MRSA) in hospital and community isolates. Both trajectories show a steep decline from 2014, coincident with the introduction of universal admission screening in Mater Dei Hospital, the main acute hospital. The curves plateau during 2020–2021, coinciding with screening suspension for COVID-19 but resumes reduction after screening restarted in 2022. By 2023, hospital MRSA is about 15%, suggesting a direct impact of systematic screening and decolonisation on endemic prevalence.

Figure 2 ranks EU and EEA member states by the proportion of MRSA in invasive *S. aureus* isolates. Malta lies close to the centre of the distribution at roughly 17%, outperforming most high burden Mediterranean countries. Although Malta's absolute percentage has dropped slightly since 2021, comparable improvements in several peers leave its relative position unchanged, underscoring the need to intensify local infection-prevention measures if further reduction is to be achieved.

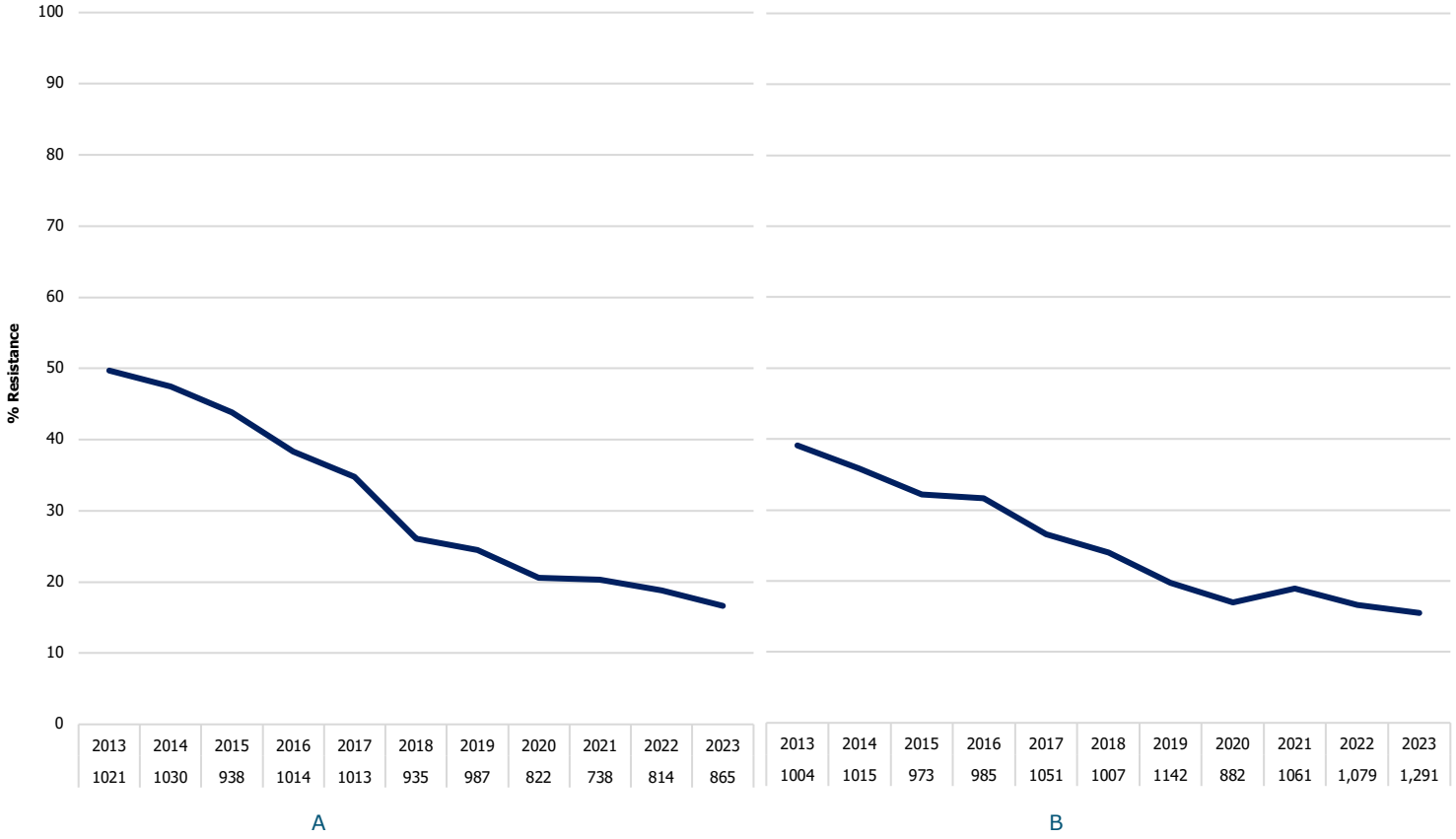


Fig 1: Proportion (in percentage) of oxacillin resistance in *Staphylococcus aureus* isolated from all clinical samples in (a) hospital and in (b) community isolates in Malta, 2013-2023

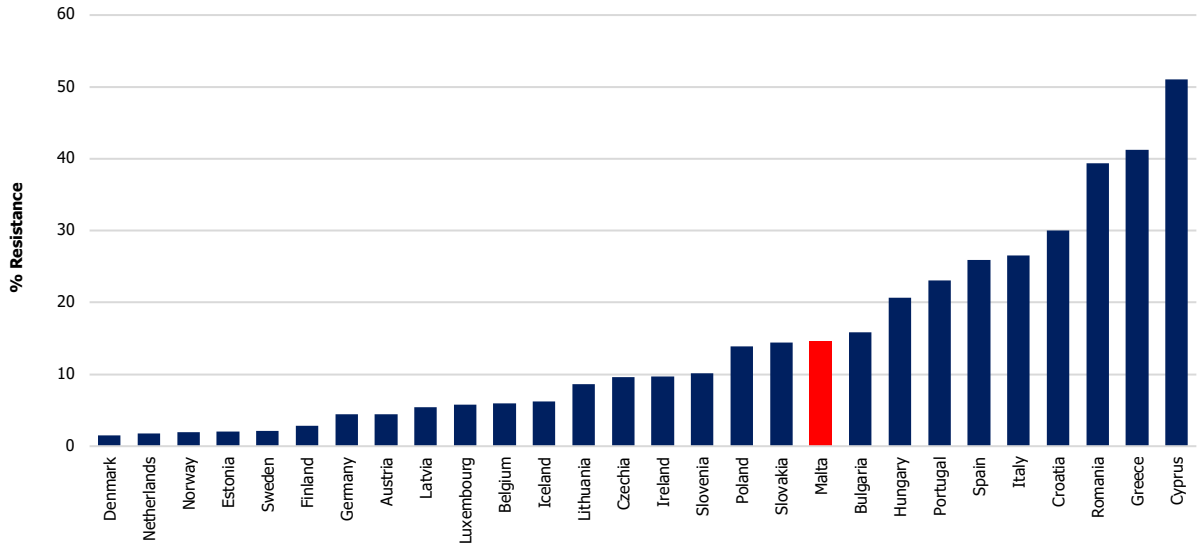


Fig 2: Percentage (%) of invasive isolates with resistance to meticillin (MRSA), in Malta and European Union/European Economic Area (EU/EEA) countries (Source: Surveillance Atlas of Infectious Diseases 2023)

Escherichia coli

Figure 3 depict fluoroquinolone and third-generation cephalosporin (3GC) non-susceptibility in *E. coli* from hospital and community settings. Fluoroquinolone resistance fell in both settings between 2018 and 2023, mirroring campaigns to reduce quinolone prescribing. Third-generation cephalosporin resistance declined marginally in hospitals yet increased approximately 2% points in primary care, narrowing the hospital-community gap. This shift suggests that outpatient cephalosporin exposure is now a dominant selective pressure and highlights the need for cephalosporin-sparing prescribing in the community sector.

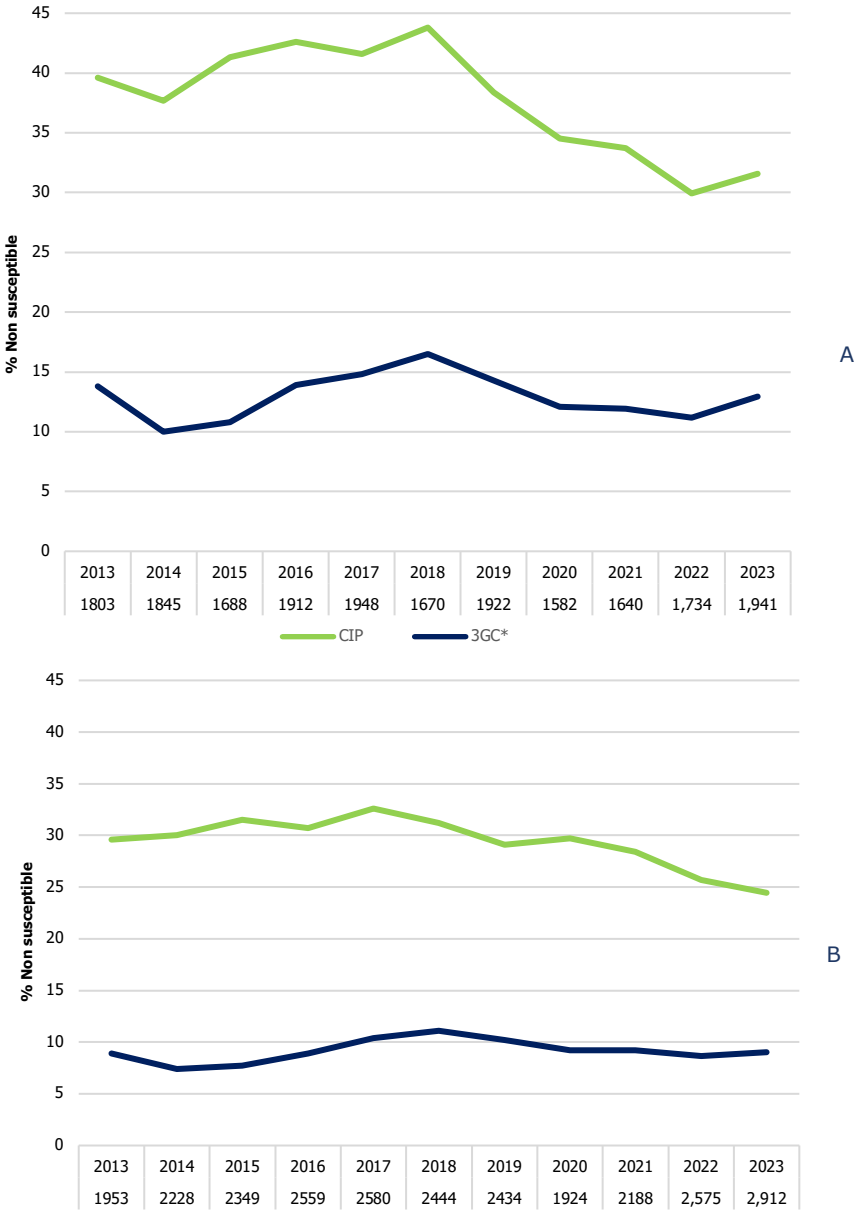


Fig 3: Total number of isolates tested (N) and percentage (%) of non-susceptible *Escherichia coli* isolated from all clinical samples from (a) hospital and (b) community, in Malta, 2013-2023

CIP ciprofloxacin; 3GC* Third-generation cephalosporin

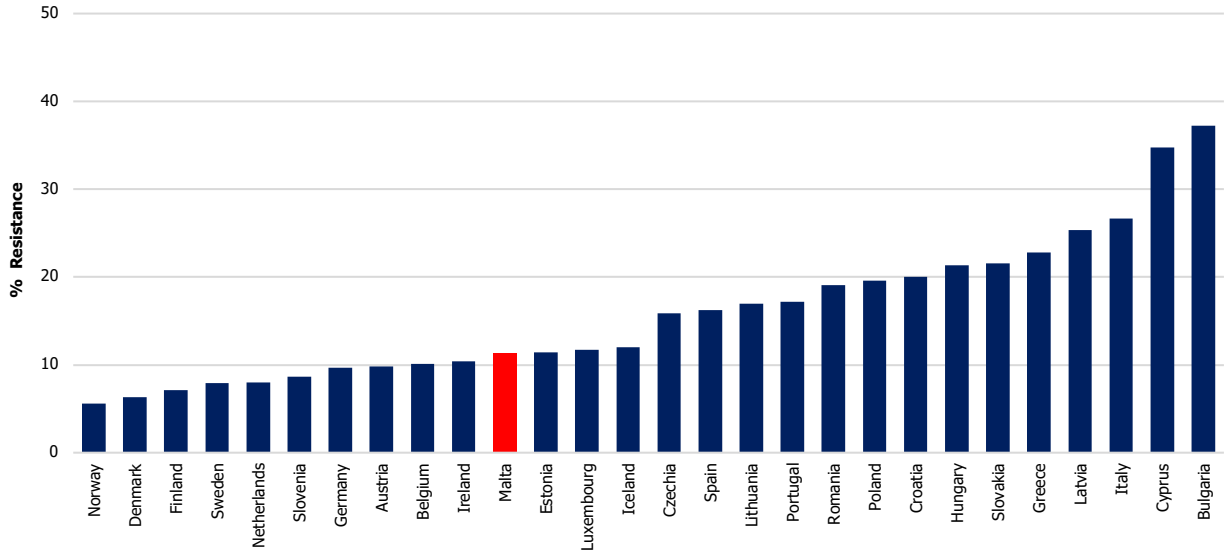


Fig 4: Percentage (%) of invasive isolates with resistance to third-generation cephalosporin, in Malta and EU/EEA countries (Source: Surveillance Atlas of Infectious Diseases 2023)

Figure 4 shows that approximately 11% of invasive *E. coli* isolates in Malta were resistant to third-generation cephalosporin in 2023. This places the country only slightly above the EU median but, given the importance of *E. coli* bacteraemia, translates into a sizeable number of resistant episodes, each potentially requiring carbapenem or piperacillin-tazobactam. Fluoroquinolones resistance in invasive *E. coli* currently stands at almost 30% and remains substantially higher than third-generation cephalosporins (3GC) resistance. (Figure 5)

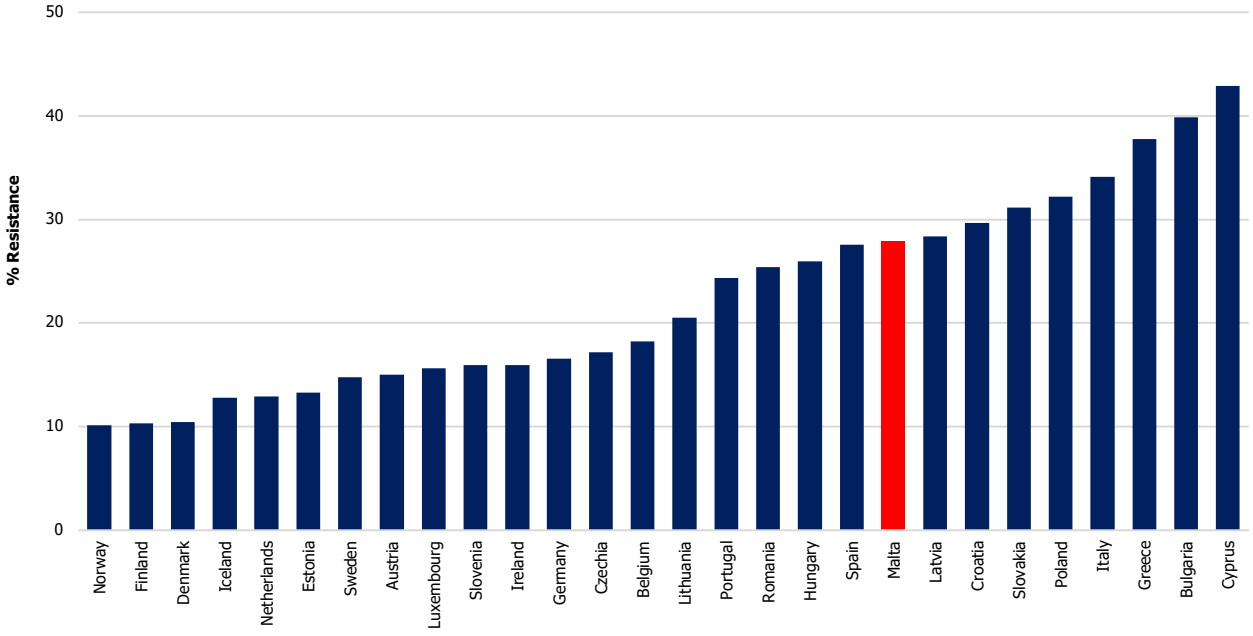


Fig 5: Percentage (%) of invasive isolates with resistance to fluoroquinolones, in Malta and EU/EEA countries (Source: Surveillance Atlas of Infectious Diseases 2023)

Klebsiella pneumoniae

Over the past years, resistance to *Klebsiella pneumoniae* (both ESBL and carbapenem resistance) has trended downwards from a peak in 2018 (Figure 6). However recent upticks are a cause for concern and need to be monitored.

In Malta, 25% of invasive bacterial isolates are resistant to third-generation cephalosporins. It is lower than the EU/EEA average, but still substantial in terms of possible impact on patient care and antibiotic failure.

Approximately 3% of invasive *Klebsiella pneumoniae* isolates are resistant to carbapenems; well below the rates of many Mediterranean countries (~70% in Greece) but higher than several northern and western countries.

