Rijksinstituut voor Volksgezondheid
en Milieu
*Ministerie van Volksgezondheid,
Welzijn en Sport*

CarMap 2023

Antimicrobial resistance among medically important bacteria in Aruba

Contents

1 Introduction

This is CarMap 2023, a RIVM/Netherlands Antilles report on the trends in antimicrobial resistance in Aruba in 2022 and previous years. CarMap is a cooperative effort of the Centre for Infectious Disease Control Netherlands (CIb) at the National Institute for Public Health and Environment (RIVM) and the participating laboratories at the Netherlands Antilles.

The major aim of CarMap is to analyse trends in antimicrobial resistance on the Netherlands Antilles and if there is a difference in antimicrobial resistance between the different islands of the Netherlands Antilles. Furthermore, it aims to compare data from the Netherlands Antilles to data from the Netherlands. Based on this comparison, the islands of the Netherlands Antilles are able to conclude if the Dutch health guidelines still need to be adhered to or if they should deviate from it.

2 Methods and description of data from the Infectious Diseases Surveillance Information Systen for Antimicrobial Resistance (ISIS-AR)

Since 2021, routinely available antimicrobial susceptibility data of isolates from the medical microbiology laboratories in the Netherlands Antilles, including minimal inhibitory concentration (MIC) values and disk zone diameters, have been collected in the Infectious Diseases Surveillance Information System for Antimicrobial Resistance (ISIS-AR). This surveillance system is a combined initiative of the Ministry of Health, Welfare and Sport and the Dutch Society of Medical Microbiology (NVMM), and is coordinated by the centre of Infectious Disease Control at the National Institute for Public Health and the Environment (RIVM) in Bilthoven.

In 2021, only Aruba of the Netherlands Antilles was connected to ISIS-AR so therefore no comparison between the islands of the Netherlands Antilles could be made. In 2022, 47 Dutch laboratories were connected to ISIS-AR, all performing antimicrobial susceptibility testing (AST) according to EUCAST guidelines. Of these 47 Dutch laboratories, 37 provided complete data on the last five years (2018 to 2022). Only data from these 37 laboratories were selected to avoid bias in time trends due to incomplete data.

All data provided to ISIS-AR are carefully validated[1]. Data confirmed or probable technical errors are, after consultation with the laboratory that provided the data, corrected or excluded from the analyses referred to in this report. The selection of isolates from the Netherlands Antilles data as well as the calculation of resistance levels and time trends are executed using the same methods as those used for the NethMap report. One exception has been made: resistance levels were also calculated for pathogens for which less than 100 isolates in each year were available for analysis. Further information on these methods can be found in Chapter 4.1 of the Nethmap 2022 report, available on the website of the RIVM.

References

[1] Altorf-van der Kuil W, Schoffelen AF, de Greeff SC, et al. (2017) National laboratory-based surveillance system for antimicrobial resistance: a successful tool to support the control of antimicrobial resistance in the Netherlands. Euro Surveill 22(46).

3 Primary care

The distribution of pathogens in diagnostic urine, wound or pus, respiratory, and genital samples from general practitioners' (GP) patients in 2022 is presented in table 3.0.0.1. The resistance levels in 2022 for *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, and *Pseudomonas aeruginosa* isolates from urine samples are presented in their respective subchapters. In accordance with age categories used in the guidelines of the Dutch College of General Practitioners (NHG) for urinary tract infections, resistance levels and five-year trends for urine isolates are calculated separately for patients aged ≤ 12 years and patients aged >12 years.

The resistance levels in 2022 for *Staphylococcus aureus* isolates from wound or pus samples, for β-haemolytic *Streptococcus* spp. group A isolates from wound/pus, respiratory, or genital samples, and for β-haemolytic *Streptococcus* spp. group B isolates from urine or genital samples are presented in their respective subchapters.

Five-year trends in resistance are shown in figure 3.1.0.1 (*E. coli*), figure 3.2.0.1 (*K. pneumoniae*), figure 3.3.0.1 (*P. mirabilis*), figure 3.4.0.1 (*P. aeruginosa*), figure 3.5.0.1 (*S. aureus*), and figure 3.6.0.1 (β-haemolytic *Streptococcus* spp. groep A and group B).

GPs usually send urine, wound, or pus samples for culture and susceptibility testing in case of antimicrobial therapy failure or (with regard to urine samples) complicated urinary tract infection. As a result, the presented resistance levels are likely to be higher than those for all patients with urinary tract infections caused by *Enterobacterales* or *P. aeruginosa* or wound infections or pus caused by *S. aureus* or β-haemolytic *Streptococcus* spp. groep A presenting at the GP. Bias due to selective sampling of patients is expected to be limited for β-haemolytic *Streptococcus* spp. groep B, because initial therapy of urinary tract infections does not affect *Streptococcus* spp. and genital samples are takes as part of routine diagnostics.

Because of the potential bias in results for *Enterobacterales*, *P. aeruginosa*, *S. aureus*, and β-haemolytic *Streptococcus* spp. groep A, the patients from whom samples were taken are hereafter referred to as 'selected general practitioners' patients'.

Table 3.0.0.1 Distribution of isolated pathogens in diagnostic urine samples (by patient age category) and diagnostic wound or pus, respiratory, and genital sampels from selected general practitioners' patients, ISIS-CAR 2022

	Urine		Wound or pus	Respiratory tract	Genital
	Age≤12	Age>12			
Pathogen	N	N	N	N	N
E. coli	11	384	7	1	29
K. pneumoniae	5	73	9	1	9
P. mirabilis	8	61	13	0	13
Other *Enterobacterales* [1]	1	29	25	1	6
P. aeruginosa	0	7	33	1	2
Other non-fermenters[2]	3	6	5	0	0
Other Gram-negatives[3]	0	0	3	2	3
S. aureus	0	11	75	7	6
ß-haemolytische *Streptococcus* spp. group A	0	0	1	1	1
ß-haemolytische *Streptococcus* spp. group B	0	80	7	3	110
Other Gram-positives[4]	2	32	44	5	25

[1] *In order of frequency: Enterobacter spp., Morganella spp., Citrobacter spp., Klebsiella spp. (non-pneumoniae), Serratia spp., Providencia spp., Cronobacter spp.*
[2] *In order of frequency: Acinetobacter spp., Pseudomonas spp. (non-aeruginosa), S. maltophilia, M. catarrhalis.*
[3] *In order of frequency: H. parainfluenzae, H. influenzae, B. fragilis complex.*
[4] *In order of frequency: Staphylococcus spp. (non-aureus), Enterococcus spp., S. pneumoniae, ß-haemolytic Streptococcus spp. groups C and G, S. mitis/S. oralis, S. anginosus, A. urinae.*

3.1 *Escherichia coli*

Table 3.1.0.1 Resistance levels among diagnostic urine isolates of *E. coli* from selected general practitioners' patients aged ≤12, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	10	7	70 (38 - 90)	9282	32 (31 - 33)
co-amoxiclav non-uuti	10	6	60 (30 - 84)	9657	24 (23 - 25)
cefuroxime	10	0	0 (NA - NA)	7753	4 (4 - 5)
cefotaxime/ceftriaxone non-men	10	0	0 (NA - NA)	9599	3 (3 - 3)
ceftazidime	10	0	0 (NA - NA)	9659	2 (2 - 2)
ciprofloxacin	10	0	0 (NA - NA)	9660	5 (5 - 6)
gentamicin	10	1	10 (1 - 47)	9282	3 (3 - 4)
tobramycin	10	1	10 (1 - 47)	8575	3 (3 - 4)
fosfomycin[1]	10	0	0 (NA - NA)	9652	1 (1 - 1)
co-trimoxazole	10	4	40 (16 - 70)	9659	17 (16 - 17)
nitrofurantoin	10	0	0 (NA - NA)	9660	0 (0 - 0)
MDOT non-uuti	10	0	0 (NA - NA)	9656	1 (1 - 1)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.
[1] *Resistance percentage calculated using an mic cut-off of 16mg/L and a diameter cut-off of 24mm (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

Table 3.1.0.2 Resistance levels among diagnostic urine isolates of *E. coli* from selected general practitioners' patients aged>12, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	379	164	43 (38 - 48)	103145	34 (34 - 34)
co-amoxiclav non-uuti	379	142	37 (33 - 42)	107167	25 (25 - 25)
cefuroxime	378	28	7 (5 - 11)	84608	7 (7 - 7)
cefotaxime/ceftriaxone non-men	379	16	4 (3 - 7)	106515	4 (4 - 4)
ceftazidime	377	12	3 (2 - 6)	107144	3 (3 - 3)
ciprofloxacin	378	74	20 (16 - 24)	107176	9 (9 - 9)
gentamicin	379	31	8 (6 - 11)	103152	4 (3 - 4)
tobramycin	379	38	10 (7 - 13)	94911	4 (4 - 4)
fosfomycin[1]	379	5	1 (1 - 3)	107095	2 (2 - 2)
co-trimoxazole	377	94	25 (21 - 30)	107119	18 (17 - 18)
nitrofurantoin	378	4	1 (0 - 3)	107187	2 (2 - 2)
MDOT non-uuti	377	22	6 (4 - 9)	107042	3 (3 - 3)

non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.
[1] *Resistance percentage calculated using an mic cut-off of 16mg/L and a diameter cut-off of 24mm (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

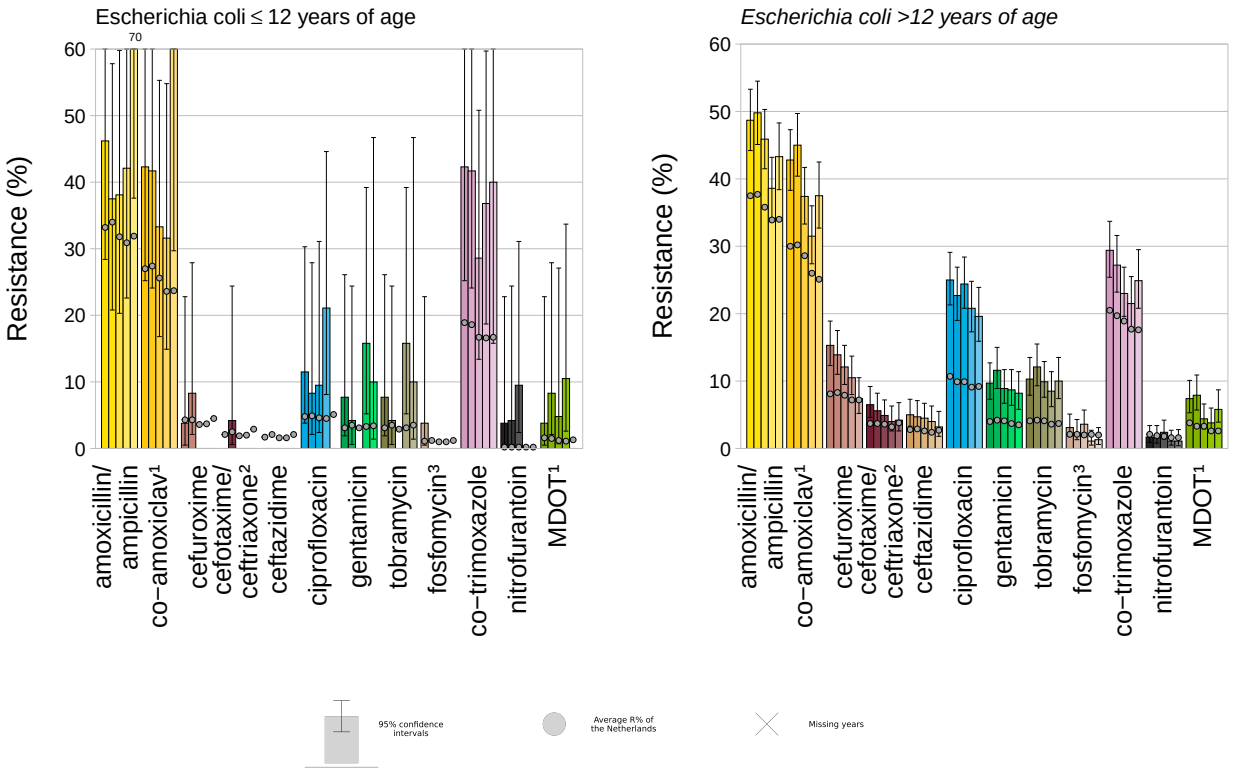

Figure 3.1.0.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic urine isolates of *E. coli* from selected general practitioners' patients in ISIS-CAR, by age category*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*
[3] *Resistance percentage calculated using an mic cut-off of 16mg/L and a diameter cut-off of 24mm (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

3.2 *Klebsiella pneumoniae*

Table 3.2.0.1 Resistance levels among diagnostic urine isolates of *K. pneumoniae* from selected general practitioners' patients aged ≤12, ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
co-amoxiclav non-uuti	5	1	20 (3 - 69)	340	30 (25 - 35)
cefuroxime	5	0	0 (NA - NA)	284	6 (4 - 10)
ceftazidime	5	0	0 (NA - NA)	340	4 (3 - 7)
ciprofloxacin	5	0	0 (NA - NA)	339	3 (1 - 5)
gentamicin	5	0	0 (NA - NA)	333	1 (0 - 3)
tobramycin	5	0	0 (NA - NA)	310	1 (0 - 3)
co-trimoxazole	5	0	0 (NA - NA)	340	4 (3 - 7)
MDOT non-uuti	5	0	0 (NA - NA)	339	0 (0 - 2)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

Table 3.2.0.2 Resistance levels among diagnostic urine isolates of *K. pneumoniae* from selected general practitioners' patients aged>12, ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
co-amoxiclav non-uuti	73	4	5 (2 - 14)	15699	18 (17 - 18)
cefuroxime	73	3	4 (1 - 12)	12316	10 (10 - 11)
cefotaxime/ceftriaxone non-men	73	2	3 (1 - 10)	15647	3 (3 - 4)
ceftazidime	73	3	4 (1 - 12)	15705	3 (3 - 3)
ciprofloxacin	73	2	3 (1 - 10)	15711	10 (9 - 10)
gentamicin	73	2	3 (1 - 10)	15151	1 (1 - 1)
tobramycin	73	1	1 (0 - 9)	13857	2 (2 - 2)
co-trimoxazole	73	4	5 (2 - 14)	15702	7 (6 - 7)
MDOT non-uuti	73	0	0 (NA - NA)	15690	2 (1 - 2)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

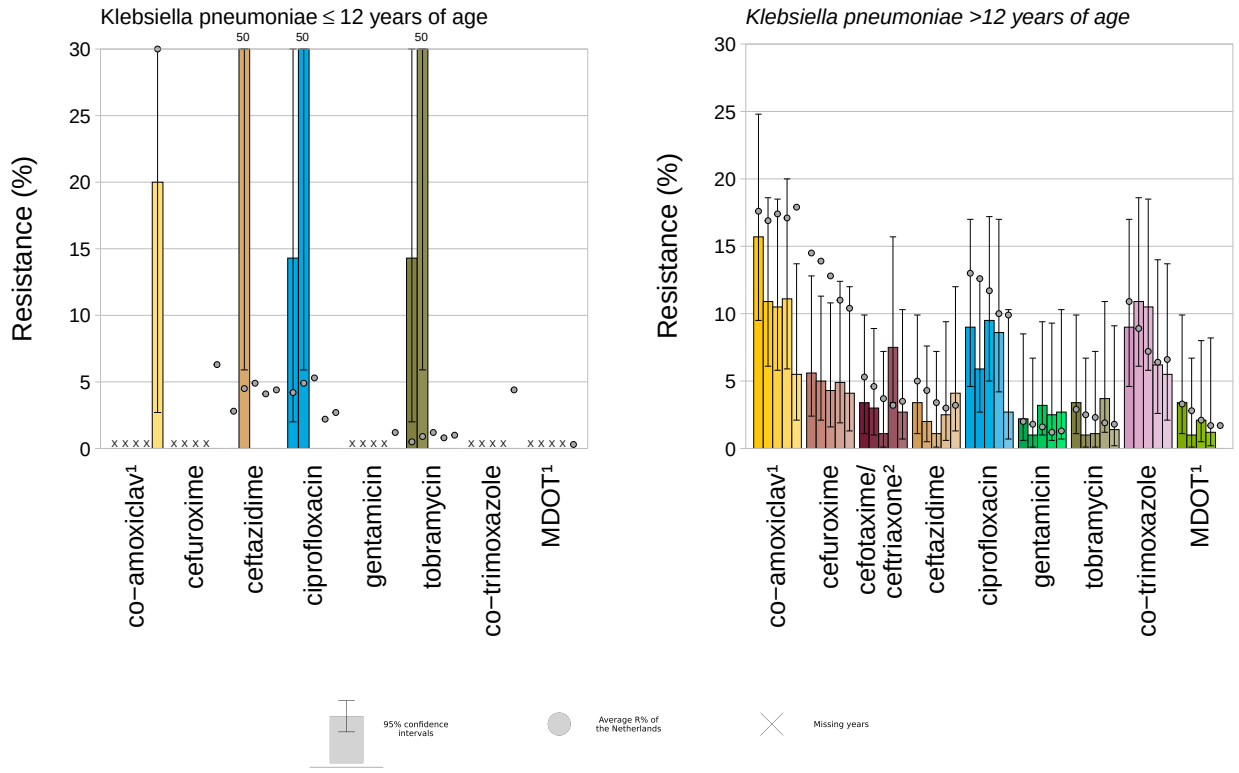

Figure 3.2.0.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic urine isolates of *K. pneumoniae* from selected general practitioners' patients in ISIS-CAR, by age category*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*

3.3 *Proteus mirabilis*

Table 3.3.0.1 Resistance levels among diagnostic urine isolates of *P. mirabilis* from selected general practitioners' patients aged ≤12, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	8	2	25 (6 - 62)	614	19 (16 - 22)
co-amoxiclav non-uuti	8	0	0 (NA - NA)	642	4 (3 - 6)
cefuroxime	8	1	13 (2 - 54)	501	1 (1 - 3)
cefotaxime/ceftriaxone non-men	8	1	13 (2 - 54)	642	1 (0 - 2)
ceftazidime	8	1	13 (2 - 54)	641	0 (0 - 1)
ciprofloxacin	8	1	13 (2 - 54)	642	6 (5 - 8)
gentamicin	8	1	12 (2 - 54)	506	3 (2 - 5)
tobramycin	8	1	13 (2 - 54)	475	4 (2 - 6)
co-trimoxazole	8	2	25 (6 - 62)	642	21 (18 - 25)
MDOT non-uuti	8	0	0 (NA - NA)	642	0 (0 - 1)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

Table 3.3.0.2 Resistance levels among diagnostic urine isolates of *P. mirabilis* from selected general practitioners' patients aged>12, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	59	9	15 (8 - 27)	9506	19 (19 - 20)
co-amoxiclav non-uuti	59	4	7 (3 - 17)	9764	5 (5 - 6)
cefuroxime	59	3	5 (2 - 15)	7780	1 (1 - 1)
cefotaxime/ceftriaxone non-men	59	1	2 (0 - 11)	9681	1 (0 - 1)
ceftazidime	59	0	0 (NA - NA)	9765	0 (0 - 0)
ciprofloxacin	59	1	2 (0 - 11)	9770	10 (9 - 10)
gentamicin	59	2	3 (1 - 13)	8124	5 (5 - 6)
tobramycin	59	2	3 (1 - 13)	7745	4 (3 - 4)
co-trimoxazole	59	4	7 (3 - 17)	9761	22 (21 - 23)
MDOT non-uuti	59	0	0 (NA - NA)	9754	1 (1 - 1)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

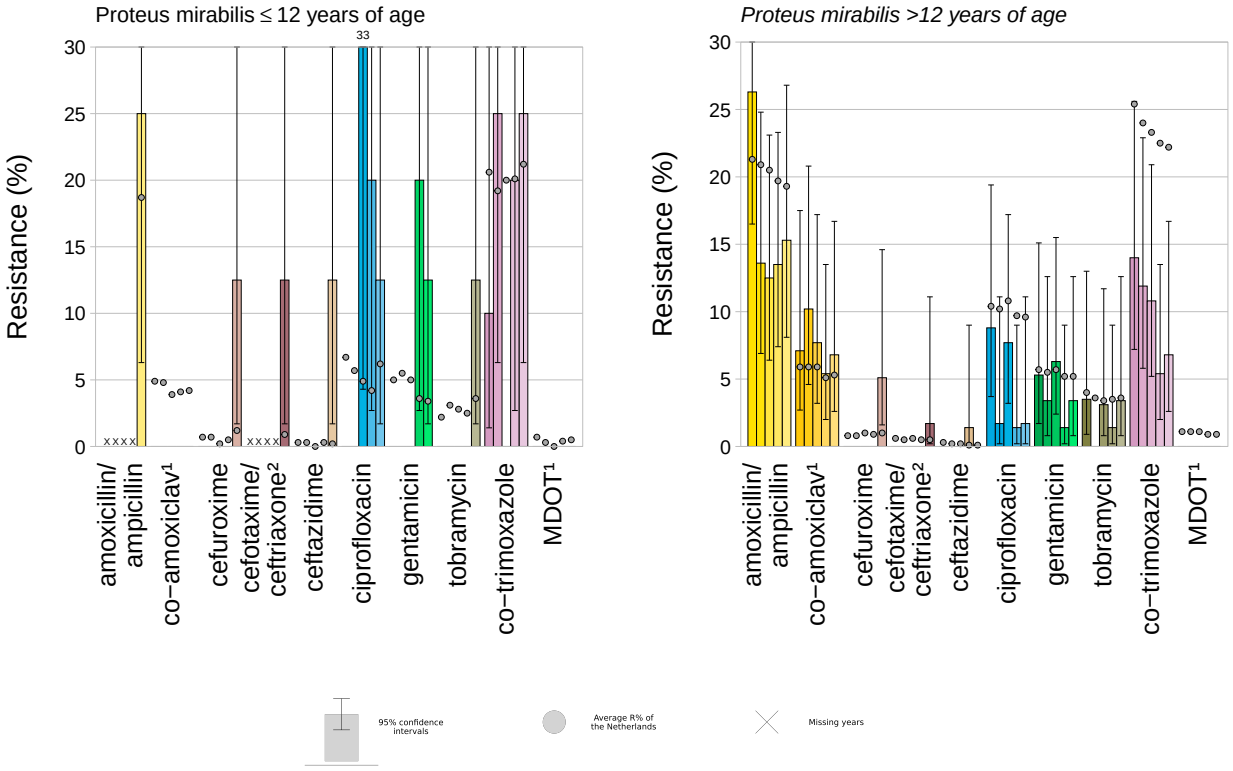

Figure 3.3.0.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic urine isolates of *P. mirabilis* from selected general practitioners' patients in ISIS-CAR, by age category*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*

3.4 *Pseudomonas aeruginosa*

There are no data available in ISIS-AR among diagnostic isolates of *P. aeruginosa* from selected general practitioners' patients aged ≤12 in 2022. Therefore, no table and figure are produced.

Table 3.4.0.1 Resistance levels among diagnostic urine isolates of *P. aeruginosa* from selected general practitioners' patients aged>12, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
piperacillin-tazobactam	4	0	0 (NA - NA)	4215	4 (4 - 5)
ceftazidime	5	0	0 (NA - NA)	4565	1 (1 - 2)
imipenem	5	0	0 (NA - NA)	3906	4 (4 - 5)
meropenem non-men	4	0	0 (NA - NA)	4559	1 (1 - 1)
ciprofloxacin	5	0	0 (NA - NA)	4704	9 (9 - 10)
tobramycin	5	0	0 (NA - NA)	4120	1 (0 - 1)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-men = According to breakpoint for indications other than meningitis.

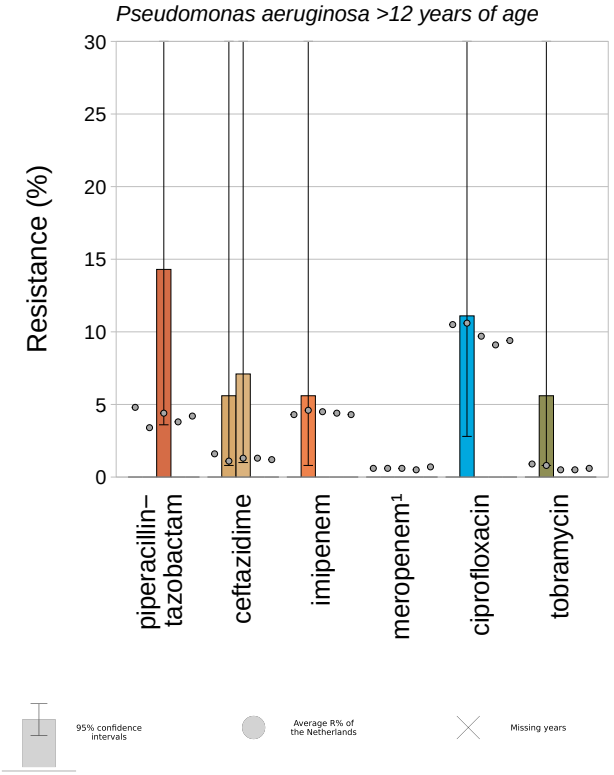

Figure 3.4.0.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic urine isolates of *P. aeruginosa* from selected general practitioners' patients in ISIS-CAR, by age category*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-men = According to breakpoint for indications other than meningitis.*

3.5 *Staphylococcus aureus*

Table 3.5.0.1 Resistance levels among diagnostic wound or pus isolates of *S. aureus* from selected general practitioners' patients, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
clindamycin incl. inducible resistance[1]	75	6	8 (4 - 17)	10486	13 (12 - 14)
doxycycline/tetracycline screen	75	5	7 (3 - 15)	10491	4 (4 - 4)
co-trimoxazole	75	2	3 (1 - 10)	10493	2 (2 - 3)
MRSA	75	14	19 (11 - 29)	10494	3 (3 - 4)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
screen = According to breakpoint for screening.
MRSA = Methicillin resistance Staphylococcus aureus. For estimation method of MRSA see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