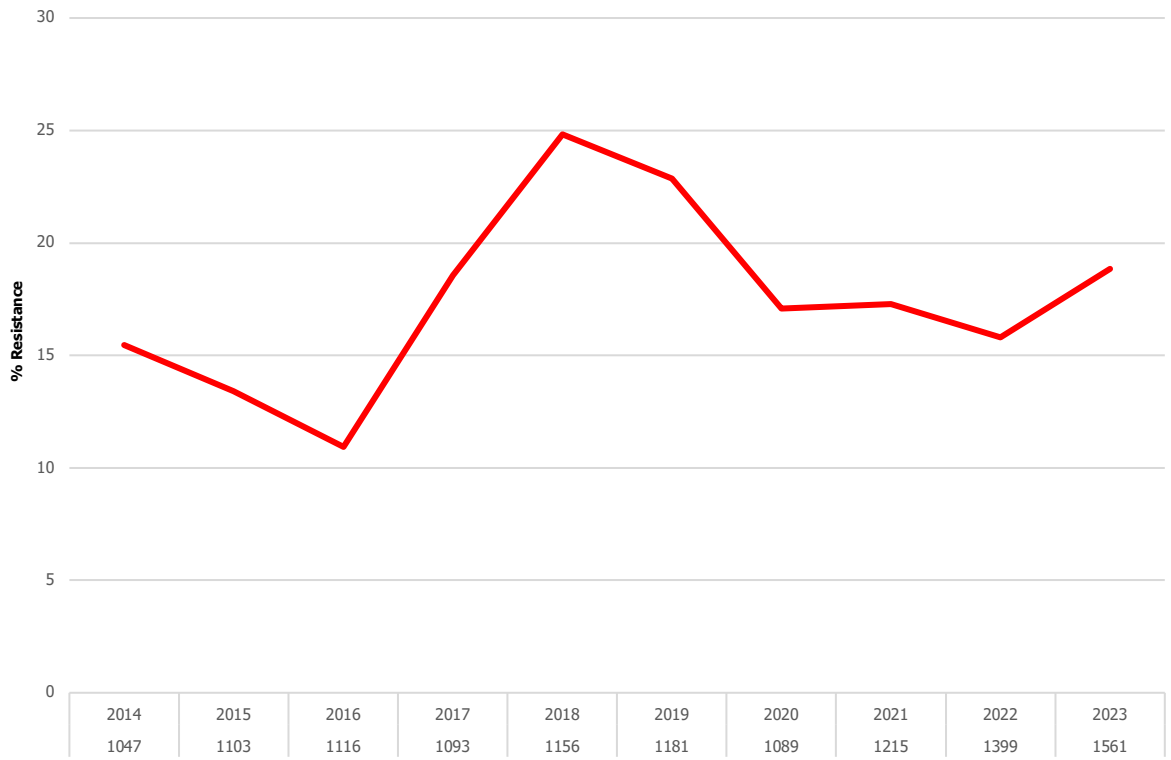


Fig 6: Total number of isolates tested (N) and percentage (%) resistant *Klebsiella pneumoniae* resistant to third-generation cephalosporins but sensitive to meropenem, in Malta, 2014-2023

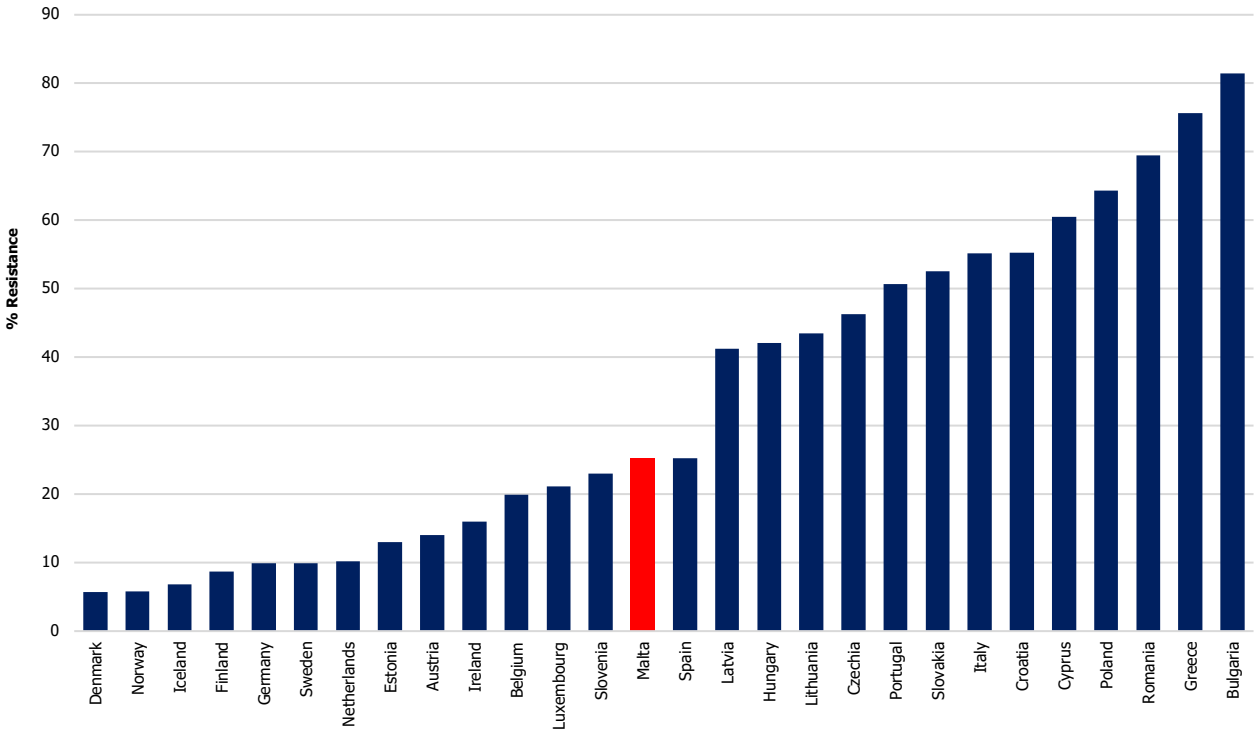


Fig 7: Percentage (%) of invasive isolates with resistance to third-generation cephalosporin, in Malta and EU/EEA countries (Source: Surveillance Atlas of Infectious Diseases 2023)

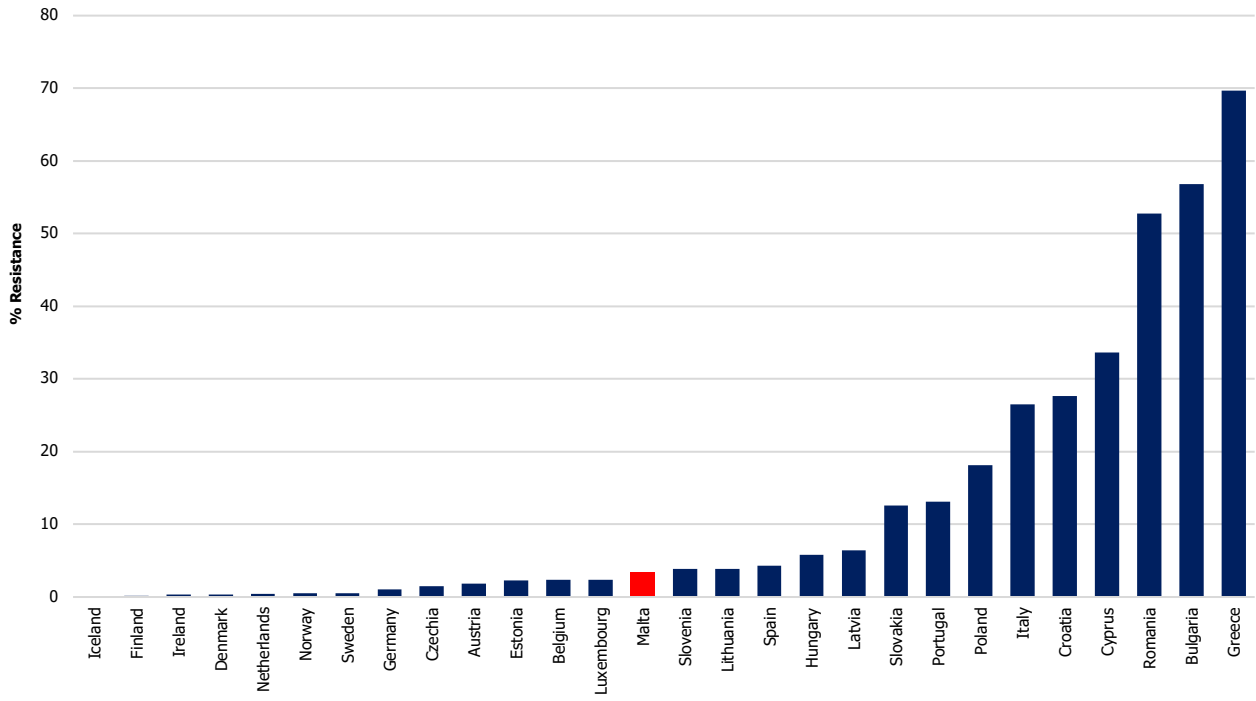


Fig 8: Percentage (%) of invasive isolates with resistance to carbapenem, in Malta and EU/EEA countries (Source: Surveillance Atlas of Infectious Diseases 2023)

Streptococcus pneumoniae

The dual-line chart (Figure 9) illustrates a favourable trend for penicillin resistance but a concerning one for macrolides. Penicillin non-susceptibility in *Streptococcus pneumoniae* has fallen below 3%. Conversely, macrolide resistance has surpassed 50% and continues to climb, mirroring the rebound in outpatient macrolide consumption and the entrenched presence of resistant clones.

When restricting analysis to invasive isolates (Figure 10), the levels of resistance appear substantially higher than for all clinical specimens. Nevertheless it should be stated that numbers are very low and therefore have a wide confidence interval. As shown in Figure 11, Malta appears as the top EU country for macrolide resistance in invasive pneumococci, exceeding 50%. Given that outpatient macrolide use in 2023 already exceeds its pre-pandemic baseline, the data suggest the urgent need to reduce macrolide courses by at least one-third and sustain that reduction before any meaningful decline in resistance can be expected.

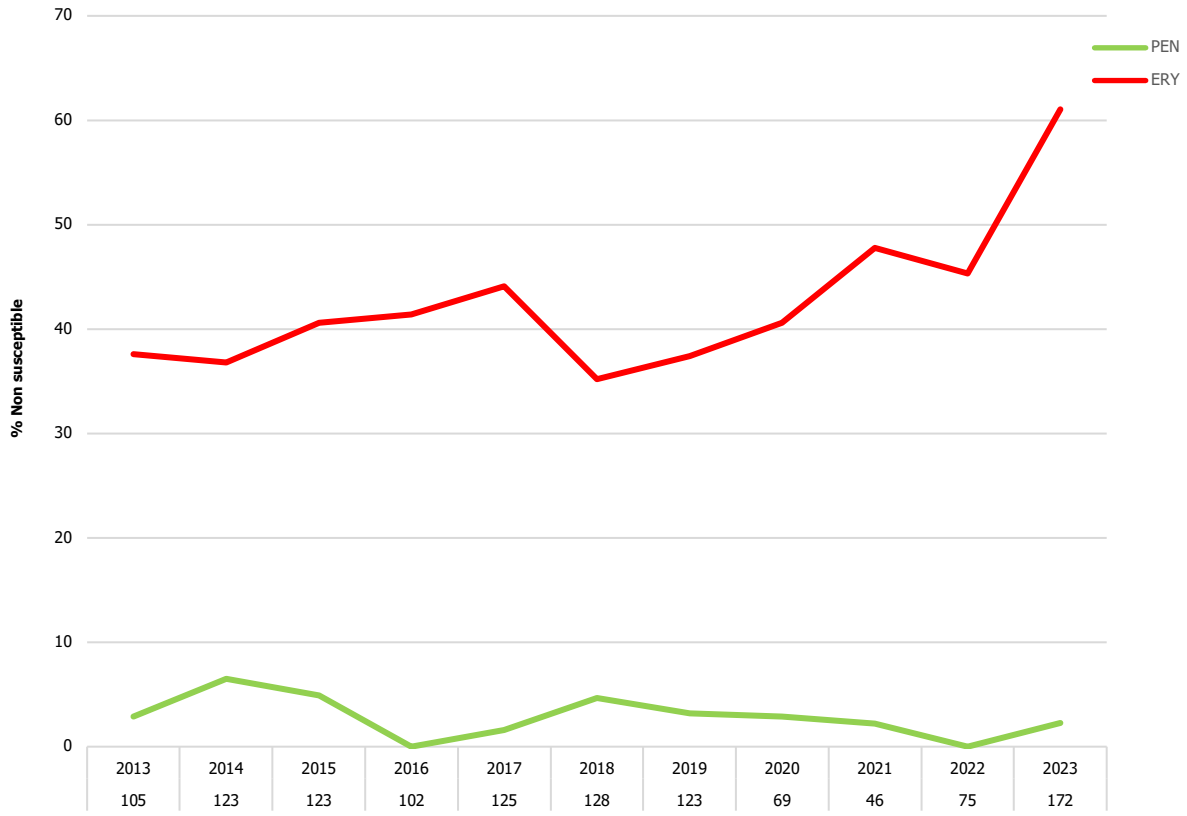
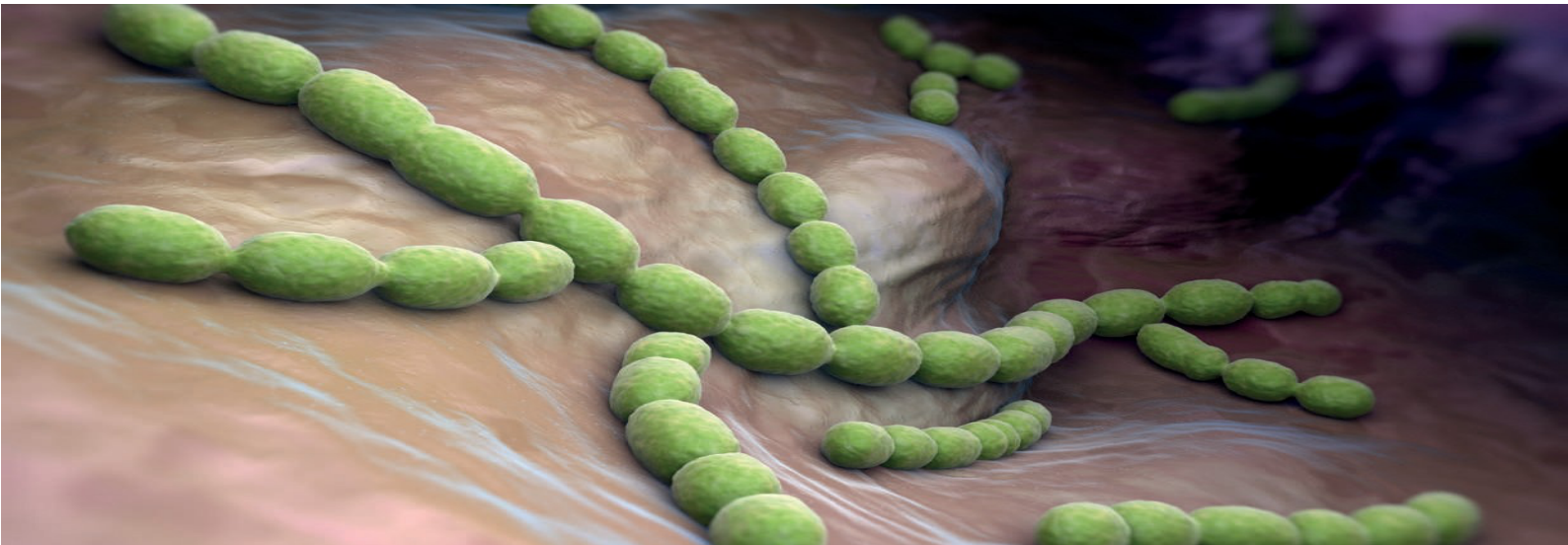


Fig 9: Total number of isolates tested (N) and percentage (%) of non-susceptible *Streptococcus pneumoniae* in all clinical samples from hospital and community isolates, in Malta, 2013-2023



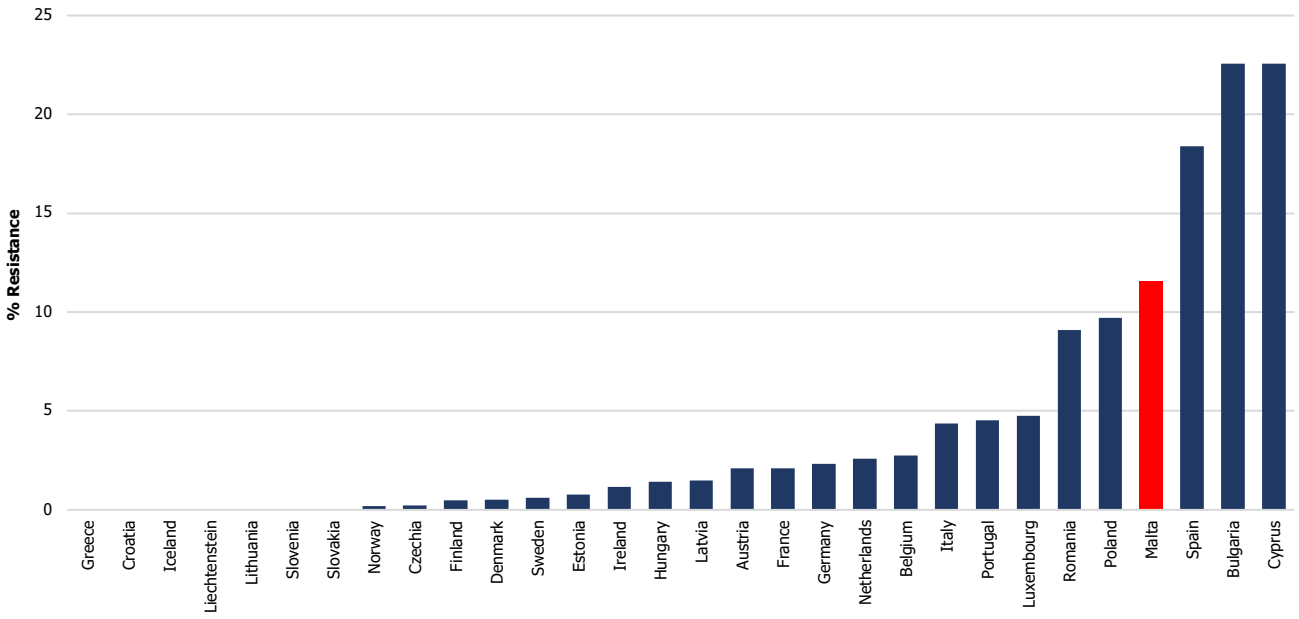


Fig 10: Percentage (%) of invasive isolates with resistance to penicillin, in Malta and EU/EEA countries (Source: EARS-Net Report 2023)