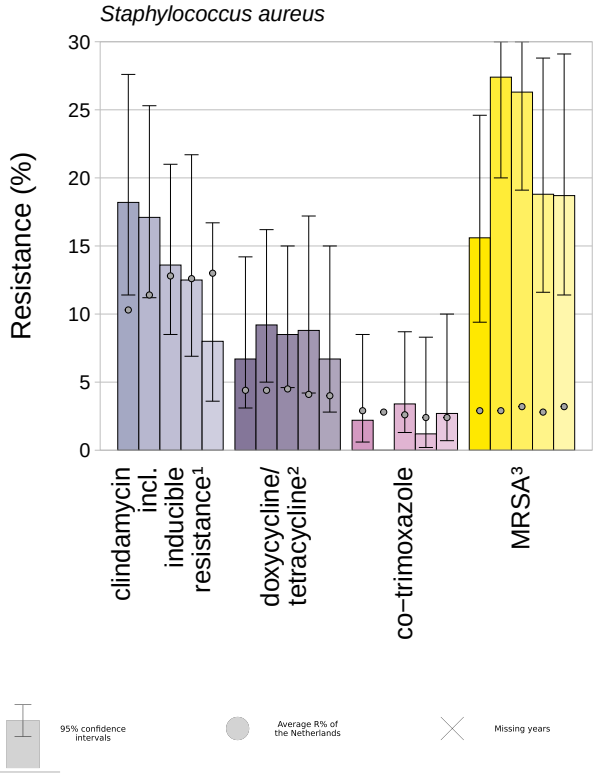

Figure 3.5.0.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic wound or pus isolates of *S. aureus* from selected general practitioners' patients in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*
[2] *screen = According to breakpoint for screening.*
[3] *MRSA = Methicillin resistance Staphylococcus aureus. For estimation method of MRSA see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information.*

3.6 β-haemolytic *Streptococcus* spp. group A and group B

Table 3.6.0.1 Resistance levels among diagnostic wound/pus, respiratory or genital isolates β-haemolytic *Streptococcus* spp. group A from selected general practitioners' patients, ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
erythromycin	3	2	67 (15 - 96)	2132	9 (8 - 10)
clindamycin incl. inducible resistance[1]	3	2	67 (15 - 96)	2133	8 (7 - 9)
doxycycline/tetracycline screen	3	2	67 (15 - 96)	2011	29 (27 - 31)
co-trimoxazole	3	0	0 (NA - NA)	1791	4 (3 - 5)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
screen = According to breakpoint for screening.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

Table 3.6.0.2 Resistance levels among diagnostic urine or genital isolates of β-haemolytic *Streptococcus* spp. group B from selected general practitioners' patients, ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
erythromycin	151	38	25 (19 - 33)	5569	21 (20 - 22)
clindamycin incl. inducible resistance[1]	172	27	16 (11 - 22)	4301	17 (16 - 18)
doxycycline/tetracycline screen	176	127	72 (65 - 78)	4386	78 (77 - 79)
co-trimoxazole	154	1	1 (0 - 4)	7378	1 (1 - 1)

screen = According to breakpoint for screening.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

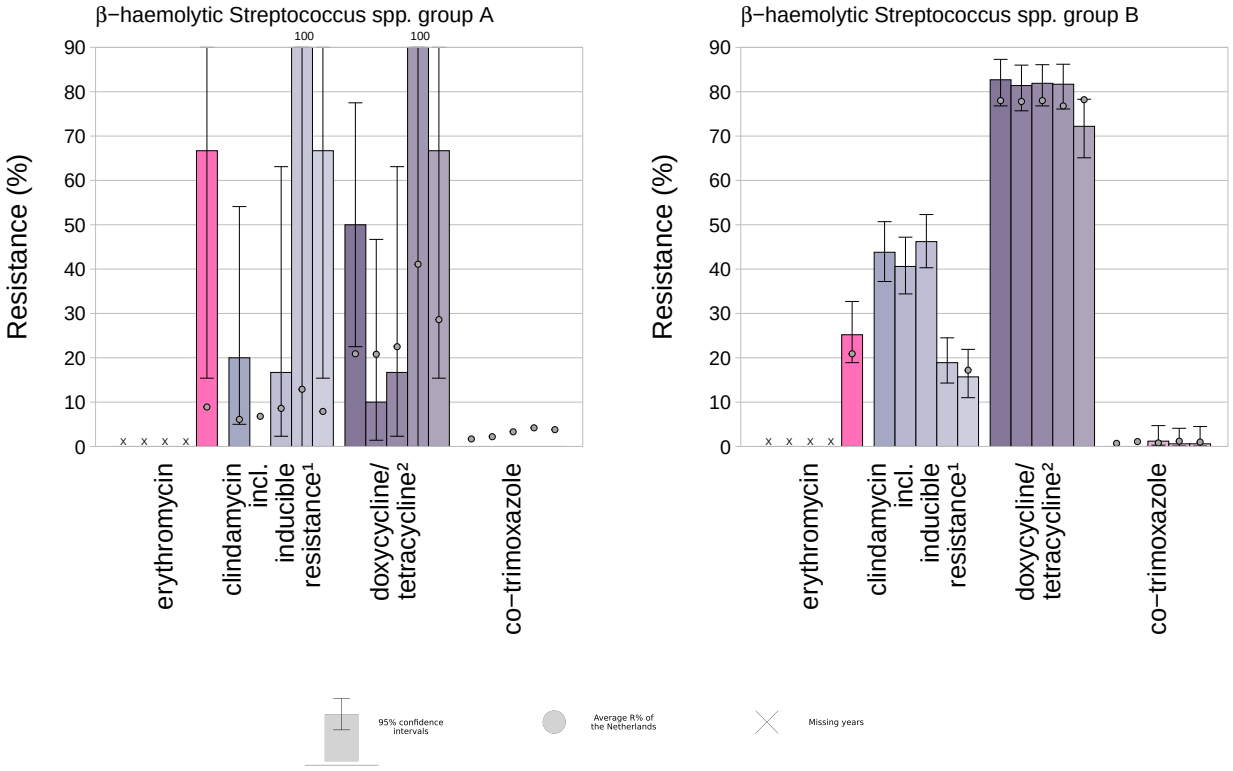

Figure 3.6.0.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic wound/pus, respiratory or genital isolates of β-haemolytic *Streptococcus* spp. group A and diagnostic urine or genital isolates of β-haemolytic *Streptococcus* spp. group B from selected general practitioners' patients in ISIS-CAR*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*
[2] *screen = According to breakpoint for screening.*

4 Hospital departments

In this section, resistance levels among isolates from patients in outpatient departments (section 4.1), inpatient departments (excluding intensive care units, section 4.2), and intensive care units (section 4.3) are presented.

4.1 Outpatient departments

The distribution of pathogens isolated from diagnostic samples (lower respiratory tract, urine, and wound or pus) from patients attending outpatient departments in 2022 is presented in table 4.1.0.1. The resistance levels for a selection of pathogens isolated from these patients in 2022 for *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* isolates are presented in their respective subchapters. Five-year trends in resistance are shown in figure 4.1.1.1 (*E. coli*), figure 4.1.2.1 (*K. pneumoniae*), figure 4.1.3.1 (*P. mirabilis*), figure 4.1.4.1 (*P. aeruginosa*), and figure 4.1.5.1 (*S. aureus*).

In outpatient departments on the Netherlands Antilles, a sample is taken from the majority of patients presenting with infections and susceptibility testing is performed as part of routine diagnostics. Therefore, bias due to selective sampling will be lower than in GP patients and resistance percentages in this section are considered representative of resistance in outpatient departments.

Table 4.1.0.1 Distribution of isolated pathogens in diagnostic samples from patients attending outpatient departments, ISIS-CAR 2022

	Lower respiratory tract	Urine	Wound or pus
Pathogen	N	N	N
E. coli	1	238	25
K. pneumoniae	0	68	24
P. mirabilis	1	50	46
Other *Enterobacterales* [1]	4	55	110
P. aeruginosa	10	19	56
Other non-fermenters[2]	5	8	11
Other Gram-negatives[3]	6	0	1
S. aureus	6	6	108
Other Gram-positives[4]	6	77	142

[1] *In order of frequency: Enterobacter spp., Morganella spp., Citrobacter spp., Serratia spp., Providencia spp., Klebsiella spp. (non-pneumoniae), Proteus spp. (non-mirabilis), Pantoea spp., Raoultella spp.*
[2] *In order of frequency: Acinetobacter spp., Pseudomonas spp. (non-aeruginosa), S. maltophilia, B. cepacia, M. catarrhalis.*
[3] *In order of frequency: H. influenzae, H. parainfluenzae.*
[4] *In order of frequency: S. pneumoniae, S. mitis/S. oralis, ß-haemolytic Streptococcus spp. groups C and G, ß-haemolytic Streptococcus spp. group A, S. anginosus, ß-haemolytic Streptococcus spp. group B, Staphylococcus spp. (non-aureus), Enterococcus spp., C. perfringens.*

4.1.1 *Escherichia coli*

Table 4.1.1.1 Resistance levels among diagnostic isolates of *E. coli* from patients attending outpatient departments, ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	262	150	57 (51 - 63)	24207	39 (39 - 40)
co-amoxiclav non-uuti	260	124	48 (42 - 54)	24205	29 (29 - 30)
piperacillin-tazobactam	261	18	7 (4 - 11)	23250	4 (3 - 4)
cefuroxime	262	42	16 (12 - 21)	22589	11 (10 - 11)
cefotaxime/ceftriaxone non-men	262	21	8 (5 - 12)	23421	6 (6 - 6)
ceftazidime	261	18	7 (4 - 11)	24200	4 (4 - 5)
meropenem/imipenem non-men	261	0	0 (NA - NA)	24200	0 (0 - 0)
ciprofloxacin	261	101	39 (33 - 45)	24219	15 (15 - 16)
gentamicin	262	38	15 (11 - 19)	24209	5 (5 - 5)
tobramycin	262	43	16 (12 - 21)	22272	5 (5 - 5)
fosfomycin[1]	262	8	3 (2 - 6)	23850	3 (2 - 3)
co-trimoxazole	261	86	33 (28 - 39)	23382	22 (22 - 23)
nitrofurantoin	261	2	1 (0 - 3)	24035	3 (2 - 3)
MDOT non-uuti	260	28	11 (8 - 15)	23353	5 (5 - 5)
co-amoxiclav + ciprofloxacin - non-uuti	260	52	20 (16 - 25)	24193	8 (8 - 8)
co-amoxiclav + gentamicin - non-uuti	260	33	13 (9 - 17)	24184	4 (3 - 4)
cefuroxime + ciprofloxacin	261	30	11 (8 - 16)	22578	6 (5 - 6)
cefuroxime + gentamicin	262	11	4 (2 - 7)	22574	2 (1 - 2)
cefotaxime/ceftriaxone + ciprofloxacin - non-men	261	18	7 (4 - 11)	23411	4 (4 - 4)
cefotaxime/ceftriaxone + gentamicin - non-men	262	7	3 (1 - 5)	23401	1 (1 - 1)

NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.
[1] *Resistance percentage calculated using an mic cut-off of 16mg/L and a diameter cut-off of 24mm (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

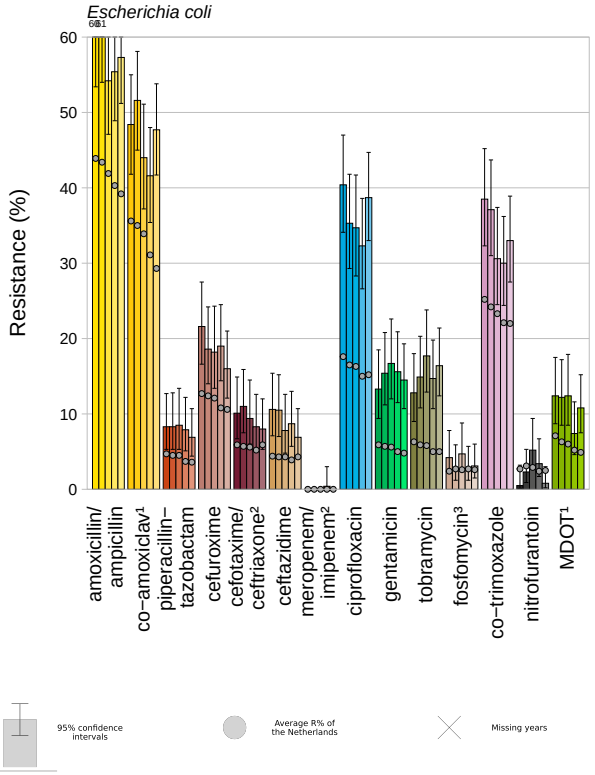

Figure 4.1.1.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *E. coli* patients attending outpatient departments in ISIS-CAR*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*
[3] *Resistance percentage calculated using an mic cut-off of 16mg/L and a diameter cut-off of 24mm (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

4.1.2 *Klebsiella pneumoniae*

Table 4.1.2.1 Resistance levels among diagnostic isolates of *K. pneumoniae* from patients attending outpatient departments, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
co-amoxiclav non-uuti	90	15	17 (10 - 26)	5133	20 (19 - 21)
piperacillin-tazobactam	90	9	10 (5 - 18)	4903	15 (14 - 16)
cefuroxime	90	6	7 (3 - 14)	4912	13 (12 - 14)
cefotaxime/ceftriaxone non-men	90	3	3 (1 - 10)	4975	7 (6 - 7)
ceftazidime	90	3	3 (1 - 10)	5133	6 (5 - 7)
meropenem/imipenem non-men	90	0	0 (NA - NA)	5133	0 (0 - 0)
ciprofloxacin	90	11	12 (7 - 21)	5135	13 (12 - 14)
gentamicin	90	1	1 (0 - 7)	5134	3 (3 - 3)
tobramycin	90	4	4 (2 - 11)	4860	4 (4 - 5)
co-trimoxazole	90	7	8 (4 - 15)	4923	11 (10 - 12)
MDOT non-uuti	90	4	4 (2 - 11)	4918	4 (3 - 4)
co-amoxiclav + ciprofloxacin - non-uuti	90	6	7 (3 - 14)	5131	6 (5 - 6)
co-amoxiclav + gentamicin - non-uuti	90	1	1 (0 - 7)	5131	2 (2 - 3)
cefuroxime + ciprofloxacin	90	3	3 (1 - 10)	4810	8 (7 - 9)
cefuroxime + gentamicin	90	0	0 (NA - NA)	4810	2 (2 - 3)
cefotaxime/ceftriaxone + ciprofloxacin - non-men	90	2	2 (1 - 8)	4973	5 (4 - 5)
cefotaxime/ceftriaxone + gentamicin - non-men	90	0	0 (NA - NA)	4974	2 (2 - 3)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

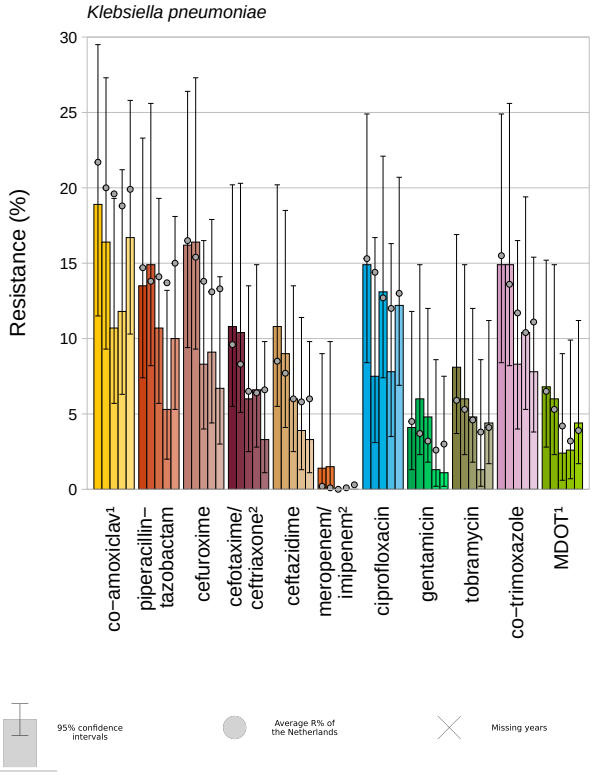

Figure 4.1.2.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *K. pneumoniae* patients attending outpatient departments in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*

4.1.3 *Proteus mirabilis*

Table 4.1.3.1 Resistance levels among diagnostic isolates of *P. mirabilis* from patients attending outpatient departments, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	95	18	19 (12 - 28)	3632	21 (20 - 22)
co-amoxiclav non-uuti	95	8	8 (4 - 16)	3637	5 (5 - 6)
piperacillin-tazobactam	95	0	0 (NA - NA)	3459	0 (0 - 1)
cefuroxime	95	3	3 (1 - 9)	3368	1 (1 - 2)
cefotaxime/ceftriaxone non-men	95	3	3 (1 - 9)	3484	1 (0 - 1)
ceftazidime	95	1	1 (0 - 7)	3636	0 (0 - 1)
meropenem non-men	95	0	0 (NA - NA)	3633	0 (0 - 0)
ciprofloxacin	95	5	5 (2 - 12)	3638	12 (11 - 13)
gentamicin	95	3	3 (1 - 9)	3076	6 (5 - 7)
tobramycin	95	2	2 (1 - 8)	2987	4 (4 - 5)
co-trimoxazole	95	15	16 (10 - 25)	3168	24 (22 - 25)
MDOT non-uuti	95	0	0 (NA - NA)	3167	1 (1 - 2)
co-amoxiclav + ciprofloxacin - non-uuti	95	0	0 (NA - NA)	3637	1 (1 - 2)
co-amoxiclav + gentamicin - non-uuti	95	1	1 (0 - 7)	3075	1 (1 - 2)
cefuroxime + ciprofloxacin	95	1	1 (0 - 7)	3368	0 (0 - 1)
cefuroxime + gentamicin	95	1	1 (0 - 7)	2809	0 (0 - 1)
cefotaxime/ceftriaxone + ciprofloxacin - non-men	95	1	1 (0 - 7)	3484	0 (0 - 0)
cefotaxime/ceftriaxone + gentamicin - non-men	95	1	1 (0 - 7)	2922	0 (0 - 1)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

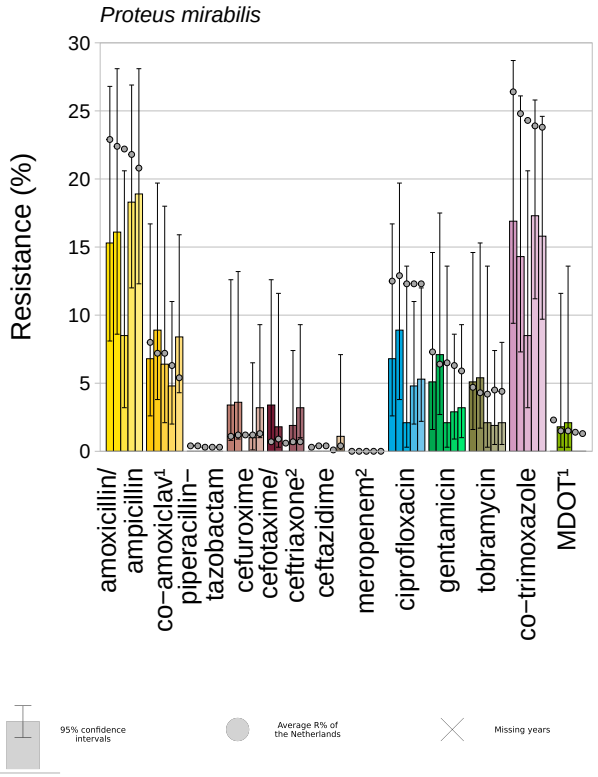

Figure 4.1.3.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *P. mirabilis* patients attending outpatient departments in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*

4.1.4 *Pseudomonas aeruginosa*

Table 4.1.4.1 Resistance levels among diagnostic isolates of *P. aeruginosa* from patients attending outpatient departments, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
piperacillin-tazobactam	84	12	14 (8 - 23)	5783	5 (5 - 6)
ceftazidime	82	4	5 (2 - 12)	6422	3 (2 - 3)
imipenem	80	3	4 (1 - 11)	5490	5 (4 - 5)
meropenem non-men	83	1	1 (0 - 8)	6393	1 (1 - 2)
ciprofloxacin	85	12	14 (8 - 23)	6436	13 (12 - 13)
tobramycin	83	3	4 (1 - 11)	6347	3 (2 - 3)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
non-men = According to breakpoint for indications other than meningitis.

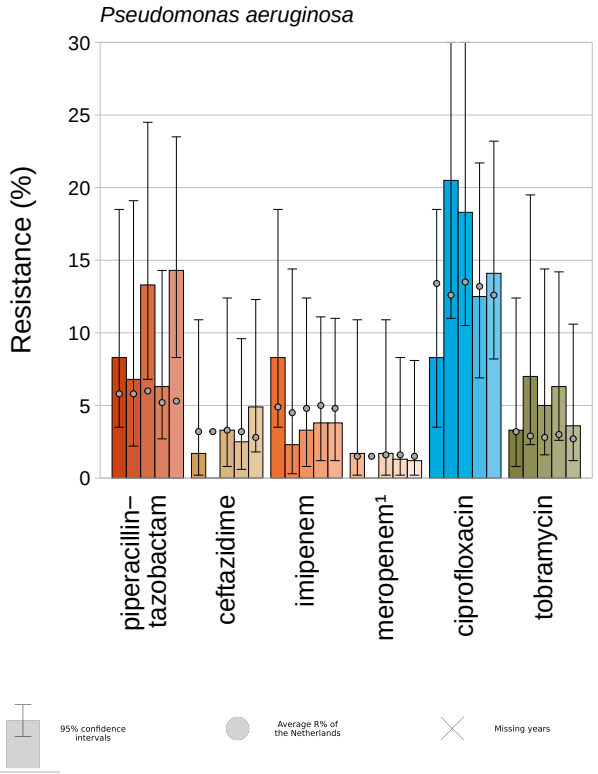

Figure 4.1.4.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *P. aeruginosa* patients attending outpatient departments in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-men = According to breakpoint for indications other than meningitis.*

4.1.5 *Staphylococcus aureus*

Table 4.1.5.1 Resistance levels among diagnostic isolates of *S. aureus* from patients attending outpatient departments, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
gentamicin	103	1	1 (0 - 7)	17815	1 (1 - 1)
clindamycin incl. inducible resistance[1]	119	12	10 (6 - 17)	18285	16 (15 - 16)
doxycycline/tetracycline screen	119	13	11 (6 - 18)	16781	4 (3 - 4)
linezolid	119	1	1 (0 - 6)	17783	0 (0 - 0)
co-trimoxazole	119	23	19 (13 - 27)	18354	2 (2 - 2)
MRSA	119	17	14 (9 - 22)	18416	2 (2 - 2)

screen = According to breakpoint for screening.
MRSA = Methicillin resistance Staphylococcus aureus. For estimation method of MRSA see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

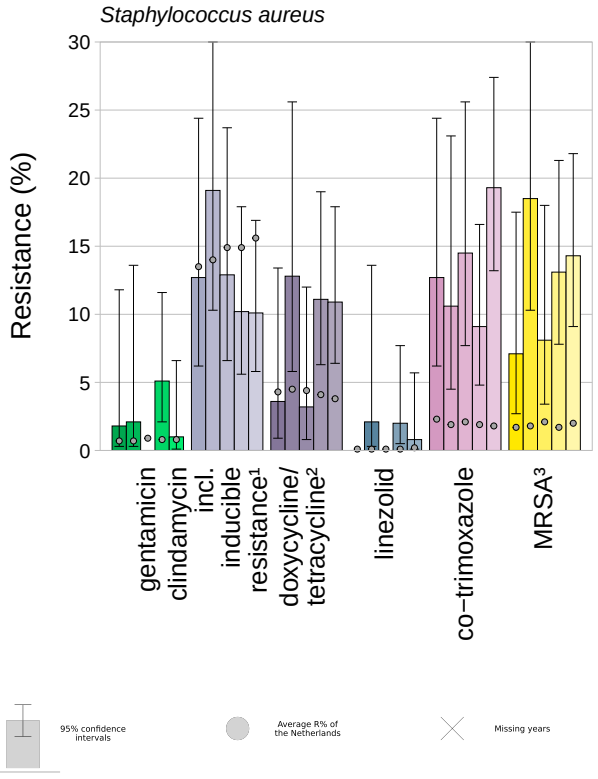

Figure 4.1.5.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *S. aureus* patients attending outpatient departments in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*
[2] *screen = According to breakpoint for screening.*
[3] *MRSA = Methicillin resistance Staphylococcus aureus. For estimation method of MRSA see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information.*

4.2 Inpatient hospital departments (excl. ICU)

The distribution of pathogens isolated from diagnostic samples (blood or cerebrospinal fluid, lower respiratory tract, urine, and wound or pus) from patients admitted to inpatient hospital departments (excl. ICU) in 2022 is presented in table 4.2.0.1.

The resistance levels for a selection of pathogens isolated from these patients in 2022 for *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Enterobacter cloacae* complex, *Acinetobacter* spp., *Enterococcus faecalis*, *Enterococcus faecium*, *Staphylococcus aureus*, *β*-haemolytic *Streptococcus* spp. group A, *β*-haemolytic *Streptococcus* spp. group B, *β*-haemolytic *Streptococcus* spp. group C/ group G, and *Streptococcus anginosus* isolates are presented in their respective subchapters.