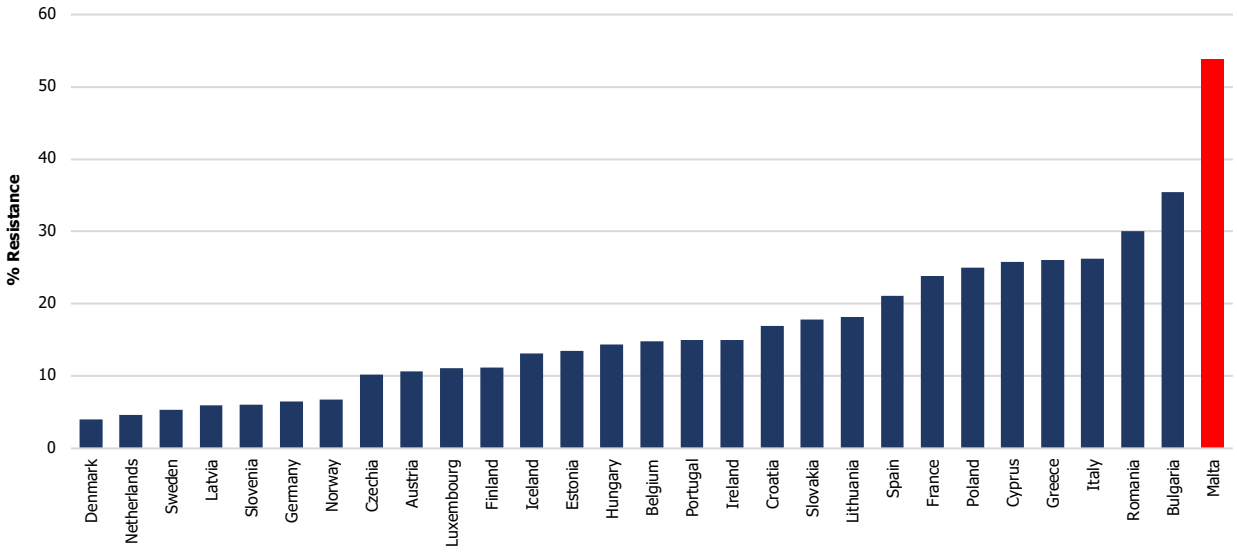


Fig 11: Percentage (%) of invasive isolates with resistance to macrolides, in Malta and EU/EEA countries (Source: EARS-Net Report 2023)

Pseudomonas aeruginosa

Surveillance of *Pseudomonas aeruginosa* demonstrates a stable picture with an increase in third-generation cephalosporins (3GC) resistance balanced by a reduction in carbapenem resistance to around 1% (Figure 12). In the EU/EEA ranking Malta remains grouped with low-resistance states, reporting single-digit carbapenem-resistant *P. aeruginosa* in invasive isolates (Figure 13).

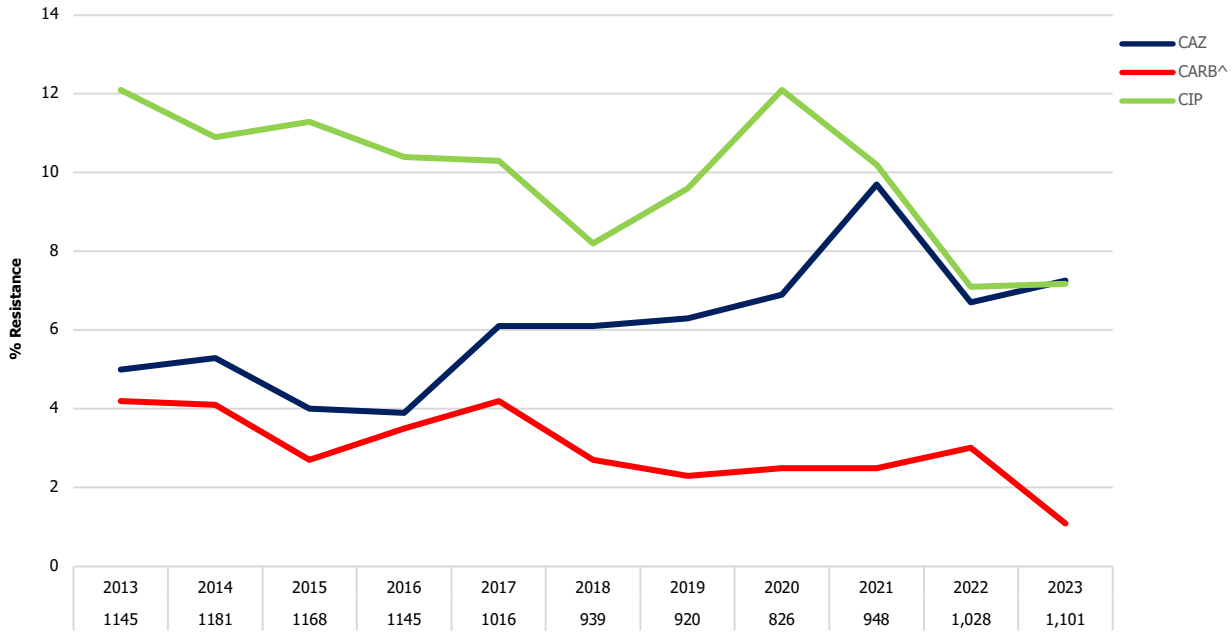


Fig 12: Total number of isolates tested (N) and percentage (%) of resistant Pseudomonas spp in all clinical samples from hospital and community isolates, in Malta, 2013-2023

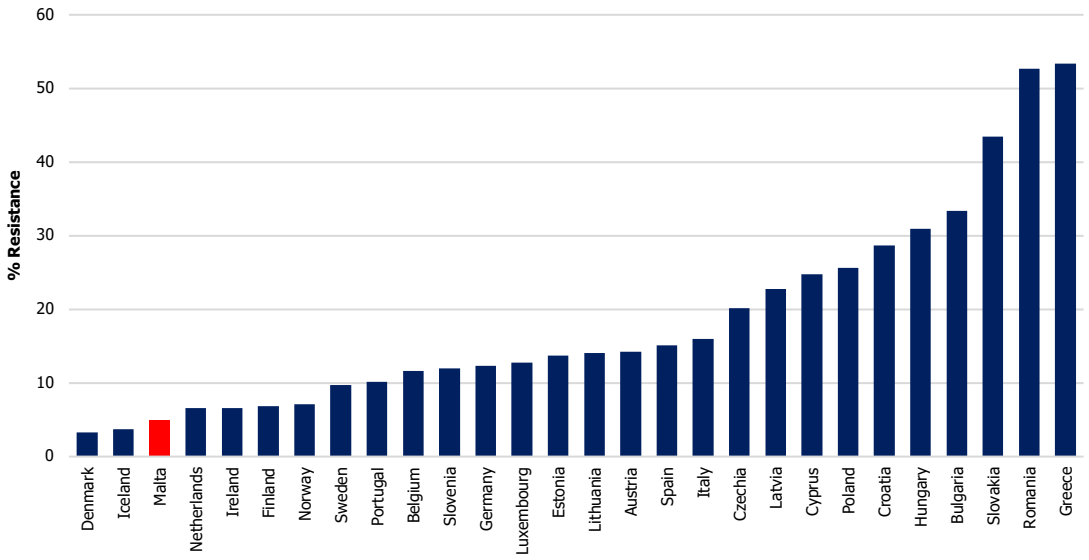


Fig 13: Percentage (%) of invasive isolates with resistance to carbapenem, in Malta and EU/EEA countries (Source: Surveillance Atlas of Infectious Diseases 2023)

Enterococcus faecium

The proportional prevalence of vancomycin-resistant *Enterococcus faecium* has reduced slightly to about 40%, underscoring the need for both antimicrobial optimisation and strengthened infection control and screening in high risk wards.

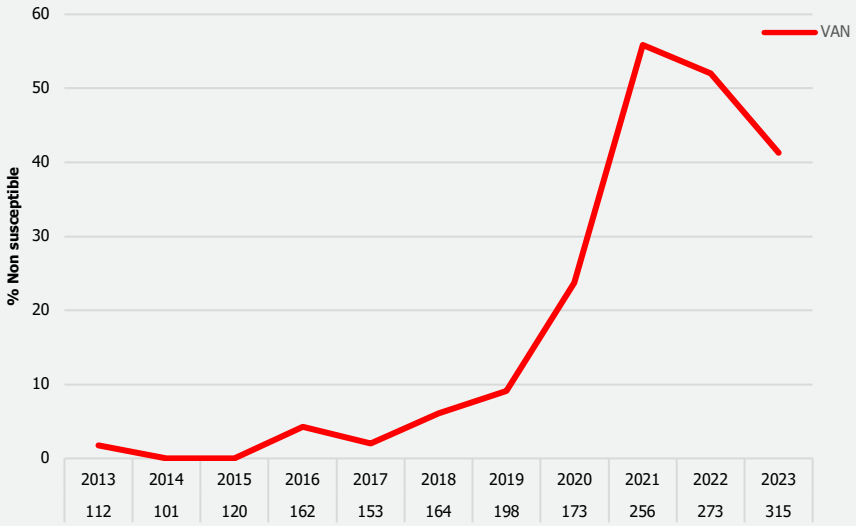


Fig 14: Total number of isolates tested (N) and percentage (%) of non-susceptible *Enterococcus faecium* in all clinical samples from hospital and community isolates, in Malta, 2013-2023

VAN vancomycin

Salmonella spp.

National data for *Salmonella spp.* show ciprofloxacin resistance rising incrementally to >20% over the past years with an uptick also in third-generation cephalosporin (3GC) resistance.

Fig 15: Total number of isolates tested (N) and percentage (%) of non-susceptible *Salmonella spp* in all clinical samples from hospital and community isolates, in Malta, 2013-2023

CIP ciprofloxacin; 3GC* Third-generation cephalosporin

2.2 Antimicrobial Consumption

Surveillance of antimicrobial use has been long established at both hospital and community care in Malta. Local datasets available by Anatomical Therapeutic Chemical (ATC) Classification System have been collected on an annual basis.

Ambulatory care

Penicillins with beta-lactamase inhibitors (primarily co-amoxiclav), macrolides (clarithromycin and azithromycin) as well as quinolones (ciprofloxacin and levofloxacin), all highly broad-spectrum formulations, continue to be the predominant classes prescribed in ambulatory care. Indeed, consumption of narrower spectrum formulations (e.g. amoxicillin and 1st generation cephalosporins) remains minimal despite their effectiveness and less resistance inducing properties.

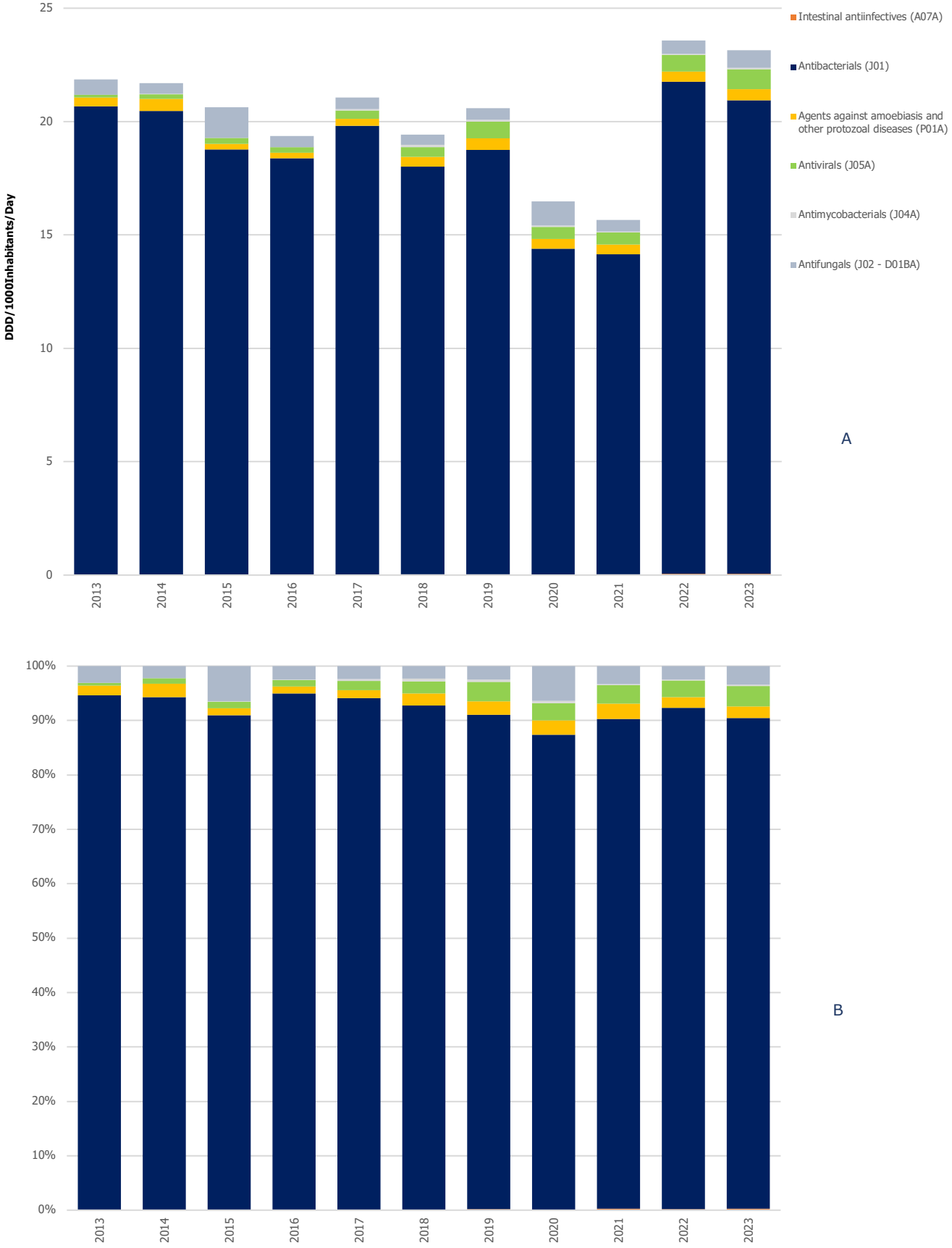


Fig 16: Trends in yearly consumption of anti-infective agents in the community care in Malta, 2013-2023, expressed as (a) total and (b) percent proportion of Daily Defined Dose (DDD) per 1000 inhabitants per day

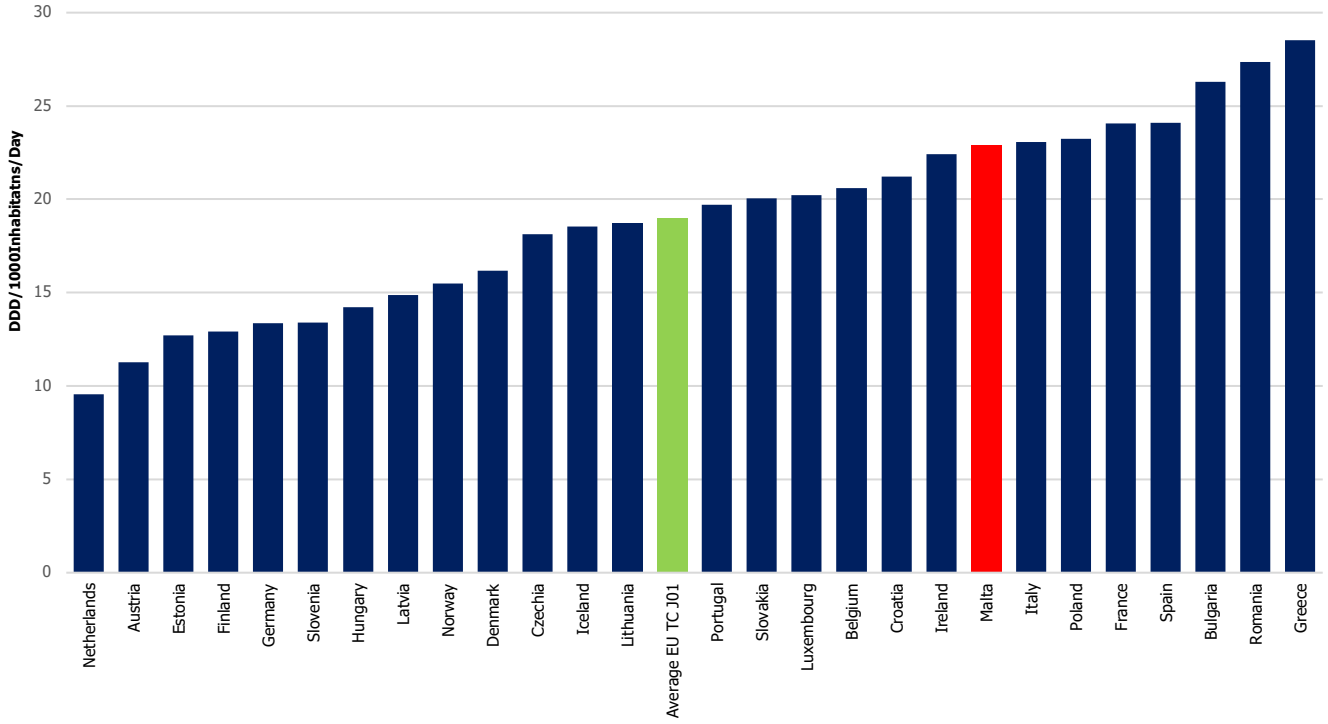


Fig 17: Consumption of antibacterials for systemic use (ATC group J01) in the community and hospital in EU/EEA countries, in 2023, expressed as Daily Defined Dose (DDD) per 1000 inhabitants per day (Source: ESAC-Net Annual Epidemiological Report 2023)

Fig 18A: Penicillin with beta-lactamase inhibitors (J01CR)

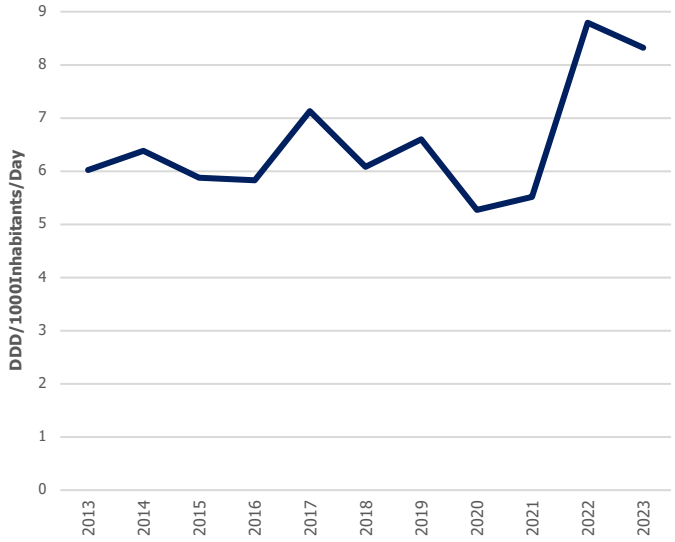


Fig 18B: 2nd generation cephalosporins (J01DC)

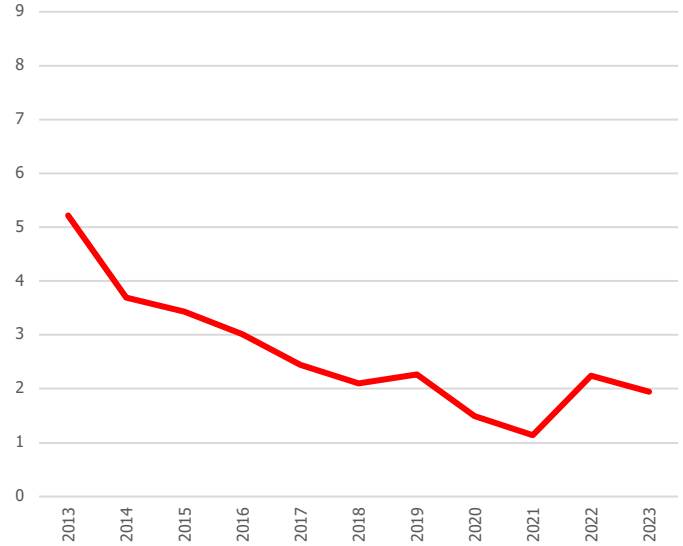


Fig 18C: Macrolides (J01FA)

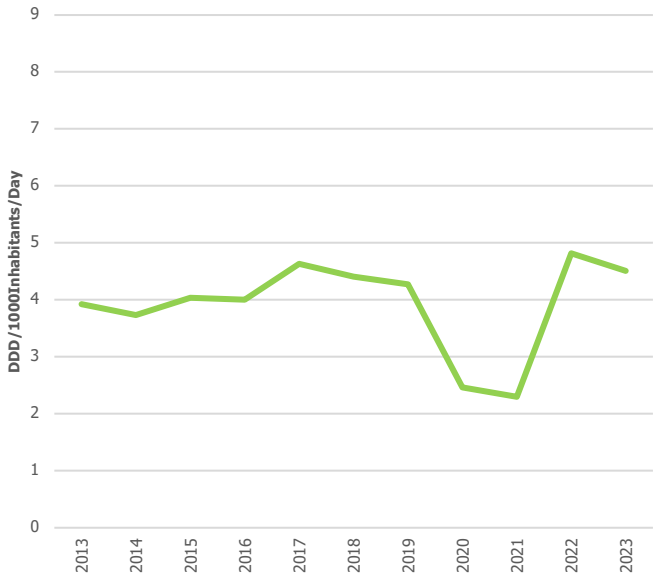


Fig 18D: Fluoroquinolones (J01MA)

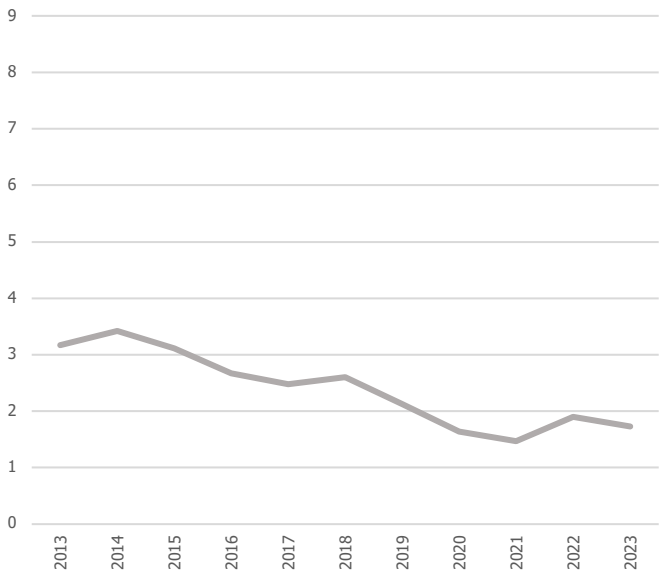


Fig 18: Trends in yearly consumption of selected classes of antibacterial for systemic use (ATC group J01) in the community in Malta, expressed as Daily Defined Dose (DDD) per 1000 inhabitants per day

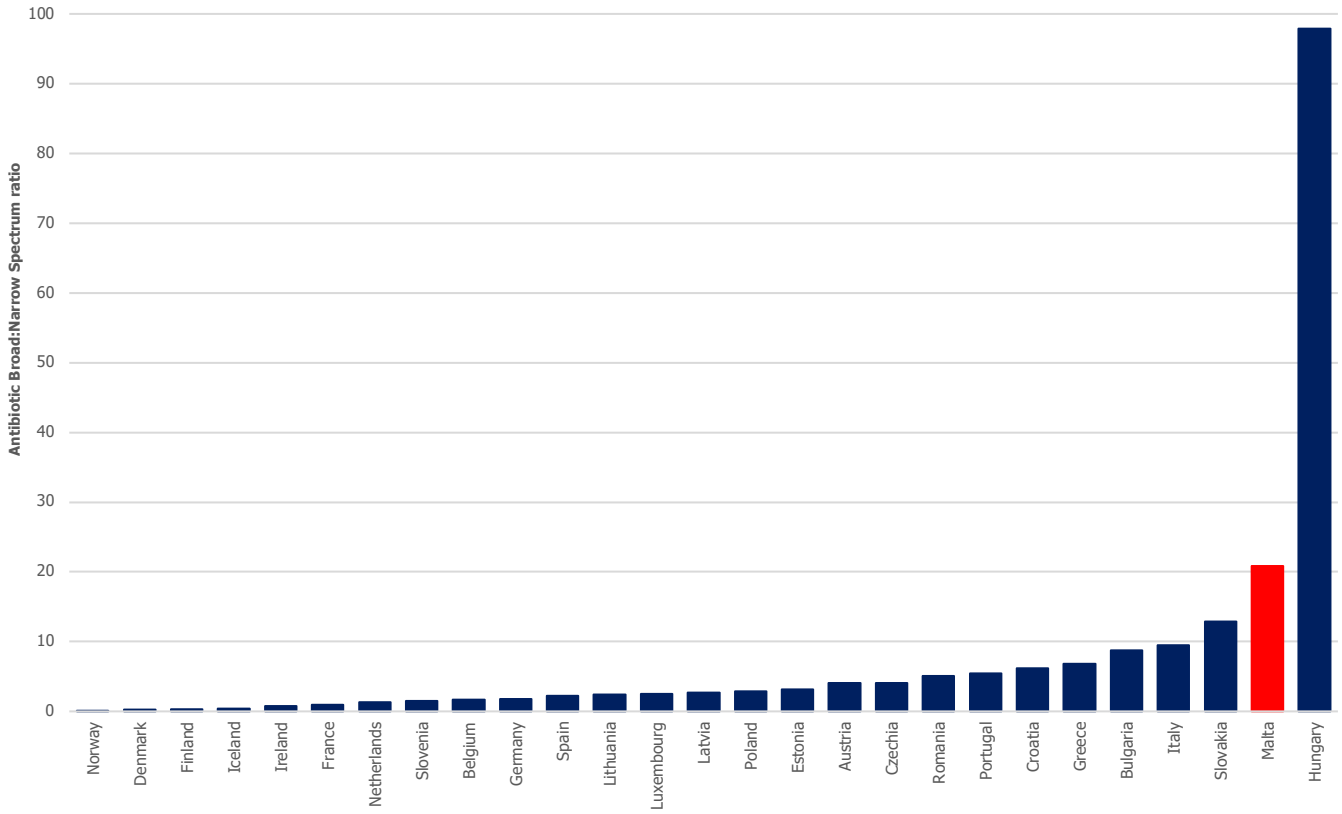


Fig 19: Ratio* of consumption of broad: narrow spectrum vs narrow spectrum antibiotic in EU/EEA countries, in 2023 (Source: ESAC-Net Annual Epidemiological Report 2023)

*Ratio calculated from consumption of broad-spectrum penicillins, cephalosporins and macrolides (except erythromycin) and fluoroquinolones against consumption of narrow-spectrum penicillins, cephalosporins and macrolides (erythromycin) per country

Hospital care

Trends of consumption of antimicrobials within the hospital setting have stabilised in recent years. However the “hospital specific” antibiotic groups has shown a consistent increase over past years. Over-use of broad-spectrum antimicrobials (especially carbapenems) still persists within Maltese hospitals. Of particular concern is the very high increase in glycopeptide prescribing (primarily teicoplanin) which has coincided with an equally dramatic increase in VRE prevalence.

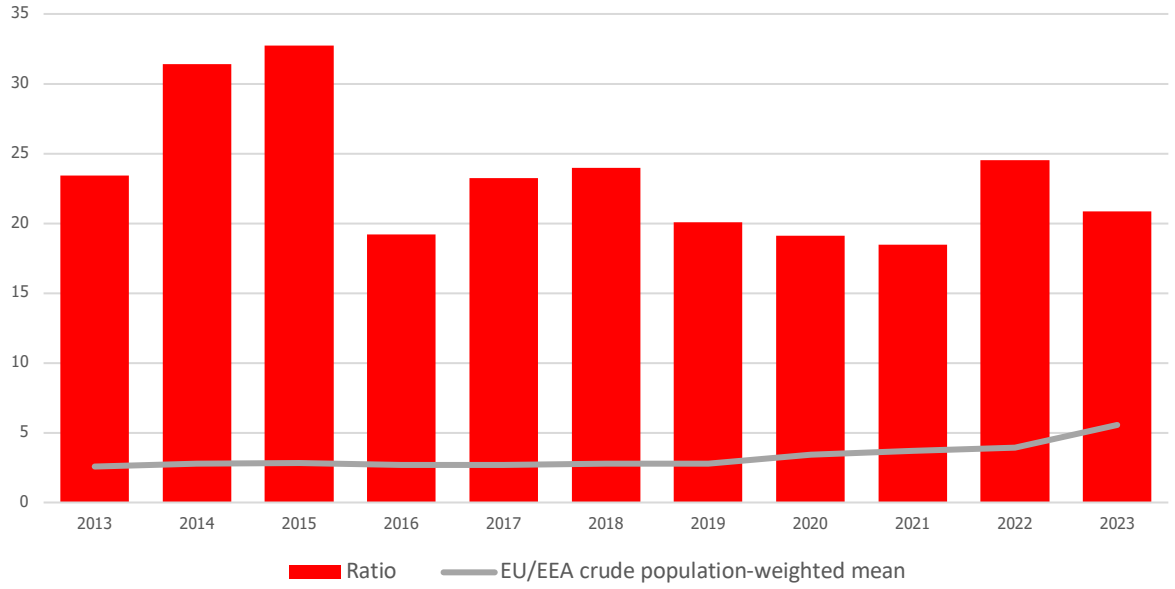


Fig 20: Trends in yearly consumption of antibacterials for systemic use (ATC group J01) for hospital specific:non-hospital specific medicines in Malta, in 2013-2023, expressed as ratio

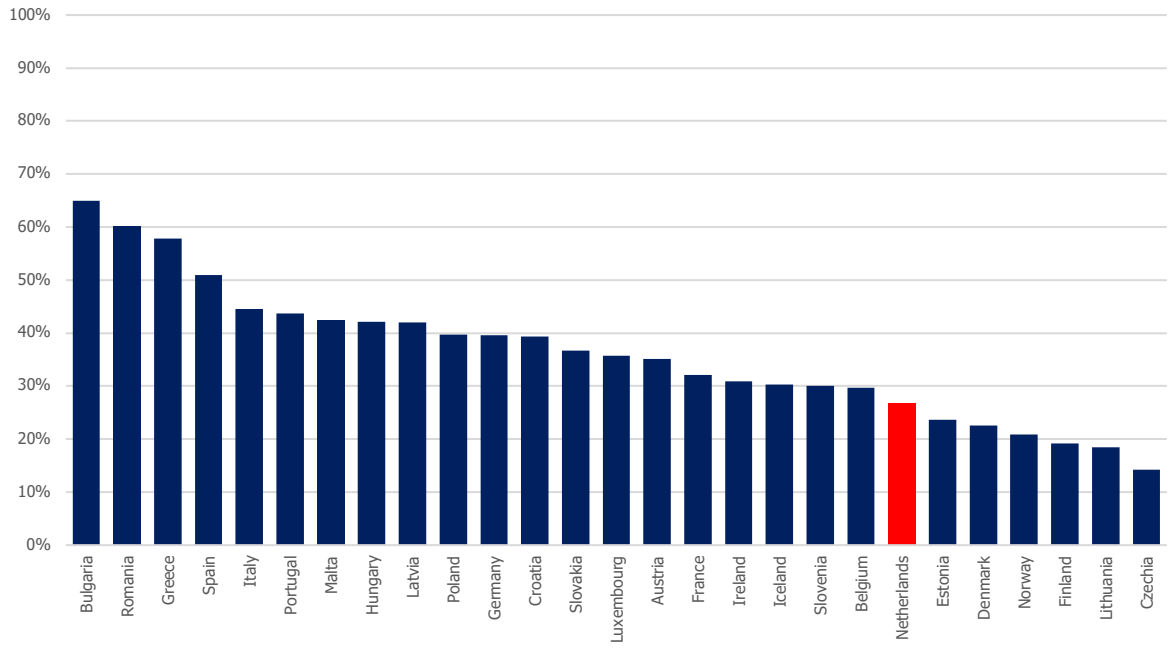


Fig 21: Consumption of antibacterials for systemic use (ATC group J01) in the hospital sector in EU/EEA countries, in 2023, expressed as percentage
(Source: ESAC-Net Annual Epidemiological Report 2023)