Five-year trends in resistance are shown in figure 4.2.1.1 (*E. coli*), figure 4.2.2.1 (*K. pneumoniae*), figure 4.2.3.1 (*P. mirabilis*), figure 4.2.4.1 (*P. aeruginosa*), figure 4.2.5.1 (*E. cloacae* complex), figure 4.2.6.1 (*Acinetobacter* spp.), figure 4.2.7.1 (*E. faecalis* and *E. faecium*}, figure 4.2.8.1 (*S. aureus*), figure 4.2.9.1 (*β*-haemolytic *Streptococcus* spp. group A and B), figure 4.2.10.1 (*β*-haemolytic *Streptococcus* spp. group C/ group G), and figure 4.2.11.1 (*S. anginosus*).

In inpatient hospital departments on the Netherlands Antilles, a sample is taken from the majority of patients presenting with infections and susceptibility testing is performed as part of routine diagnostics. Therefore, bias due to selective sampling of patients is expected to be limited.

Table 4.2.0.1 Distribution of isolated pathogens in diagnostic samples from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Pathogen	Blood or cerebrospinal fluid	Lower respiratory tract	Urine	Wound or pus
	N	N	N	N
E. coli	83	5	378	96
K. pneumoniae	33	7	115	51
P. mirabilis	18	3	98	45
E. cloaecae complex	9	4	17	24
Other *Enterobacterales* [1]	31	10	58	82
P. aeruginosa	12	16	45	58
Acinetobacter spp.	6	3	5	5
Other non-fermenters[2]	7	5	0	6
Other Gram-negatives[3]	14	6	0	7
E. faecalis	11	2	57	58
E. faecium	1	0	2	7
S. aureus	42	13	19	161
ß-haemolytische *Streptococcus* spp. group A	4	0	0	4
ß-haemolytische *Streptococcus* spp. group B	16	1	37	45
ß-haemolytic Streptococcus spp. groups C and G	3	0	0	1
S. anginosus	9	0	2	15
S. mitis/ S. oralis	15	3	7	6
Other Gram-positives[4]	319	13	39	62

[1] *In order of frequency: Morganella spp., Citrobacter spp., Providencia spp., Serratia spp., Klebsiella spp. (non-pneumoniae), Enterobacter spp. (non-cloacae complex), Proteus spp. (non-mirabilis), Salmonella spp., Pantoea spp., Raoultella spp.*
[2] *In order of frequency: S. maltophilia, Pseudomonas spp. (non-aeruginosa), M. catarrhalis.*
[3] *In order of frequency: H. influenzae, H. parainfluenzae, B. fragilis complex, C. jejuni.*
[4] *In order of frequency: Staphylococcus spp. (non-aureus), S. pneumoniae, S. dysgalactiae subsp. equisimilis, Enterococcus spp. (non-faecalis, non-faecium), A. urinae, L. monocytogenes.*

4.2.1 *Escherichia coli*

Table 4.2.1.1 Resistance levels among diagnostic isolates of *E. coli* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	779	420	54 (50 - 57)	54175	39 (38 - 39)
co-amoxiclav non-uuti	777	354	46 (42 - 49)	54187	29 (29 - 29)
piperacillin-tazobactam	774	46	6 (4 - 8)	51956	4 (4 - 4)
cefuroxime	779	114	15 (12 - 17)	51406	11 (10 - 11)
cefotaxime/ceftriaxone non-men	776	74	10 (8 - 12)	52659	6 (6 - 6)
ceftazidime	777	59	8 (6 - 10)	54168	4 (4 - 4)
meropenem/imipenem non-men	778	0	0 (NA - NA)	54178	0 (0 - 0)
ciprofloxacin	778	215	28 (25 - 31)	54214	13 (13 - 13)
gentamicin	779	86	11 (9 - 13)	54191	5 (4 - 5)
tobramycin	779	93	12 (10 - 14)	49696	5 (5 - 5)
fosfomycin[1]	779	24	3 (2 - 5)	52651	2 (2 - 2)
co-trimoxazole	777	245	32 (28 - 35)	47136	20 (20 - 20)
nitrofurantoin	778	8	1 (1 - 2)	53002	2 (2 - 2)
MDOT non-uuti	776	68	9 (7 - 11)	47089	4 (4 - 4)
co-amoxiclav + ciprofloxacin - non-uuti	777	118	15 (13 - 18)	54169	7 (7 - 7)
co-amoxiclav + gentamicin - non-uuti	777	76	10 (8 - 12)	54147	3 (3 - 4)
cefuroxime + ciprofloxacin	778	74	10 (8 - 12)	51388	5 (5 - 5)
cefuroxime + gentamicin	779	28	4 (2 - 5)	51373	2 (1 - 2)
cefotaxime/ceftriaxone + ciprofloxacin - non-men	775	55	7 (5 - 9)	52642	4 (4 - 4)
cefotaxime/ceftriaxone + gentamicin - non-men	776	20	3 (2 - 4)	52622	1 (1 - 1)

NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.
[1] *Resistance percentage calculated using an mic cut-off of 16mg/L and a diameter cut-off of 24mm (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

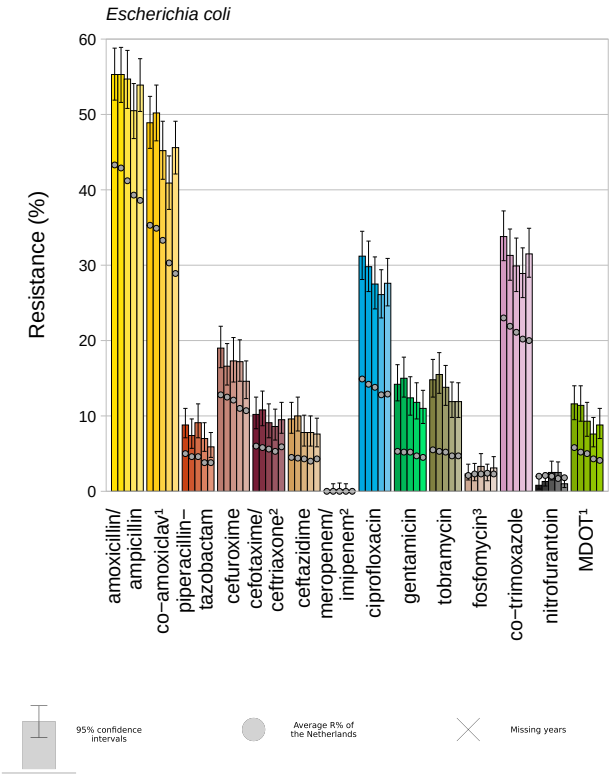

Figure 4.2.1.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *E. coli* from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*
[3] *Resistance percentage calculated using an mic cut-off of 16mg/L and a diameter cut-off of 24mm (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

4.2.2 *Klebsiella pneumoniae*

Table 4.2.2.1 Resistance levels among diagnostic isolates of *K. pneumoniae* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
co-amoxiclav non-uuti	267	33	12 (9 - 17)	11013	20 (19 - 21)
piperacillin-tazobactam	265	25	9 (6 - 14)	10474	15 (15 - 16)
cefuroxime	267	23	9 (6 - 13)	10612	13 (12 - 14)
cefotaxime/ceftriaxone non-men	265	10	4 (2 - 7)	10703	7 (7 - 8)
ceftazidime	267	6	2 (1 - 5)	11014	6 (6 - 7)
meropenem/imipenem non-men	267	0	0 (NA - NA)	11016	0 (0 - 0)
ciprofloxacin	267	22	8 (5 - 12)	11019	11 (11 - 12)
gentamicin	266	2	1 (0 - 3)	11015	3 (3 - 4)
tobramycin	267	5	2 (1 - 4)	10479	4 (4 - 5)
co-trimoxazole	267	20	7 (5 - 11)	9286	10 (9 - 10)
MDOT non-uuti	267	4	1 (1 - 4)	9277	4 (3 - 4)
co-amoxiclav + ciprofloxacin - non-uuti	267	9	3 (2 - 6)	11011	5 (5 - 6)
co-amoxiclav + gentamicin - non-uuti	266	1	0 (0 - 3)	11008	3 (2 - 3)
cefuroxime + ciprofloxacin	267	6	2 (1 - 5)	10460	7 (7 - 8)
cefuroxime + gentamicin	266	1	0 (0 - 3)	10457	3 (2 - 3)
cefotaxime/ceftriaxone + ciprofloxacin - non-men	265	3	1 (0 - 3)	10701	5 (4 - 5)
cefotaxime/ceftriaxone + gentamicin - non-men	264	1	0 (0 - 3)	10700	3 (2 - 3)

NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

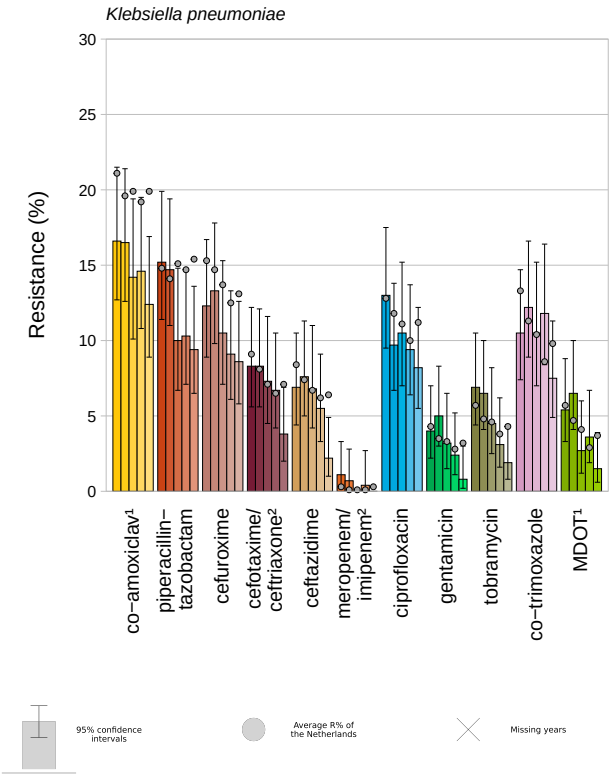

Figure 4.2.2.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *K. pneumoniae* from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*

4.2.3 *Proteus mirabilis*

Table 4.2.3.1 Resistance levels among diagnostic isolates of *P. mirabilis* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	245	39	16 (12 - 21)	7766	21 (20 - 22)
co-amoxiclav non-uuti	244	14	6 (3 - 9)	7769	6 (5 - 6)
piperacillin-tazobactam	243	1	0 (0 - 3)	7394	0 (0 - 1)
cefuroxime	245	6	2 (1 - 5)	7338	1 (1 - 2)
cefotaxime/ceftriaxone non-men	243	4	2 (1 - 4)	7527	1 (1 - 1)
ceftazidime	245	3	1 (0 - 4)	7770	0 (0 - 1)
meropenem non-men	244	0	0 (NA - NA)	7763	0 (0 - 0)
ciprofloxacin	245	9	4 (2 - 7)	7773	11 (10 - 12)
gentamicin	245	6	2 (1 - 5)	6543	5 (5 - 6)
tobramycin	245	3	1 (0 - 4)	6358	4 (3 - 4)
co-trimoxazole	245	31	13 (9 - 17)	6423	24 (22 - 25)
MDOT non-uuti	244	1	0 (0 - 3)	6421	1 (1 - 2)
co-amoxiclav + ciprofloxacin - non-uuti	244	1	0 (0 - 3)	7769	1 (1 - 2)
co-amoxiclav + gentamicin - non-uuti	244	1	0 (0 - 3)	6539	1 (1 - 2)
cefuroxime + ciprofloxacin	245	2	1 (0 - 3)	7338	1 (0 - 1)
cefuroxime + gentamicin	245	1	0 (0 - 3)	6111	0 (0 - 1)
cefotaxime/ceftriaxone + ciprofloxacin - non-men	243	2	1 (0 - 3)	7527	0 (0 - 0)
cefotaxime/ceftriaxone + gentamicin - non-men	243	1	0 (0 - 3)	6298	0 (0 - 0)

NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

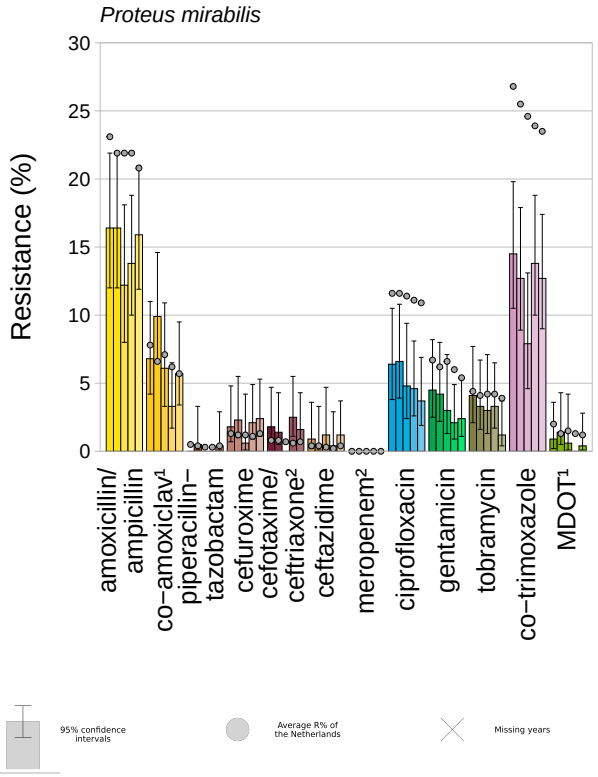

Figure 4.2.3.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *P. mirabilis* from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*

4.2.4 *Pseudomonas aeruginosa*

Table 4.2.4.1 Resistance levels among diagnostic isolates of *P. aeruginosa* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
piperacillin-tazobactam	197	22	11 (7 - 16)	10824	6 (6 - 7)
ceftazidime	195	9	5 (2 - 9)	12118	3 (3 - 4)
imipenem	186	5	3 (1 - 6)	10953	5 (5 - 5)
meropenem non-men	197	1	1 (0 - 4)	12061	1 (1 - 2)
ciprofloxacin	199	20	10 (7 - 15)	12144	10 (10 - 11)
tobramycin	197	3	2 (0 - 5)	11872	2 (2 - 2)
ciprofloxacin + tobramycin	197	2	1 (0 - 4)	10562	1 (1 - 1)

non-men = According to breakpoint for indications other than meningitis.