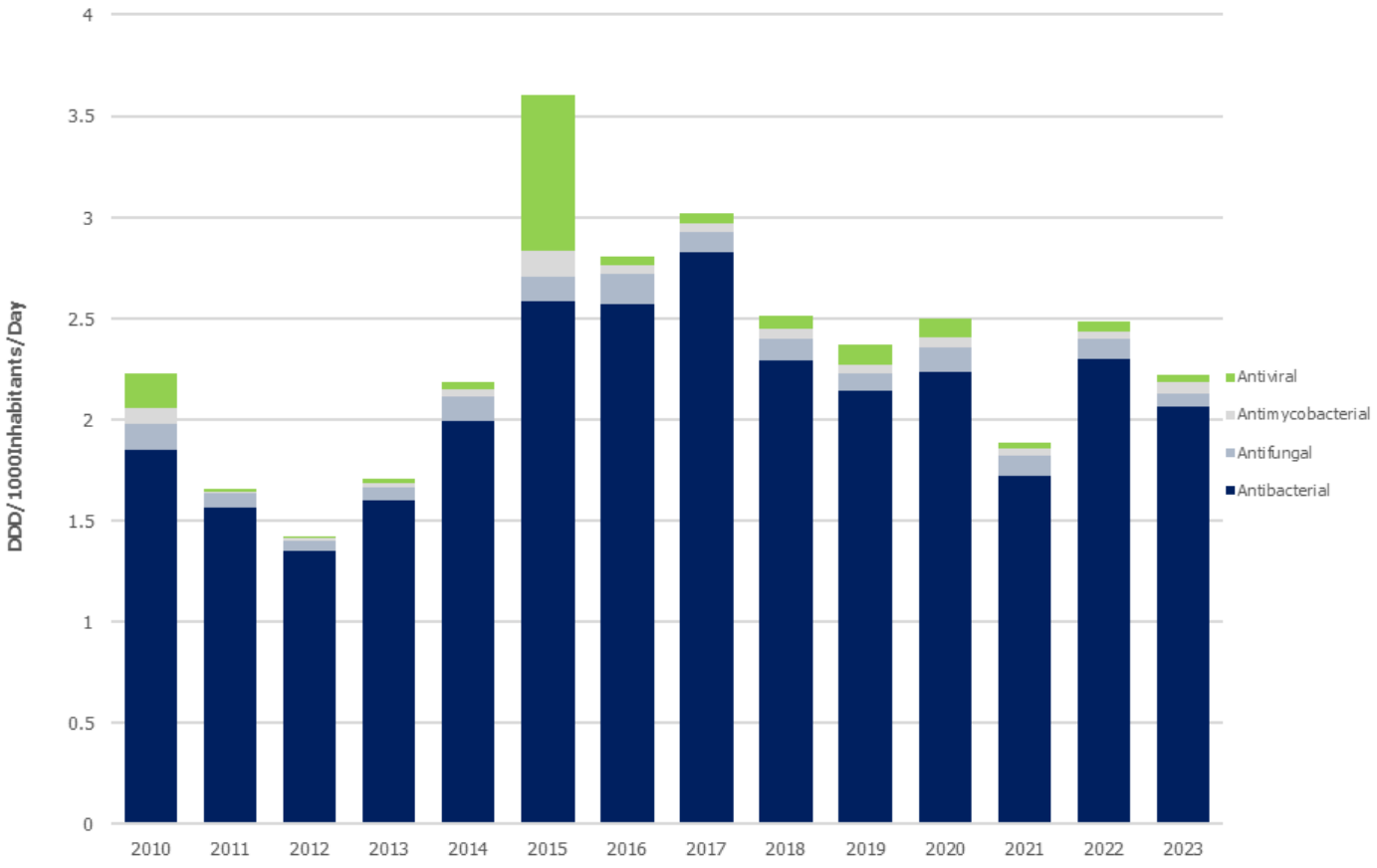


Fig 22: Trends in yearly consumption of anti-infective agents in the hospital care in Malta, in 2010-2023, expressed as Daily Defined Dose (DDD) per 1000 inhabitants per day

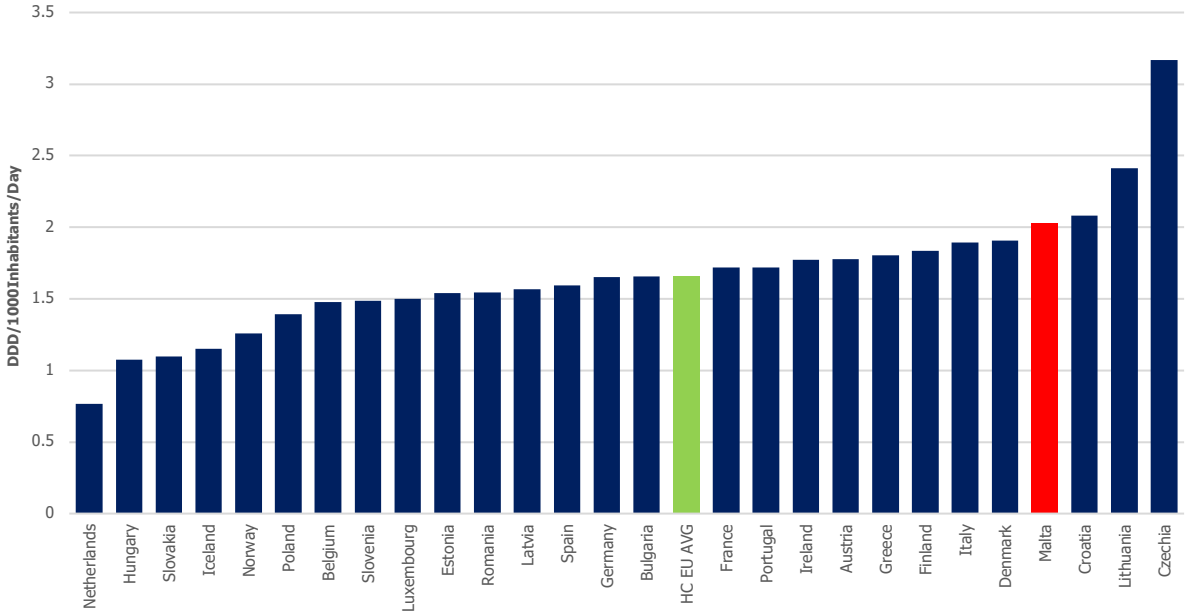


Fig 23: Consumption of antibacterials for systemic use (ATC group J01) in the hospital care in EU/EEA countries, in 2023, expressed as Daily Defined Dose (DDD) per 1000 inhabitants per day
(Source: ESAC-Net Annual Epidemiological Report 2023)

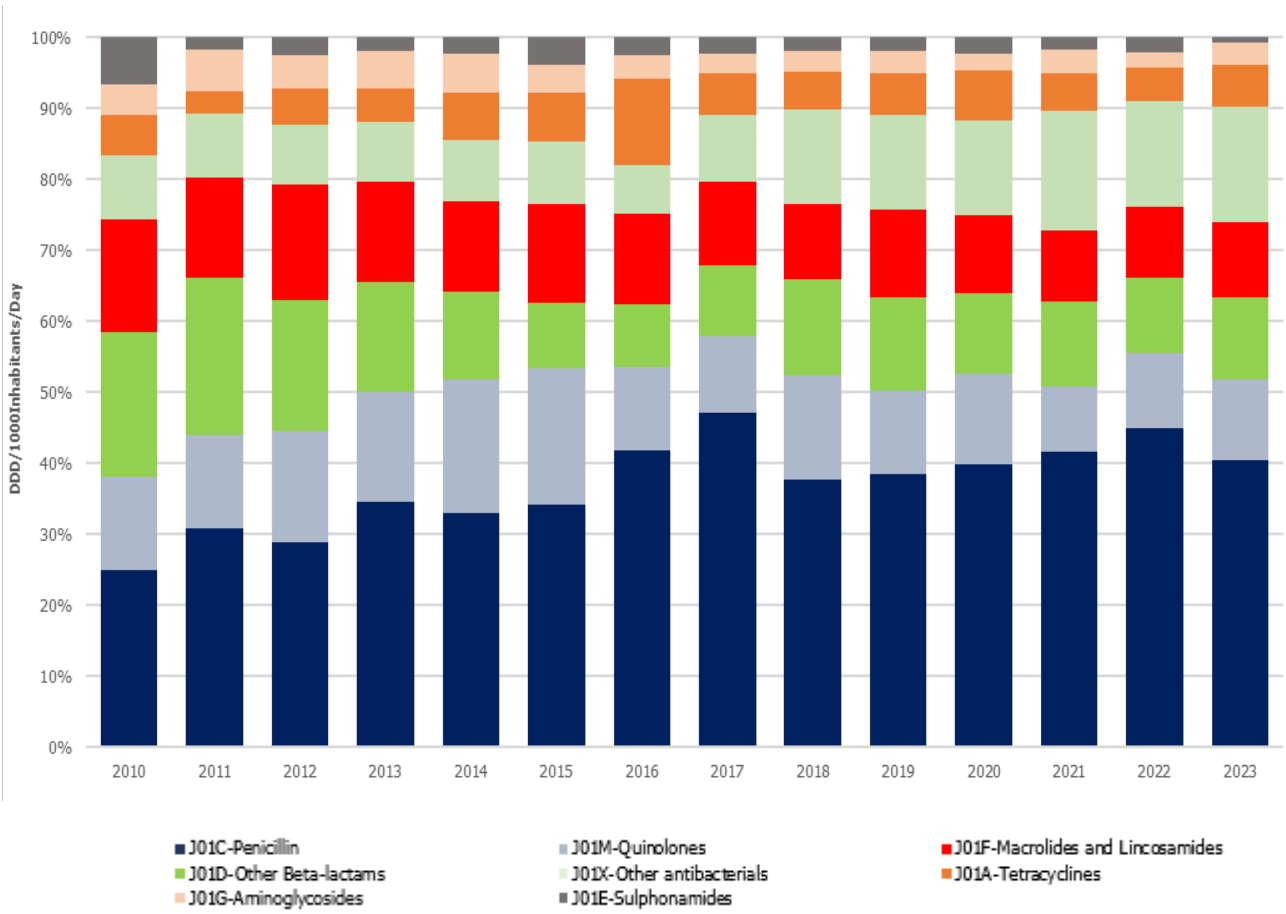


Fig 24: Trends in yearly consumption of antibacterials for systemic use (ATC group J01) in the hospital care in Malta, in 2010-2023, expressed as Daily Defined Dose (DDD) per 1000 inhabitants per day

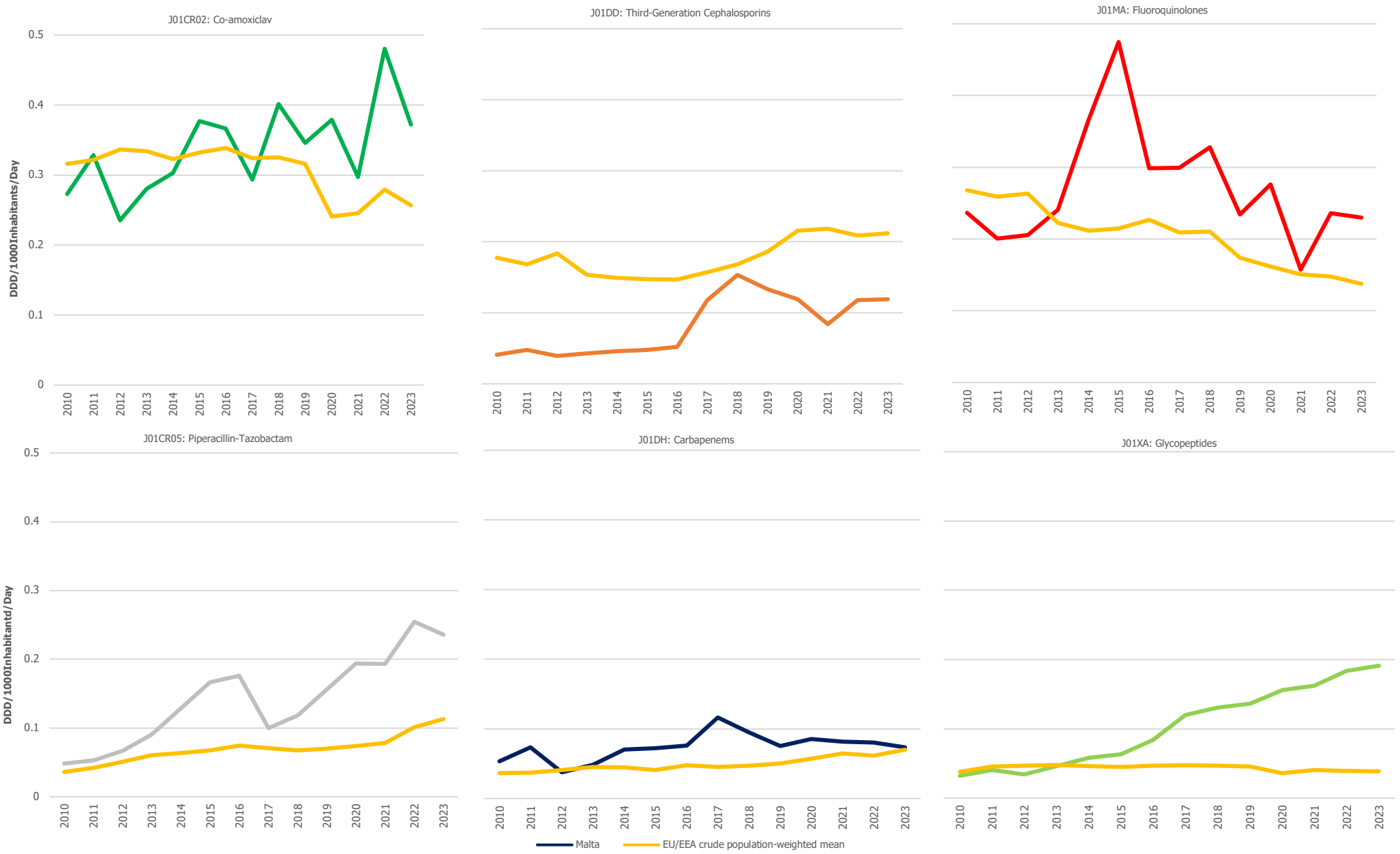


Fig 25: Yearly consumption of selected classes of antibacterials for systemic use (J01) in the hospital care, in 2010-2023, expressed as Daily Defined Dose (DDD) per 1000 inhabitants

3 Animal Health

3.1 AMR Epidemiology

The National Veterinary Laboratory (NVL) has been chosen as one of the designated laboratories for analysing samples for the Monitoring of AMR in Zoonotic and Commensal Bacteria by the Competent Authority since 2014. Analysis is performed on samples for the isolation of *Salmonella* spp., *Campylobacter* spp., commensal indicator *Escherichia coli*, ESBL-/AmpC-/Carbapenemase- producing *Escherichia coli*. A study will be carried out on MRSA in 2025.

Isolation of Presumptive ESBL-, AmpC- or Carbapenemase-producing *Escherichia coli* from caecal samples

In 2022, 125 samples have been analysed for the presence of presumptive ESBL-/AmpC- producing *Escherichia coli* in poultry caeca. These samples were collected form the 4 private slaughterhouses situated around Malta. Out of these, 57 isolates have been obtained which correspond to 45.6% of the samples being positive.

A total of 213 swine caeca samples were collected during 2023. These samples originated from the two swine slaughterhouses, with the largest one situated in Malta and a smaller one siutated in Gozo. NVL has isolated isolated 91 presumptive ESBL-/AmpC- producing *Escherichia coli.*This has resulted in occurrence of 42.7%.

During 2022 and 2023, all samples were analysed for the presence of presumptive Carbapenemase-producing *Escherichia coli* using a selective agar with a specific chromogenic substrate and peptones which aid in the identification of Carbapenemase-producing *Escherichia coli* by coloration.

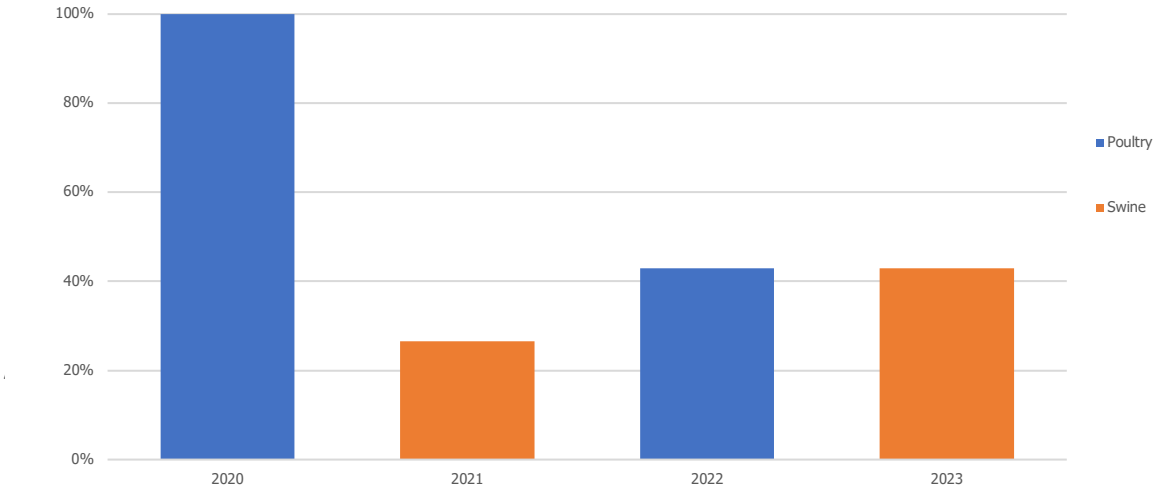


Fig 26: The prevalence of ESBL-/AmpC- producing *Escherichia coli* in poultry and swine caeca from 2020 to 2023

During the 2022, *Salmonella* spp. samples were collected and analysed through the Salmonella National Control programme. These samples were covering both the broiler and layer farms throughout Malta and Gozo. The isolates obtained were then further analysed for their resistance to antimicrobials.

During the AMR Programme in 2023, swine caeca samples were tested for *Salmonella* spp. Out of the 213 caeca, 78 *Salmonella* spp. isolates were obtained and tested for AMR. Out of these:

- 38 isolates (48.7%) resulted to be susceptible to all of the antimicrobials against which they were tested for.
- 10 isolates (12.8%) were resistant to one antimicrobial
- 13 isolates (16.7%) were resistant to two antimicrobials
- 14 isolates (17.9%) were resistant to three antimicrobials
- 2 isolates (2.6%) were resistant to four antimicrobials
- 1 isolate was resistant to >four antimicrobials

All *Salmonella* spp. Isolates were tested against 15 different antimicrobials as per Table II of the Annex of Commission Implementing Decision (CID) 2020/1729. There was only one isolate which have resulted to be resistant to Cefotaxime and Ceftizidime which need further testing. The resistant isolate was further tested against 10 antimicrobials, where it resulted to be an ESBL-phenotype. The ESBL-producing *Salmonella spp.* culture was serotype as *Salmonella Kentucky.*

Trends of AMR in *Salmonella* spp. isolates

Throughout the last four years, *Salmonella spp*. have been analysed twice from swine caecal samples collected from the slaughterhouses in Malta and Gozo. These were collected in 2021 and 2023. In 2020 and 2022, isolates were obtained through the *Salmonella* National Control Programme. In this case, *Salmonella* bootswabs were collected from broiler flocks, while faecal and dust swabs were collected from layer flocks. Fig 26 shows the percentage of *Salmonella* isolates having an ESBL-phenotype over a number of years. In the case of *Salmonella* isolates, no AmpC- phenotype nor ESBL-/AmpC- phenotype have ever been isolated from either poultry nor swine samples. Table 1 shows the proportion of *Salmonella* spp. isolates which were resistant for each antimicrobial during 2022 and 2023.

Table 1: Proportion and Percentage resistant isolates of *Salmonella* spp for each antibiotic during 2022 and 2023

	2022		2023	
	Total Number of Resistant Isolates tested	% Resistance Isolates	Total Number of Resistant Isolates tested	% Resistance Isolates
Ampicillin	48	25%	79	28.2%
Azithromycin	48	0%	79	0%
Amikacin	48	2.1%	79	1.3%
Gentamicin	48	8.3%	79	0%
Tigecycline	48	4.2%	79	9%
Ceftazidime	48	8.3%	79	1.3%
Cefotaxime	48	8.3%	79	1.3%
Colistin	48	0%	79	0%
Nalidixic Acid	48	14.6%	79	5.1%
Tetracycline	48	14.6%	79	35.9%
Trimethoprim	48	2.1%	79	1.3%
Sulfamethoxazole	48	6.3%	79	32%
Chloramphenicol	48	6.3%	79	1.3%
Meropenem	48	0%	79	0%
Ciprofloxacin	48	14.6%	79	5.1%

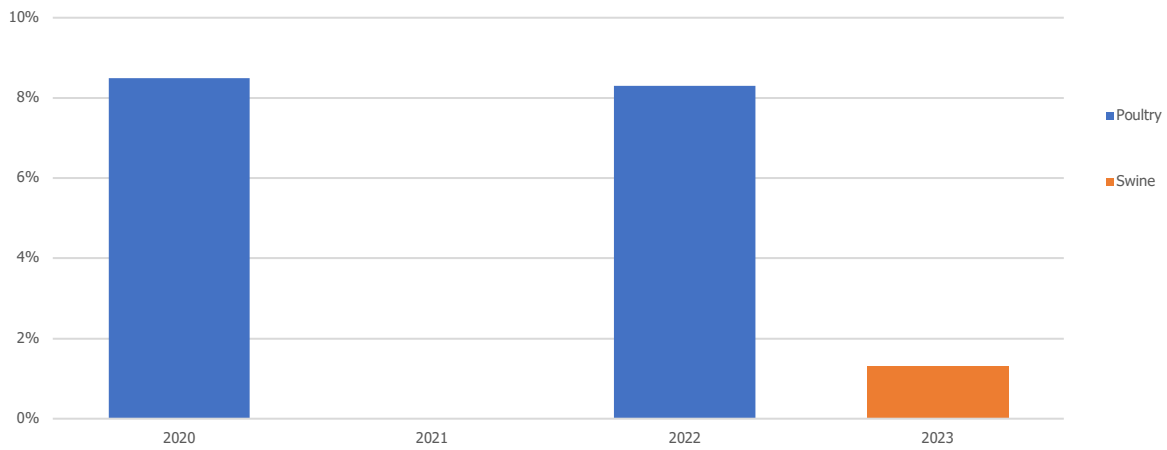


Fig 27: The prevalence of ESBL-/AmpC- producing *Salmonella* spp. cultures in poultry and swine caeca from 2020 to 2023

AMR in commensal indicator *Escherichia coli*

In 2022, NVL analysed 125 commensal indicator *Escherichia coli* isolates for AMR. Out of these samples, 6 isolates resulted in having an ESBL- producing phenotype accounting to 4.8% of the isolates. None of the isolates resulted in having AmpC- or ESBL- and AmpC- producing phenotype. The most common resistance was for Ampicillin which was found in 79 isolates, resulting in 63.2% of the isolates.

The second most common resistance was for Tetracycline which was found in 68 isolates, resulting in 54.4% resistant isolates. The third most common resistance was for Ciprofloxacin, for which 65 isolates were resistant accounting to 52%. All of the isolates obtained in 2022 were susceptible for Colistin and Meropenem.

In 2023, 213 isolates of commensal indicator *Escherichia coli* were isolated and tested for AMR. Two of the analysed cultures resulted in having an ESBL- phenotype which accounts to 0.9% of all indicator commensal *Escherichia coli* isolates. The most common antimicrobial resistant substance was Tetracycline with 139 cultures accounting to 65.3% resistance. The second most common resistance was for Sulfamethoxazole for which 94 cultures were resistant and accounting for 44.1%. The third most common resistance was Ampicillin with 68 resistant cultures, which accounted to 31.9% resistance. Table 2 shows the proportion of *Escherichia coli* isolates which were resistant for each antimicrobial during 2022 and 2023.

	Table 2: Proportion and Percentage resistant isolates of *Escherichia coli* for each antibiotic during 2022 and 2023			
	2022		2023	
	Total Number of Resistant Isolates tested	% Resistance Isolates	Total Number of Resistant Isolates tested	% Resistance Isolates
Ampicillin	182	75.3%	267	45.9%
Azithromycin	182	8.2%	267	0.7%
Amikacin	182	0.5%	267	1.5%
Gentamicin	182	8.8%	267	5.2%
Tigecycline	182	3.3%	267	1.1%
Ceftazidime	182	34.6%	267	20.5%
Cefotaxime	182	34.6%	267	21.3%
Colistin	182	0%	267	0%
Nalidixic Acid	182	94%	267	15.7%
Tetracycline	182	53.8%	267	70.9%
Trimethoprim	182	43.4%	267	47%
Sulfamethoxazole	182	53.3%	267	52.2%
Chloramphenicol	182	37.9%	267	27.2%
Meropenem	182	0%	267	0%
Ciprofloxacin	182	64.3%	267	28%

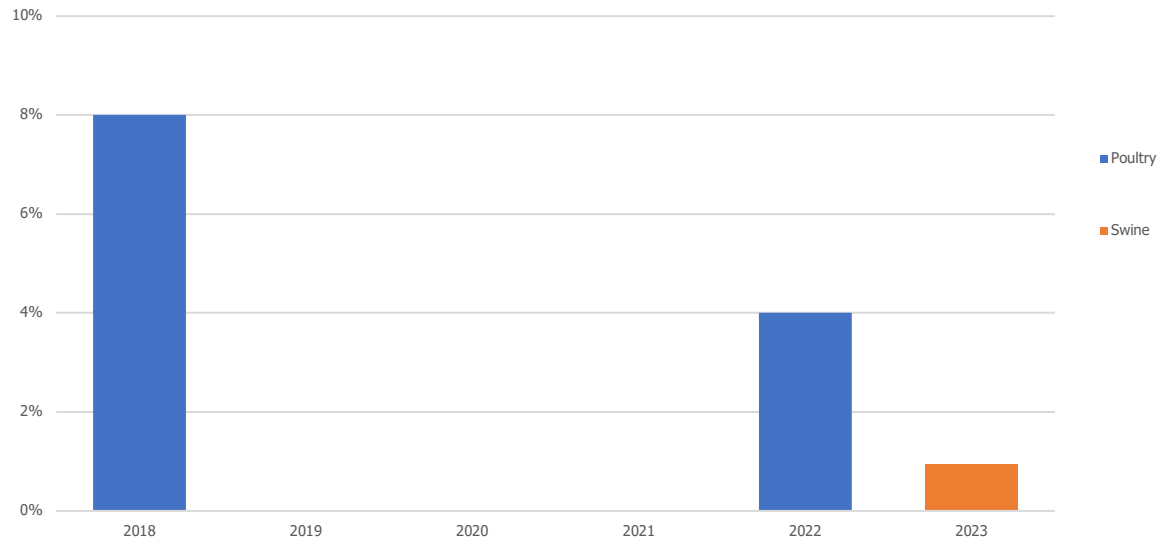


Fig 28: ESBL-prevalence of commensal indicator *E. coli* from 2018 to 2023

Trends of AMR in commensal indicator *Escherichia coli*

In the AMR monitoring programme carried out on poultry samples from 2018 to 2020 there was a decrease in the amount of ESBL- phenotype isolated from commensal indicator *Escherichia coli*. This decrease might have also been due to the low amount of samples which were collected in 2020 as a consequence of the Covid-19 pandemic. The amount of ESBL- phenotype isolates have increase again in 2022 resulting in 4% ESBL- phenotype. Excluding the year 2020, it is noticeable that from 2018 to 2022 there was a 50% decrease in the incidence of ESBL- producing phenotype in commensal indicator *Escherichia coli* isolates.

During swine testing in 2023 there were 2 isolates which have resulted to be ESBL- phenotype. This has given a sudden increase of 0.93% incidence since no ESBL- phenotype has ever been isolated in commensal indicator *Escherichia coli* isolated from swine samples during 2019 and 2021 AMR programmes.

AMR in presumptive ESBL-/AmpC- *Escherichia coli*

During 2022, NVL analysed 57 isolates which were ESBL-/AmpC- producing *E. coli*. Fig 29 shows the distribution of ESBL-/AmpC- isolates obtained from poultry caeca samples. The most common phenotype obtained was the ESBL- phenotype which was isolated from 51 different flocks resulting in 89% of the all the presumptive ESBL-/AmpC- producing *Escherichia coli*. The second most common phenotype was the AmpC- phenotype which was isolated 5 times having an occurrence of 9%. The least common isolate was the ESBL- + AmpC- producing phenotype which has been only isolated once in 2022, corresponding to an occurrence of 2%.

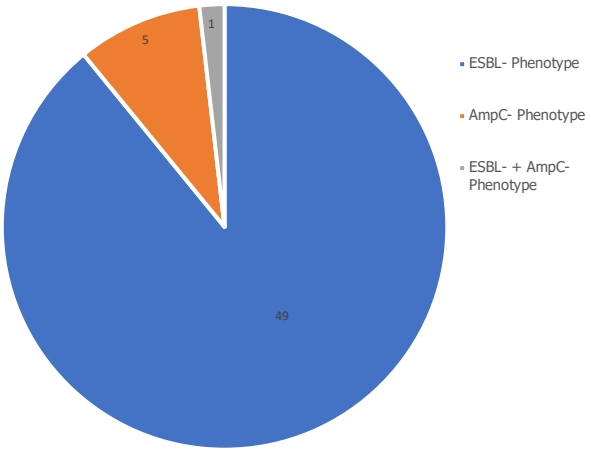


Fig. 29: Distribution of ESBL-/AmpC- phenotypes in Presumptive ESBL-/AmpC- producing Escherichia coli isolates obtained from Poultry samples in 2022

In 2023, NVL obtained 54 isolates of ESBL-/AmpC- producing *E. coli* which were analysed for their phenotypic traits. Fig 30 shows the distribution of ESBL-/AmpC- isolates obtained from swine caeca samples. The most prevalent phenotype was the ESBL- phenotype which was isolated from 49 samples and accounting for 91% of all presumptive ESBL-/AmpC-producing *Escherichia coli*. The ESBL- + AmpC- phenotype was the second most common, detected in 4 instances, representing 7% of the isolates. The rarest phenotype, AmpC- was observed only once during the year, corresponding to an occurrence of 2%.

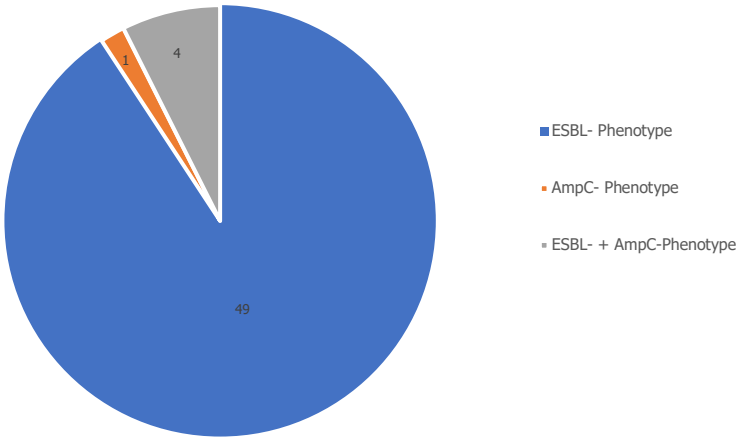


Fig. 30: Distribution of ESBL-/AmpC- phenotypes in Presumptive ESBL-/AmpC- producing Escherichia coli isolates obtained from Swine samples in 2023

Table 1: Proportion and Percentage resistant isolates of Escherichia coli for each antibiotic during 2022 and 2023

3.2 Antimicrobial Consumption

The Veterinary Medicine Antimicrobial 2022 summary report presents data on the sales of veterinary antimicrobial agents for the year 2017-2022. This summary report places emphasis on food-producing animals. The data and information included in this report has been reviewed by formerly known as the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) and now ASU (Antimicrobial Sales and Use) Platform

Collection and calculation of sales data

Veterinary Medicines Unit collected, and compiled sales data provided by all local veterinary medicinal products wholesale dealers, medicated feed mills and medicated feed traders. Data collected was the number of packages sold for each product presentation, that is, the name of veterinary medicinal products, pharmaceutical form, strength and pack size. The weight of sold active substance for each product presentation were calculated by multiplying the number of packages sold by the amount of active ingredient (strength) in each package. With regard to combination preparations, the amount sold is calculated for all ingredients. Results presented were in tonnes sold for each product presentation.

Results

The sales of antimicrobial veterinary medicinal products in Malta, expressed as mg sold per population correction unit (PCU), was 74.4mg/PCU for 2022. Data for 2023 was not available for time of publication of report. The EU average, as stipulated in 2022 ESVAC Report, was 73.9mg/PCU with a range from 2.1 mg/PCU to 254.7 mg/PCU across the 31 countries.

Since 2017, a decrease in the overall annual sales (from 129.3 mg/PCU to 74.4 mg/PCU in 2022, reduction 42.4%), total quinolone sales (from 16.3 mg/PCU to 12.6 mg/PCU in 2022, reduction of 22.6%). A reduction of 17.1% in fluoroquinolone sales and 93.7% polymyxin sales (from 4.9 mg/PCU to 0.31 mg/PCU in 2022).

An increase (9.5%) in the use of third- and fourth-generation cephalosporin sales (from 0.26 mg/PCU to 0.28 mg/PCU in 2022) was recorded.

In 2022, overall sales decreased by 32.7% in comparison to 2021 (from 110.5 mg/PCU to 74.4 mg/PCU). The three highest selling antibiotic classes were tetracyclines, quinolones and sulfonamides, which accounted for 27.6%, 17.0% and 16.4% of total sales, respectively.

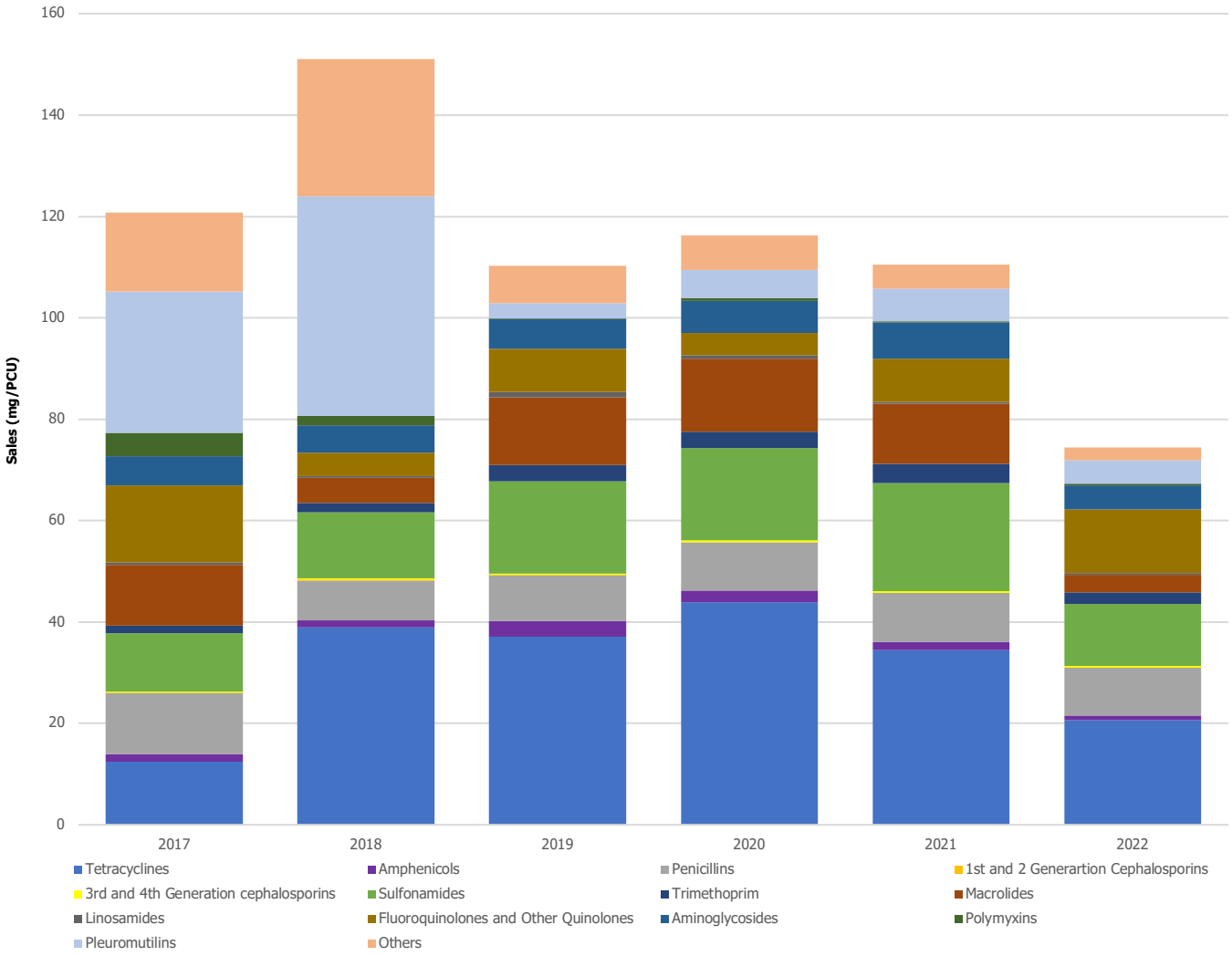


Fig 31: Sales for food-producing animals, in mg per population correction unit (mg/PCU) of various veterinary antimicrobial classes, from 2017–2022
*bacitracin, fosfomycin, furaltadone, metronidazole, novobiocin, paromomycin, rifaximin and spectinomycin