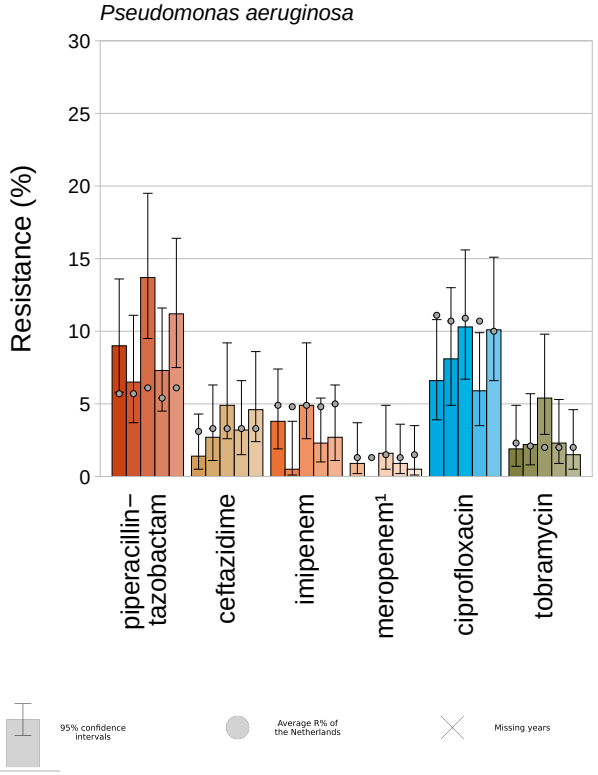

Figure 4.2.4.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *P. aeruginosa* from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
[1] *non-men = According to breakpoint for indications other than meningitis.*

4.2.5 *Enterobacter cloacae* complex

Table 4.2.5.1 Resistance levels among diagnostic isolates of *E. cloacae* complex from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
meropenem/imipenem non-men	87	0	0 (NA - NA)	6418	0 (0 - 0)
ciprofloxacin	87	6	7 (3 - 15)	6425	4 (3 - 4)
gentamicin	87	1	1 (0 - 8)	6419	3 (2 - 3)
tobramycin	87	3	3 (1 - 10)	6043	3 (3 - 4)
co-trimoxazole	87	6	7 (3 - 15)	5175	6 (6 - 7)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-men = According to breakpoint for indications other than meningitis.

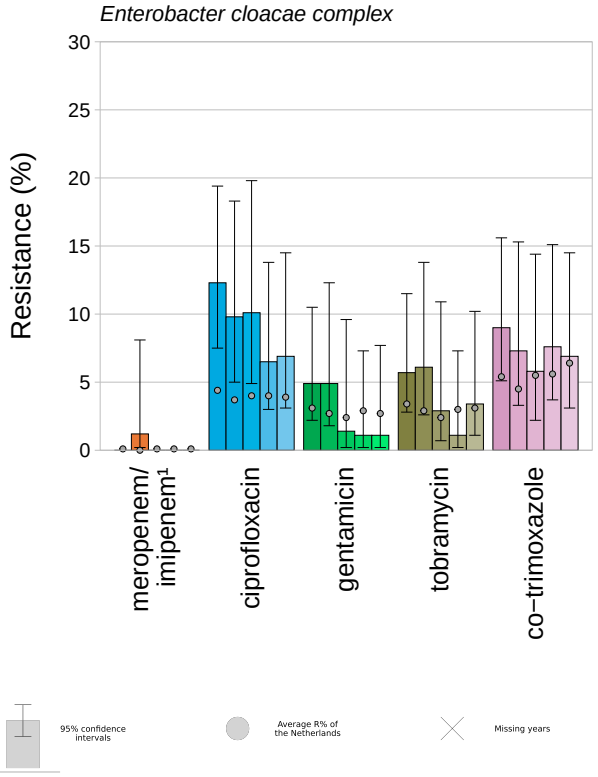

Figure 4.2.5.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *E. cloacae* complex from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-men = According to breakpoint for indications other than meningitis.*

4.2.6 *Acinetobacter* spp.

Table 4.2.6.1 Resistance levels among diagnostic isolates of *Acinetobacter* spp. from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
meropenem/imipenem non-men	31	0	0 (NA - NA)	1358	2 (1 - 2)
ciprofloxacin	17	3	18 (6 - 43)	1419	4 (3 - 5)
gentamicin	31	1	3 (0 - 20)	1450	4 (3 - 5)
tobramycin	31	1	3 (0 - 20)	1433	3 (2 - 4)
co-trimoxazole	31	4	13 (5 - 30)	1457	4 (3 - 5)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-men = According to breakpoint for indications other than meningitis.

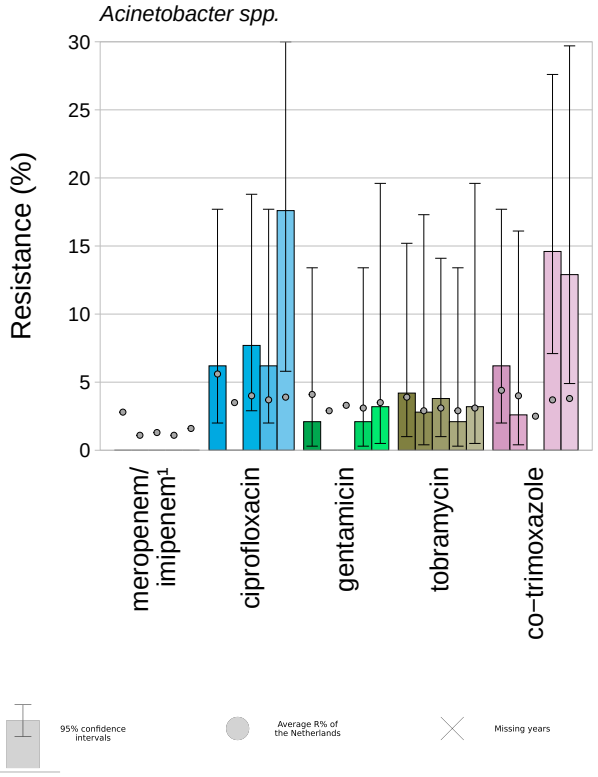

Figure 4.2.6.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *Acinetobacter* spp. from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-men = According to breakpoint for indications other than meningitis.*

4.2.7 *Enterococcus faecalis* and *Enterococcus faecium*

Table 4.2.7.1 Resistance levels among diagnostic isolates of *E. faecalis* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
vancomycin	177	2	1 (0 - 4)	11777	0 (0 - 0)
nitrofurantoin	176	0	0 (NA - NA)	12308	1 (0 - 1)

NA = not applicable.

Table 4.2.7.2 Resistance levels among diagnostic isolates of *E. faecium* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	11	4	36 (14 - 66)	3809	85 (84 - 87)
vancomycin	11	0	0 (NA - NA)	4108	0 (0 - 0)
linezolid	11	0	0 (NA - NA)	3580	0 (0 - 1)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.

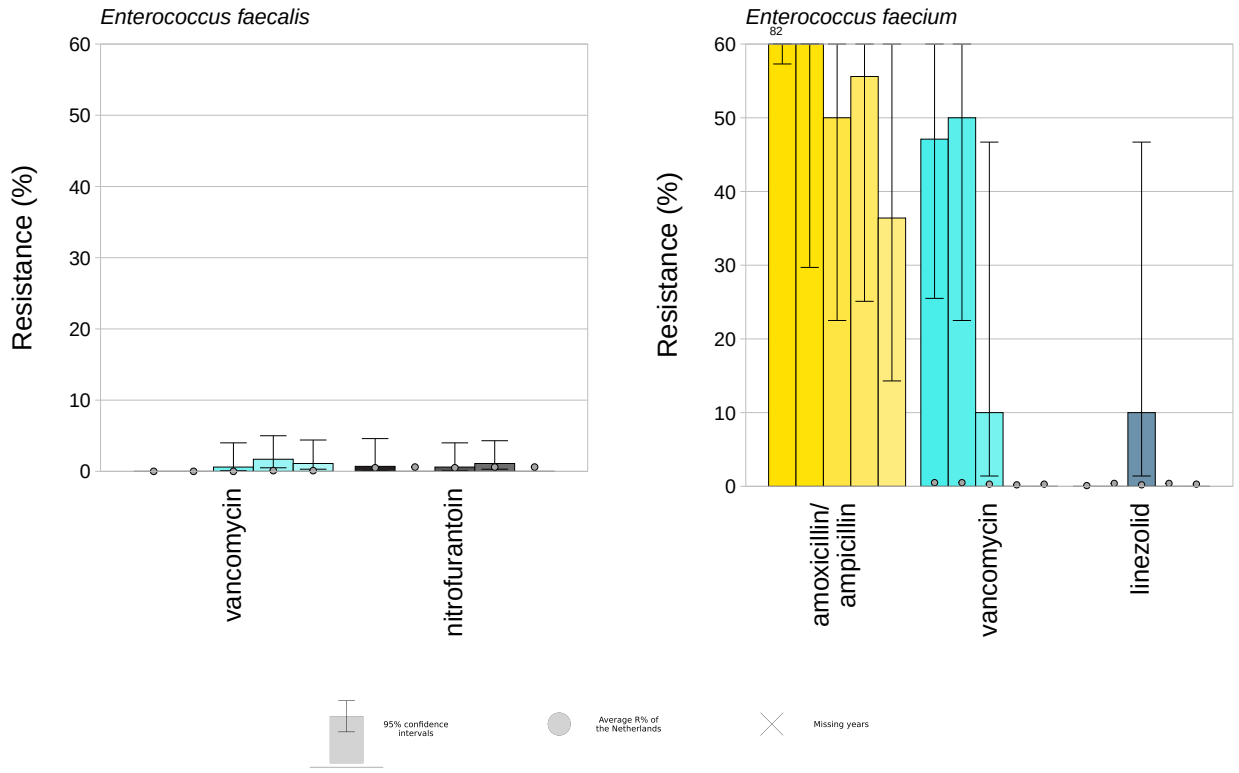

Figure 4.2.7.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *E. faecalis* and *E. faecium* from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*,**

** A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
*** Y axis of the figures differs from the standard format.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

4.2.8 *Staphylococcus aureus*

Table 4.2.8.1 Resistance levels among diagnostic isolates of *S. aureus* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
gentamicin	290	5	2 (1 - 4)	31184	1 (1 - 1)
clindamycin incl. inducible resistance[1]	333	32	10 (7 - 13)	32053	15 (15 - 16)
doxycycline/tetracycline screen	333	24	7 (5 - 11)	29114	4 (3 - 4)
linezolid	333	4	1 (0 - 3)	31160	0 (0 - 0)
co-trimoxazole	333	34	10 (7 - 14)	32166	2 (2 - 2)
MRSA	334	59	18 (14 - 22)	32289	2 (2 - 2)

screen = According to breakpoint for screening.
MRSA = Methicillin resistance Staphylococcus aureus. For estimation method of MRSA see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

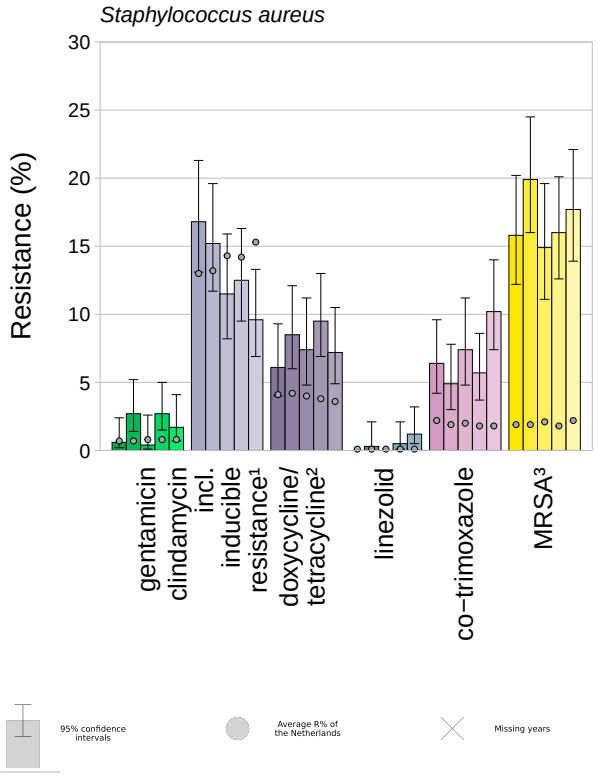

Figure 4.2.8.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *S. aureus* from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*
[2] *screen = According to breakpoint for screening.*
[3] *MRSA = Methicillin resistance Staphylococcus aureus. For estimation method of MRSA see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information.*