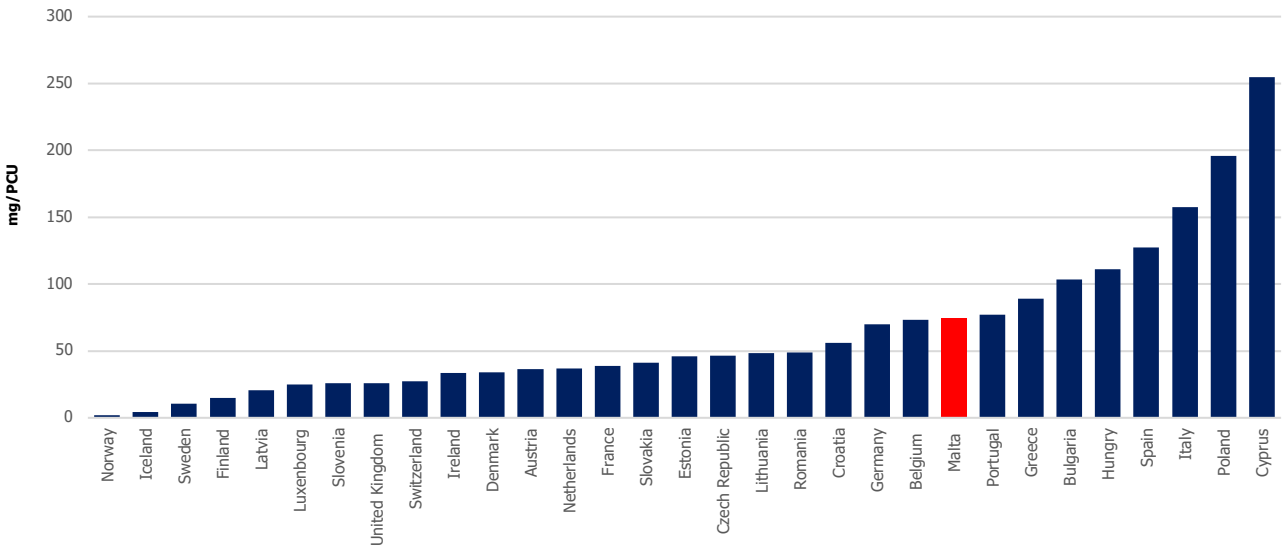


Fig 32: Total sales for food-producing animals, in mg per population correction unit (mg/PCU) of the various veterinary antimicrobial classes for European countries, 2022

As shown in Figure 33, sales of oral powders, oral solutions and premixes accounted for 84.7% of total sales in 2022. In Figure 34, the majority of antibiotic VMP sales in 2022 belonged to AMEG category D (Prudence), accounting for 63% of total sales. PCU increased by 11.8% between 2017 and 2022.

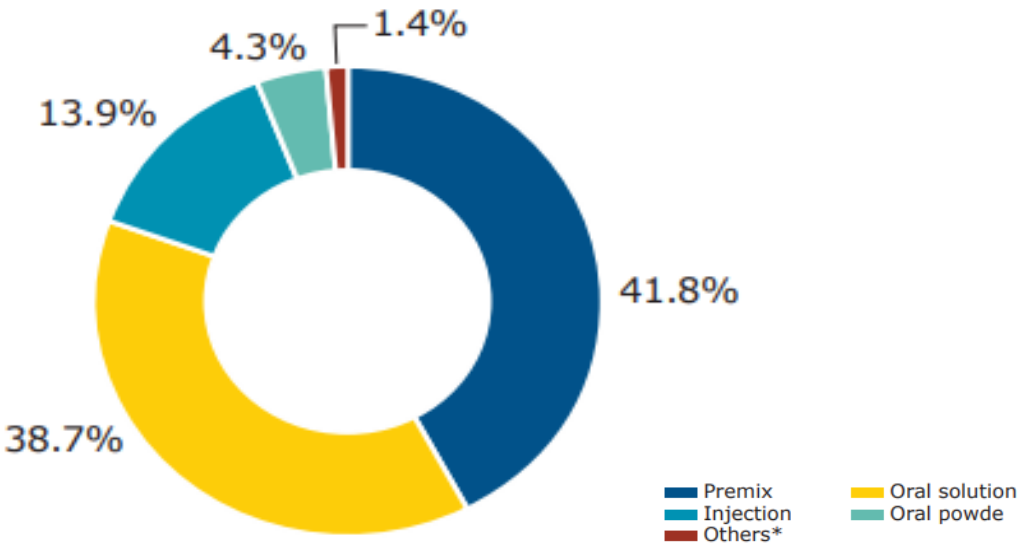


Fig 33: Proportion of sales (mg/PCU) by product form in 2022.

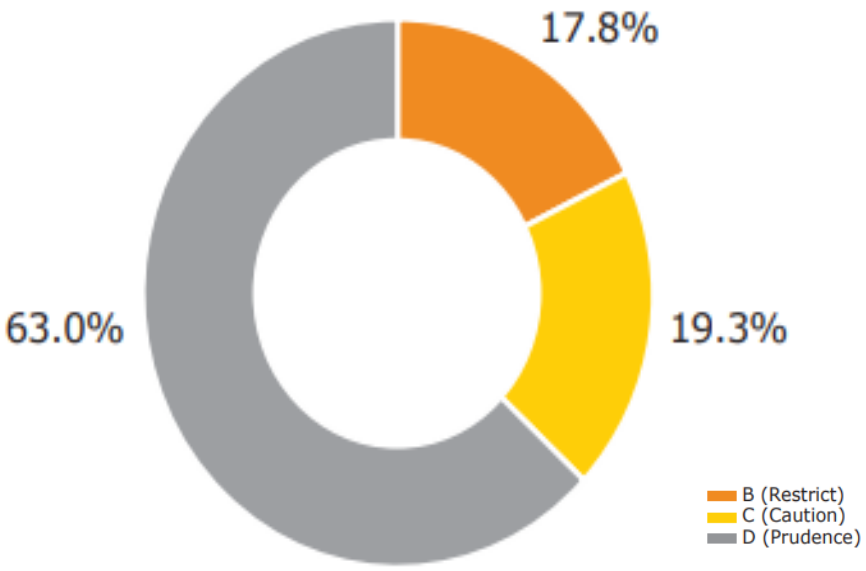


Fig 34: Proportion of sales (mg/PCU) by The Antimicrobial Advice Ad Hoc Expert Group (AMEG) categories in 2022.

4 Environmental Health

4.1 AMR in food production

A substantial number of *E. coli* isolated from meat samples taken from retail establishments, in 2023 tested negative for ESBL. Presumptive positive ESBL was found in only 4% samples for beef and 2.7% samples for pork.

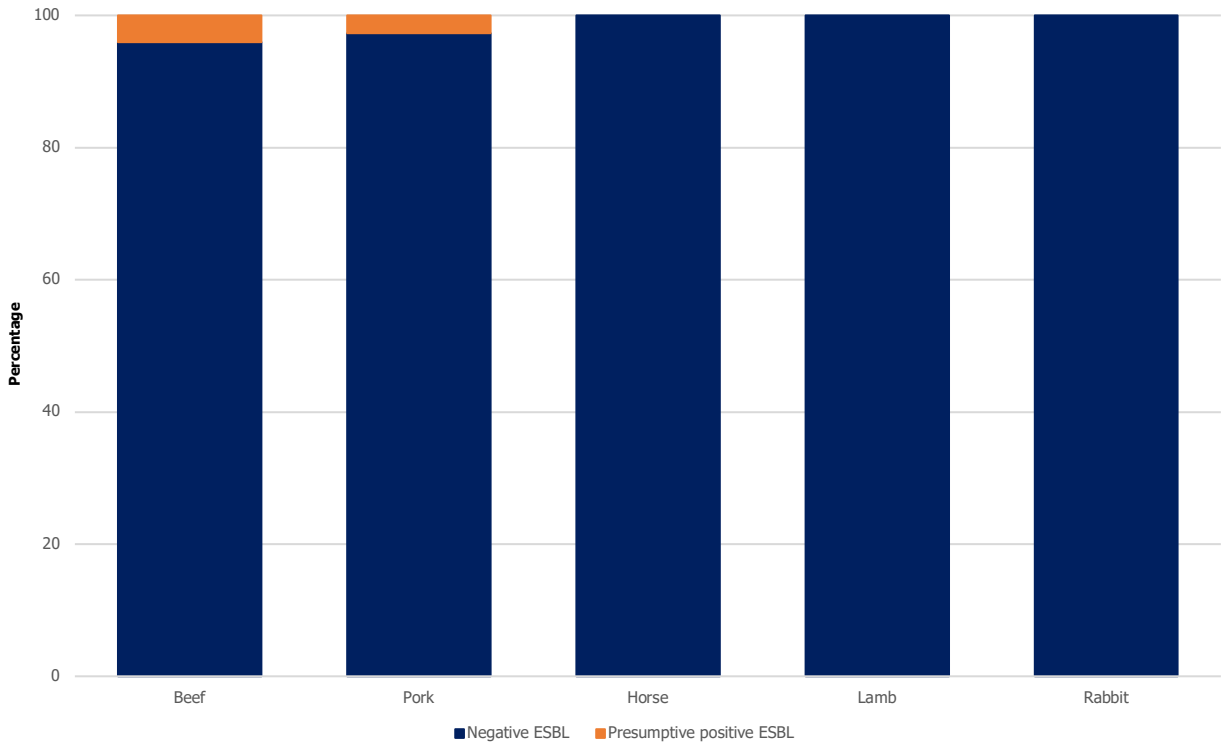


Fig 35: Proportion (in percentage) of ESBL- *Escherichia coli* isolated from samples submitted to Public Health Laboratory from retail outlets of beef (n=150), pork (n=150), horse (n=1), lamb (n=13), rabbit (n=50) in Malta, in 2023

5 National Targets

5.1 National targets for Human Health

Table 2: National targets for human health

National Targets		
	Target by 2030	**Baseline year**
Human health		
Total consumption of antibiotics in community and hospital sectors combined including also long-term care facilities (DDD/1000 inhabitants/day)*	18% reduction	2019
Percentage consumption of 'ACCESS' group of antibiotics from all AWaRe group*	≤65%	-
ECDC/European Food Safety Authority (EFSA)/European Medicines Agency (EMA) secondary indicator for consumption of antibacterials for systemic use in the hospital sector ~	≤35%	-
Incidence of bloodstream infections with meticillin-resistant *Staphylococcus aureus* (MRSA) (BSI/100000 population)*	10% reduction	2019
Incidence of bloodstream infections with third-generation cephalosporin-resistant *Escherichia coli* (ESBL) (BSI/100000 population)*	12% reduction	2019
Incidence of bloodstream infections with carbapenem-resistant *Klebsiella pneumoniae* (CRE) (BSI/100000 population)*	4% reduction	2019
Consumption of alcohol hand rub in acute care hospitals~	50 Litres/1000 patient-days	-

Targets designated with * are those already set by the EU in human health

Targets designated with ~ are deemed important process indicators for hospital care as per current ECDC criteria

Incidence of bloodstream infections with meticillin-resistant *Staphylococcus aureus* (MRSA) (BSI/100000 population)*

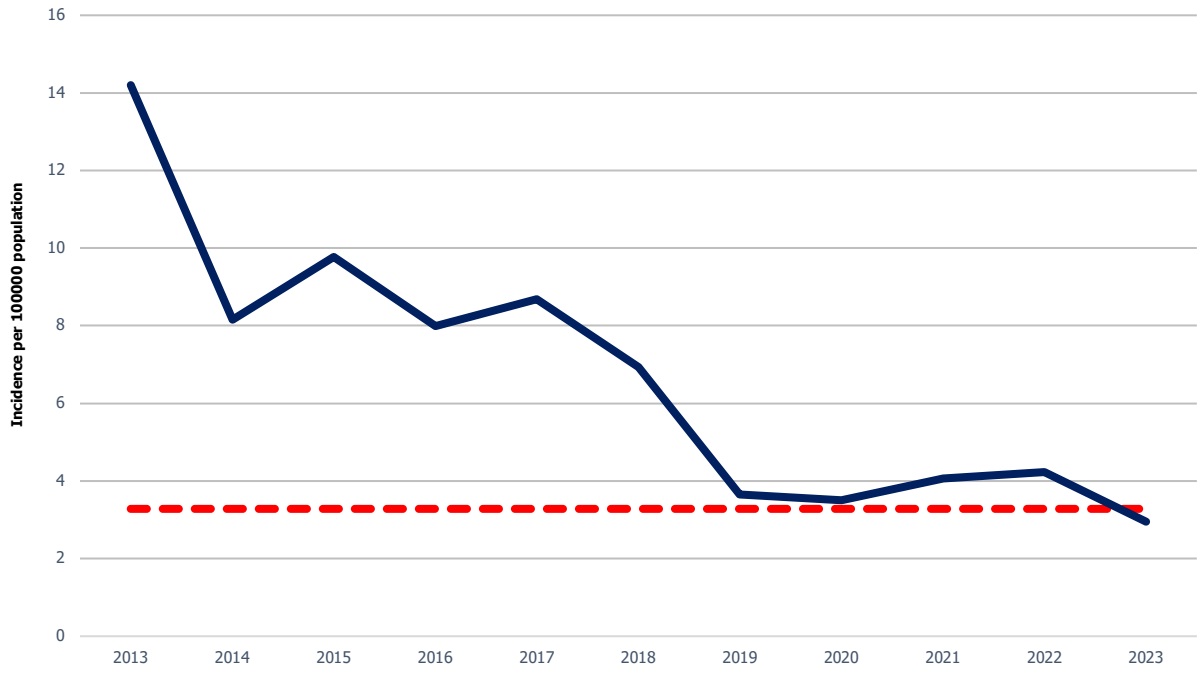


Fig 36: Incidence of bloodstream infections with meticillin-resistant *Staphylococcus aureus* (MRSA)

Incidence of bloodstream infections with third-generation cephalosporin-resistant *Escherichia coli* (ESBL)

(BSI/100000 population)

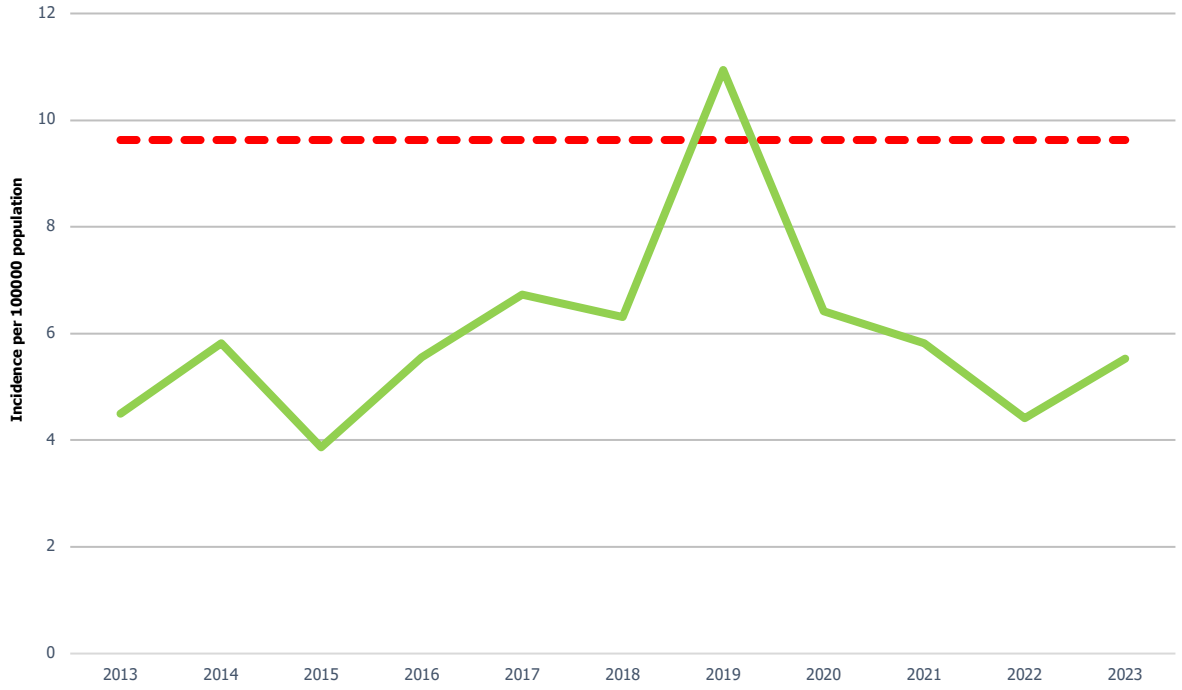


Fig 37: Incidence of bloodstream infections with third-generations cephalosporin-resistant *Escherichia coli* (ESBL)