4.2.9 β-haemolytic *Streptococcus* spp. group A and group B

Table 4.2.9.1 Resistance levels among diagnostic isolates of β-haemolytic *Streptococcus* spp. group A from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
erythromycin	12	5	42 (18 - 69)	2261	8 (7 - 9)
clindamycin incl. inducible resistance[1]	12	5	42 (18 - 69)	2179	6 (5 - 7)
doxycycline/tetracycline screen	12	6	50 (24 - 76)	1571	26 (23 - 28)
co-trimoxazole	12	0	0 (NA - NA)	1180	3 (2 - 5)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
screen = According to breakpoint for screening.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

Table 4.2.9.2 Resistance levels among diagnostic isolates of β-haemolytic *Streptococcus* spp. group B from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
erythromycin	146	24	16 (11 - 23)	4162	20 (19 - 22)
clindamycin incl. inducible resistance[1]	166	23	14 (9 - 20)	3637	17 (16 - 18)
co-trimoxazole	149	1	1 (0 - 5)	3010	1 (1 - 2)

[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

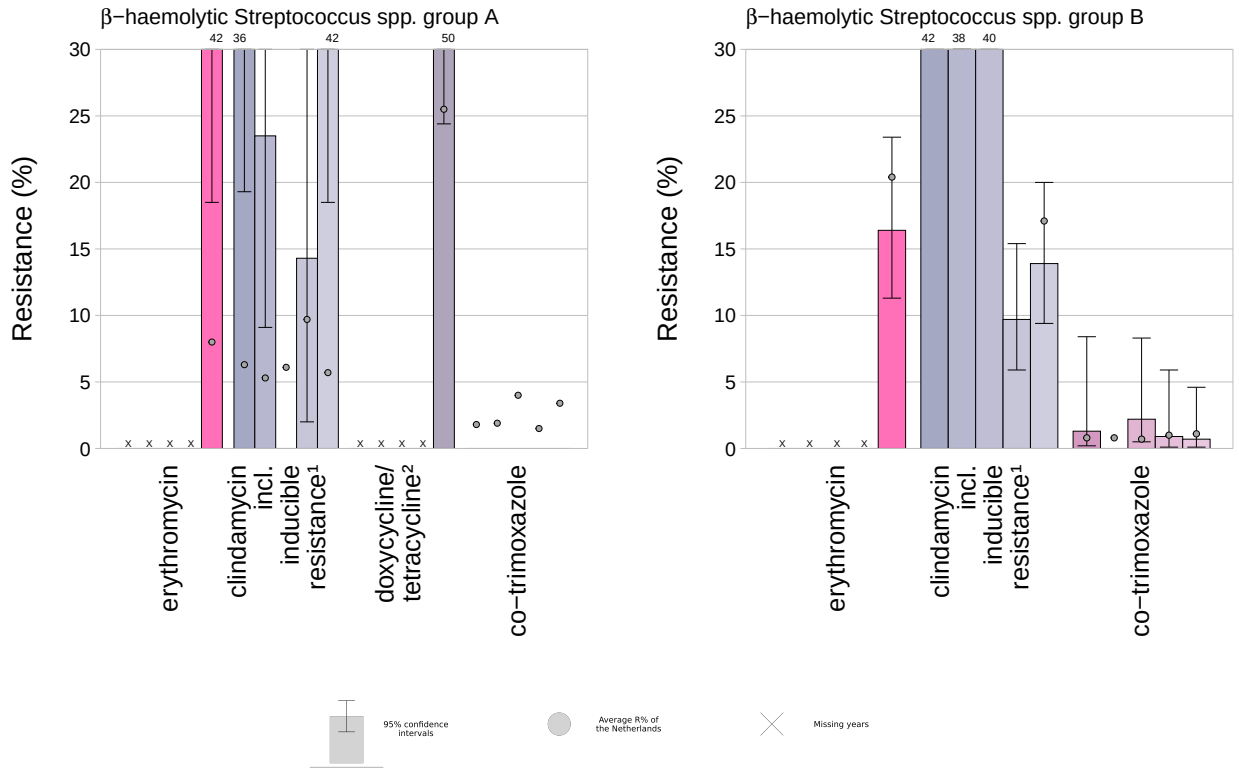

Figure 4.2.9.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of β-haemolytic *Streptococcus* spp. group A and group B from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *screen = According to breakpoint for screening.*
[2] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

4.2.10 β-haemolytic *Streptococcus* spp. group C and group G

Table 4.2.10.1 Resistance levels among diagnostic isolates of β-haemolytic *Streptococcus* spp. group C and G from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
erythromycin	6	0	0 (NA - NA)	628	15 (13 - 18)
clindamycin incl. inducible resistance[1]	6	0	0 (NA - NA)	605	15 (13 - 18)
co-trimoxazole	6	0	0 (NA - NA)	729	0 (0 - 1)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

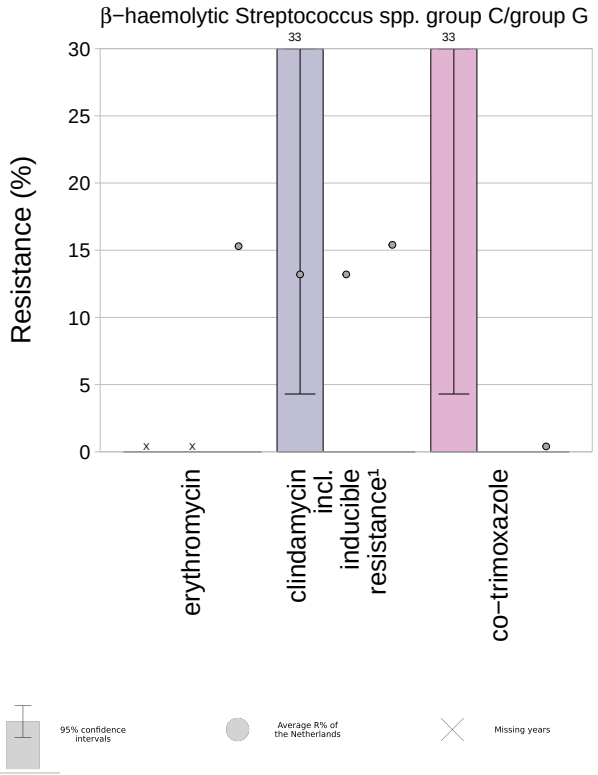

Figure 4.2.10.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of β-haemolytic *Streptococcus* spp. group C and G from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

4.2.11 *Streptococcus anginosus*

Table 4.2.11.1 Resistance levels among diagnostic isolates of *Streptococcus anginosus* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	27	4	15 (6 - 33)	993	0 (0 - 1)
clindamycin incl. inducible resistance[1]	24	1	4 (1 - 24)	901	9 (7 - 11)
(benzyl-)penicillin	28	2	7 (2 - 24)	1104	0 (0 - 1)
(benzyl-)penicillin screen	28	4	14 (5 - 32)	1104	1 (0 - 2)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
screen = According to breakpoint for screening.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

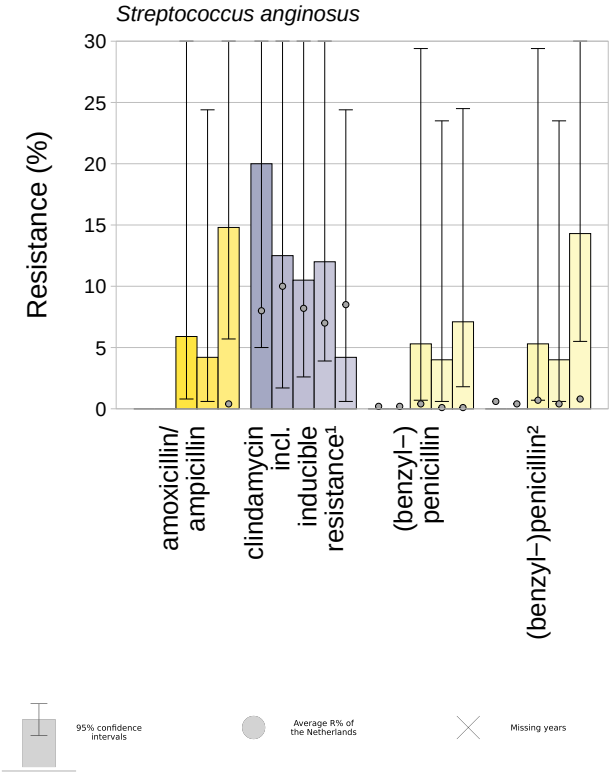

Figure 4.2.11.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *Streptococcus anginosus* from patients admitted to inpatient departments (excl. intensive care units) in ISIS-CAR*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*
[2] *screen = According to breakpoint for screening.*

4.3 Intensive Care Units

The distribution of pathogens from diagnostic samples (blood or cerebrospinal fluid, lower respiratory tract, urine, and wound or pus) from patients admitted to intensive care units in 2022 is presented in table 4.3.0.1.

The resistance levels for a selection of pathogens isolated from these patients in 2022 for *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Enterobacter cloacae* complex, *Acinetobacter* spp., *Enterococcus faecalis*, *Enterococcus faecium*, and *Staphylococcus aureus* isolates are presented in their respective subchapters.

Five-year trends in resistance are shown in figure 4.3.1.1 (*E. coli*), figure 4.3.2.1 (*K. pneumoniae*), figure 4.3.3.1 (*P. mirabilis*), figure 4.3.4.1 (*P. aeruginosa*), figure 4.3.5.1 (*E. cloacae* complex), figure 4.3.6.1 (*Acinetobacter* spp.), figure 4.3.7.1 (*E. faecalis* and *E. faecium*), and figure 4.3.8.1 (*S. aureus*).

In intensive care units on the Netherlands Antilles, a sample is taken from almost all patients presenting with infections and susceptibility testing is performed as part of routine diagnostics. Bias due to selective sampling of patients is therefore unlikely.

Table 4.3.0.1 Distribution of isolated pathogens in diagnostic samples from patients admitted to intensive care units, ISIS-CAR 2022

	Blood or cerebrospinal fluid	Lower respiratory tract	Urine	Wound or pus
Pathogen	N	N	N	N
E. coli	5	4	10	7
K. pneumoniae	3	4	2	8
P. mirabilis	3	0	0	1
E. cloaecae complex	0	2	1	0
Other *Enterobacterales* [1]	1	7	5	6
P. aeruginosa	1	7	0	5
Acinetobacter spp.	0	2	1	1
Other non-fermenters[2]	1	5	0	0
Other Gram-negatives	2	3	0	0
E. faecalis	2	1	6	5
E. faecium	0	0	1	0
S. aureus	2	8	0	5
ß-haemolytische *Streptococcus* spp. group A	1	0	0	0
ß-haemolytische *Streptococcus* spp. group B	0	0	1	0
Other Gram-positives[3]	40	4	1	5

[1] *In order of frequency: Klebsiella spp. (non-pneumoniae), Morganella spp., Serratia spp., Providencia spp., Citrobacter spp., Pantoea spp., Raoultella spp., Enterobacter spp. (non-cloacae complex).*
[2] *In order of frequency: S. maltophilia, Pseudomonas spp. (non-aeruginosa), M. catarrhalis.*
[3] *In order of frequency: Staphylococcus spp. (non-aureus), S. anginosus, S. pneumoniae, S. mitis/S. oralis, Enterococcus spp. (non-faecalis, non-faecium).*

4.3.1 *Escherichia coli*

Table 4.3.1.1 Resistance levels among diagnostic isolates of *E. coli* from patients admitted to intensive care units, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	25	18	72 (52 - 86)	1457	40 (37 - 42)
co-amoxiclav non-uuti	25	16	64 (44 - 80)	1457	28 (26 - 31)
piperacillin-tazobactam	25	2	8 (2 - 27)	1385	5 (4 - 7)
cefuroxime	25	10	40 (23 - 60)	1414	14 (12 - 16)
cefotaxime/ceftriaxone non-men	25	8	32 (17 - 52)	1431	8 (7 - 9)
ceftazidime	25	7	28 (14 - 48)	1455	6 (5 - 8)
meropenem/imipenem non-men	25	0	0 (NA - NA)	1456	0 (0 - 0)
ciprofloxacin	25	8	32 (17 - 52)	1458	11 (10 - 13)
gentamicin	25	4	16 (6 - 36)	1458	4 (3 - 5)
tobramycin	25	4	16 (6 - 36)	1413	4 (3 - 5)
co-trimoxazole	25	12	48 (30 - 67)	1457	18 (16 - 20)
MDOT non-uuti	25	4	16 (6 - 36)	1456	4 (3 - 5)
co-amoxiclav + ciprofloxacin - non-uuti	25	6	24 (11 - 44)	1457	6 (5 - 8)
co-amoxiclav + gentamicin - non-uuti	25	4	16 (6 - 36)	1457	3 (2 - 4)
cefuroxime + ciprofloxacin	25	6	24 (11 - 44)	1414	6 (5 - 7)
cefuroxime + gentamicin	25	3	12 (4 - 31)	1414	2 (1 - 3)
cefotaxime/ceftriaxone + ciprofloxacin - non-men	25	5	20 (9 - 40)	1431	5 (4 - 6)
cefotaxime/ceftriaxone + gentamicin - non-men	25	3	12 (4 - 31)	1431	2 (1 - 2)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