Incidence of bloodstream infections with carbapenem-resistant *Klebsiella pneumoniae* (CRE)

(BSI/100000 population)

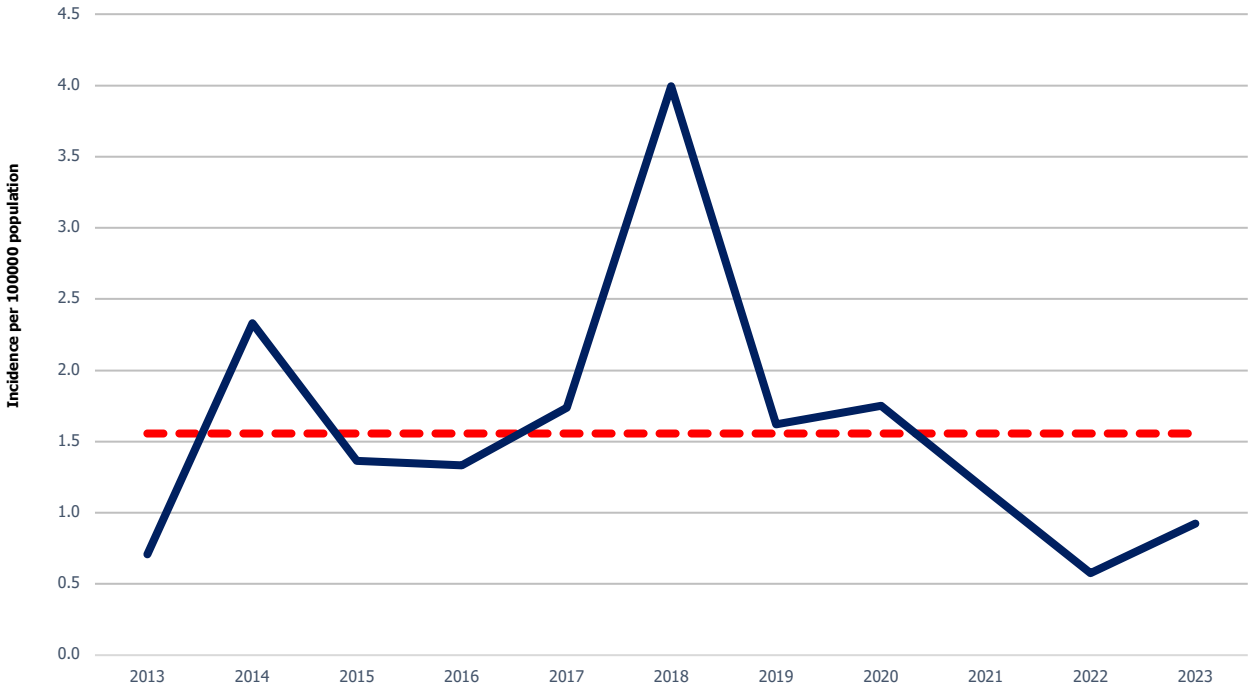


Fig 38: Incidence of bloodstream infections with carbapenem-resistant *Klebsiella pneumoniae* (CRE)

Total consumption of antibiotics in community and hospital sectors combined including also long-term care facilities

(DDD/1000 inhabitants/day)

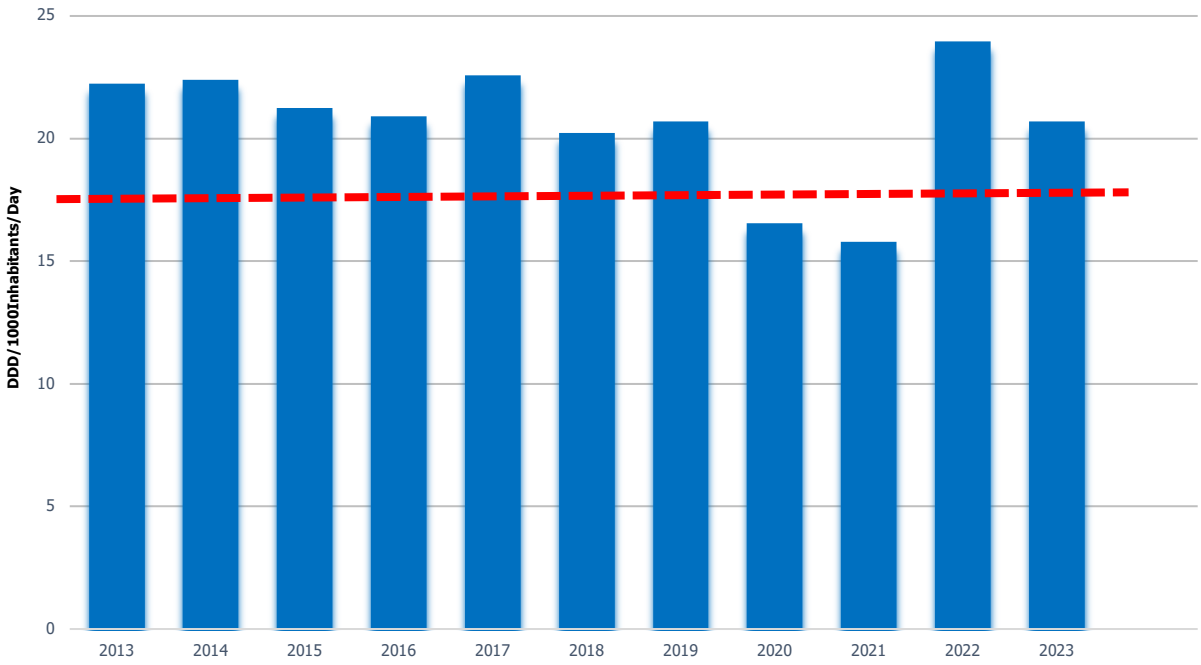


Fig 39: Total consumption of antibiotics in community and hospital sectors combined including also long-term care facilities

Percentage consumption of 'ACCESS' group of antibiotics from all AWaRe group

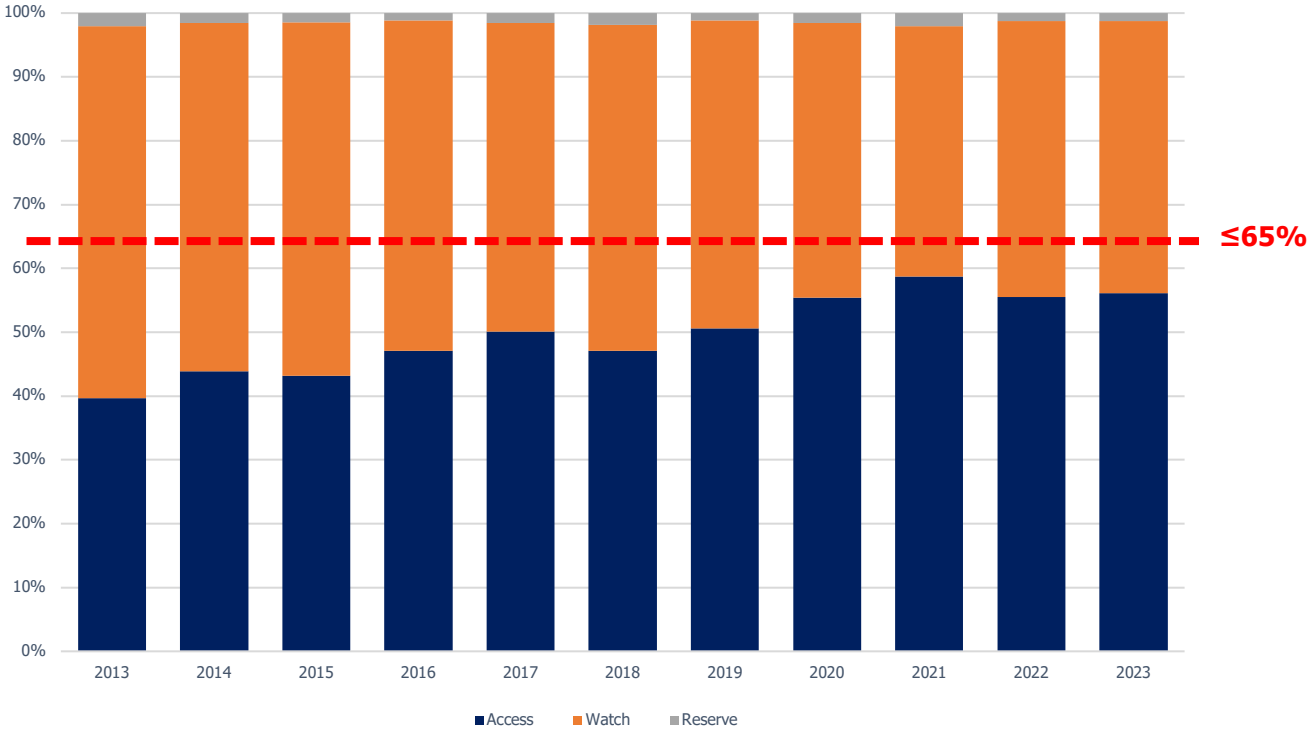


Fig 40: Trends in yearly consumption of antibacterials in the community and hospital care in Malta, in 2013-2023, expressed in accordance to AWaRe classification of antibiotics

ECDC/European Food Safety Authority (EFSA)/European Medicines Agency (EMA) secondary indicator for consumption of antibacterials for systemic use in the hospital sector

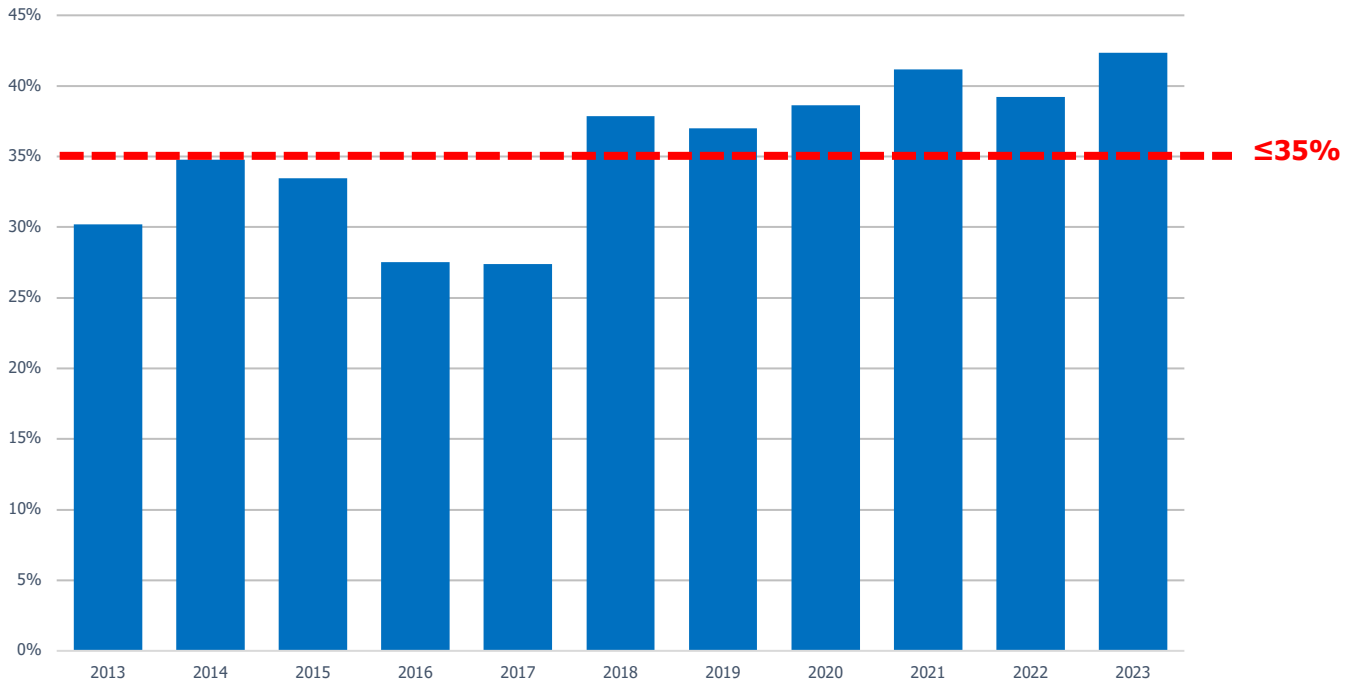


Fig 41: ECDC/European Food Safety Authority (EFSA)/ European Medicines Agency (EMA) secondary indicator for consumption of antibacterials for systemic use in the hospital sector

Consumption of alcohol hand rub in acute care hospitals

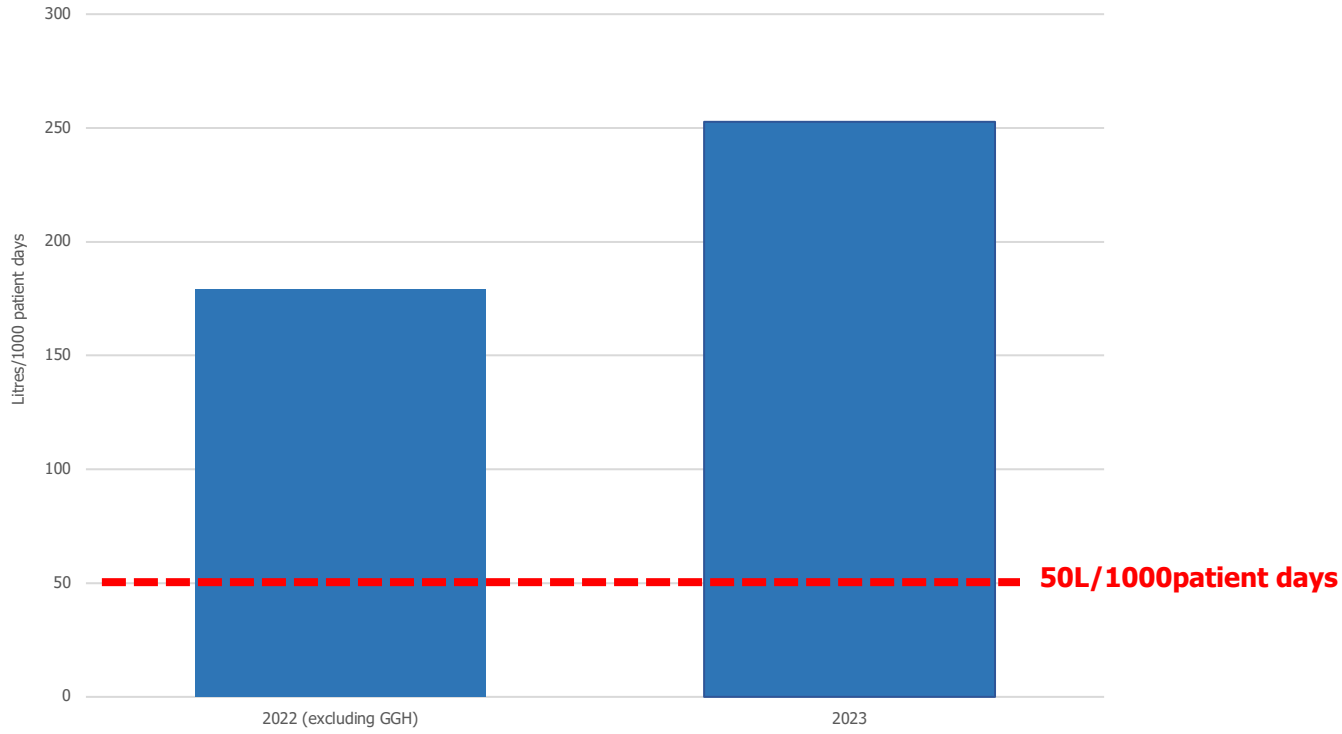


Fig 42: Consumption of alcohol hand rub (litres/1000 patient-days) in acute hospitals (Mater Dei Hospital, Sir Anthony Mamo Oncology Centre, Gozo General Hospital) in Malta, in 2022 and 2023

5.2 National targets for Animal Health

Table 3: National Target for animal health

National Target		
	Target by 2030	**Baseline year**
Animal Health		
Total antimicrobial use in farmed and aquatic species	15% reduction	2025

Target has been agreed between Ministry for Agriculture, Fisheries and Animal rights and the European Commission.

Bibliography

European Centre for Disease Prevention and Control, European Food Safety Authority and European Medicines Agency. (2017). Joint Scientific Opinion on a list of outcome indicators as regards surveillance of antimicrobial resistance and antimicrobial consumption in humans and food-producing animals. EFSA Journal,15(10):5017-5087.

European Centre for Disease Prevention and Control. Antimicrobial consumption in the EU/EAA (ESACNet) – Annual epidemiological report for 2023. 2024. Accessed at: https://www.ecdc.europa.eu/en/publications-data/antimicrobial-consumption-eueea-esac-net-annual-epidemiological-report-2023#:~:text=In%202023%2C%20the%20EU%20population,country%20range%209.6%E2%88%9228.5).

European Centre for Disease Prevention and Control. Surveillance Atlas of Infectious Diseases.2023. Accessed at: https://www.ecdc.europa.eu/en/surveillance-atlas-infectious-diseases

European Medicine Agency. European Surveillance of Veterinary Antimicrobial Consumption (ESVAC). 2009-2023. Accessed at: https://www.ema.europa.eu/en/veterinary-regulatory-overview/antimicrobial-resistance-veterinary-medicine/european-surveillance-veterinary-antimicrobial-consumption-esvac-2009-2023.

L.N.122 of 2018 as part of the Public Health Act (Cap.465).

L.N.105 of 2023 as part of the Public Health Act (Cap.465).

World Health Organisation. AWaRe classification of antibiotics for evaluation and monitoring of use, 2023. 26 July 2023. Accessed at: https://www.who.int/publications/i/item/WHO-MHP-HPS-EML-2023.04