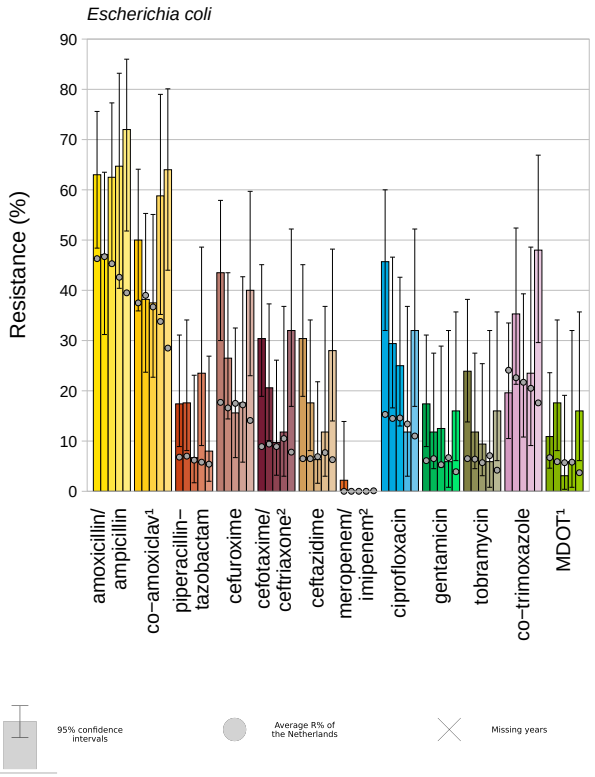

Figure 4.3.1.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *E. coli* from patients admitted to intensive care units in ISIS-CAR*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*

4.3.2 *Klebsiella pneumoniae*

Table 4.3.2.1 Resistance levels among diagnostic isolates of *K. pneumoniae* from patients admitted to intensive care units, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
co-amoxiclav non-uuti	16	1	6 (1 - 34)	372	25 (21 - 30)
piperacillin-tazobactam	16	1	6 (1 - 34)	348	18 (14 - 22)
cefuroxime	16	1	6 (1 - 34)	360	18 (14 - 22)
cefotaxime/ceftriaxone non-men	16	1	6 (1 - 34)	367	14 (11 - 18)
ceftazidime	16	0	0 (NA - NA)	372	12 (9 - 16)
meropenem/imipenem non-men	16	0	0 (NA - NA)	372	1 (0 - 2)
ciprofloxacin	16	2	13 (3 - 39)	371	14 (11 - 18)
gentamicin	16	0	0 (NA - NA)	372	7 (5 - 10)
tobramycin	16	0	0 (NA - NA)	365	8 (6 - 12)
co-trimoxazole	16	1	6 (1 - 34)	372	14 (11 - 18)
MDOT non-uuti	16	1	6 (1 - 34)	371	8 (6 - 11)
co-amoxiclav + ciprofloxacin - non-uuti	16	1	6 (1 - 34)	371	10 (8 - 14)
co-amoxiclav + gentamicin - non-uuti	16	0	0 (NA - NA)	372	6 (4 - 9)
cefuroxime + ciprofloxacin	16	1	6 (1 - 34)	359	11 (8 - 15)
cefuroxime + gentamicin	16	0	0 (NA - NA)	360	7 (5 - 10)
cefotaxime/ceftriaxone + ciprofloxacin - non-men	16	1	6 (1 - 34)	366	10 (7 - 13)
cefotaxime/ceftriaxone + gentamicin - non-men	16	0	0 (NA - NA)	367	7 (4 - 10)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

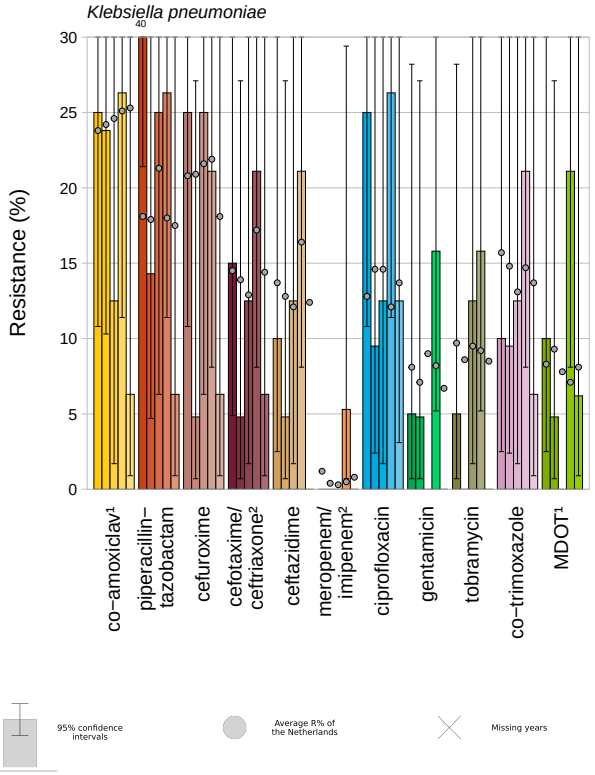

Figure 4.3.2.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *K. pneumoniae* from patients admitted to intensive care units in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*

4.3.3 *Proteus mirabilis*

Table 4.3.3.1 Resistance levels among diagnostic isolates of *P. mirabilis* from patients admitted to intensive care units, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	4	0	0 (NA - NA)	181	23 (17 - 29)
co-amoxiclav non-uuti	4	0	0 (NA - NA)	182	8 (5 - 13)
piperacillin-tazobactam	4	0	0 (NA - NA)	175	1 (0 - 4)
cefuroxime	4	0	0 (NA - NA)	178	2 (1 - 6)
cefotaxime/ceftriaxone non-men	4	0	0 (NA - NA)	181	1 (0 - 4)
ceftazidime	4	0	0 (NA - NA)	183	0 (0 - 0)
meropenem non-men	4	0	0 (NA - NA)	183	0 (NA - NA)
ciprofloxacin	4	0	0 (NA - NA)	183	10 (6 - 15)
gentamicin	4	0	0 (NA - NA)	158	4 (2 - 8)
tobramycin	4	0	0 (NA - NA)	158	3 (1 - 7)
co-trimoxazole	4	1	25 (3 - 76)	183	27 (21 - 34)
MDOT non-uuti	4	0	0 (NA - NA)	182	2 (1 - 5)
co-amoxiclav + ciprofloxacin - non-uuti	4	0	0 (NA - NA)	182	2 (1 - 5)
co-amoxiclav + gentamicin - non-uuti	4	0	0 (NA - NA)	157	1 (0 - 5)
cefuroxime + ciprofloxacin	4	0	0 (NA - NA)	175	1 (0 - 4)
cefuroxime + gentamicin	4	0	0 (NA - NA)	150	1 (0 - 5)
cefotaxime/ceftriaxone + ciprofloxacin - non-men	4	0	0 (NA - NA)	181	1 (0 - 4)
cefotaxime/ceftriaxone + gentamicin - non-men	4	0	0 (NA - NA)	156	1 (0 - 4)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.
non-men = According to breakpoint for indications other than meningitis.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.

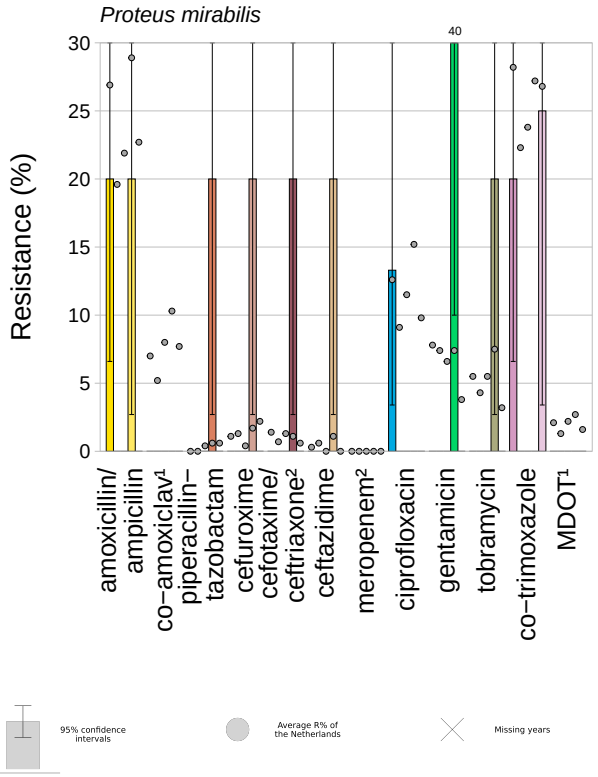

Figure 4.3.3.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *P. mirabilis* from patients admitted to intensive care units in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
MDOT = multidrug resistance to oral therapy, defined as resistance to the oral agents co-amoxiclav (according to the breakpoint for indications other than uncomplicated urinary tract infections), ciprofloxacin, and co-trimoxazole combined.
[1] *non-uuti = According to breakpoint for indications other than uncomplicated urinary tract infection.*
[2] *non-men = According to breakpoint for indications other than meningitis.*

4.3.4 *Pseudomonas aeruginosa*

Table 4.3.4.1 Resistance levels among diagnostic isolates of *P. aeruginosa* from patients admitted to intensive care units, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
piperacillin-tazobactam	13	1	8 (1 - 39)	520	16 (13 - 19)
ceftazidime	13	1	8 (1 - 39)	616	10 (8 - 12)
imipenem	13	0	0 (NA - NA)	592	9 (7 - 12)
meropenem non-men	13	0	0 (NA - NA)	613	4 (3 - 6)
ciprofloxacin	13	0	0 (NA - NA)	616	11 (9 - 14)
tobramycin	13	0	0 (NA - NA)	614	4 (3 - 6)
ciprofloxacin + tobramycin	13	0	0 (NA - NA)	603	3 (2 - 5)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-men = According to breakpoint for indications other than meningitis.

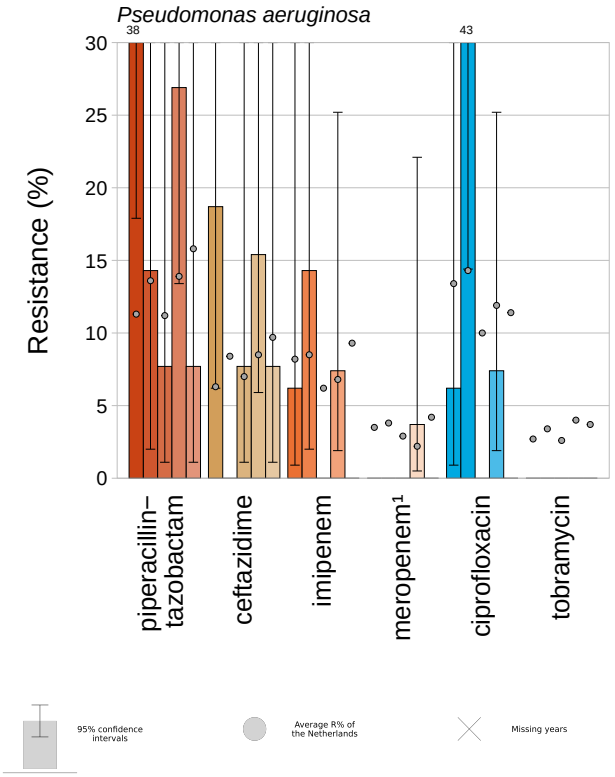

Figure 4.3.4.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *P. aeruginosa* from patients admitted to intensive care units in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-men = According to breakpoint for indications other than meningitis.*

4.3.5 *Enterobacter cloacae* complex

Table 4.3.5.1 Resistance levels among diagnostic isolates of *E. cloacae* complex from patients admitted to intensive care units, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
meropenem/imipenem non-men	3	0	0 (NA - NA)	416	1 (0 - 3)
ciprofloxacin	3	0	0 (NA - NA)	417	5 (3 - 7)
gentamicin	3	0	0 (NA - NA)	416	6 (4 - 9)
tobramycin	3	0	0 (NA - NA)	414	6 (4 - 9)
co-trimoxazole	3	0	0 (NA - NA)	417	7 (5 - 10)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-men = According to breakpoint for indications other than meningitis.

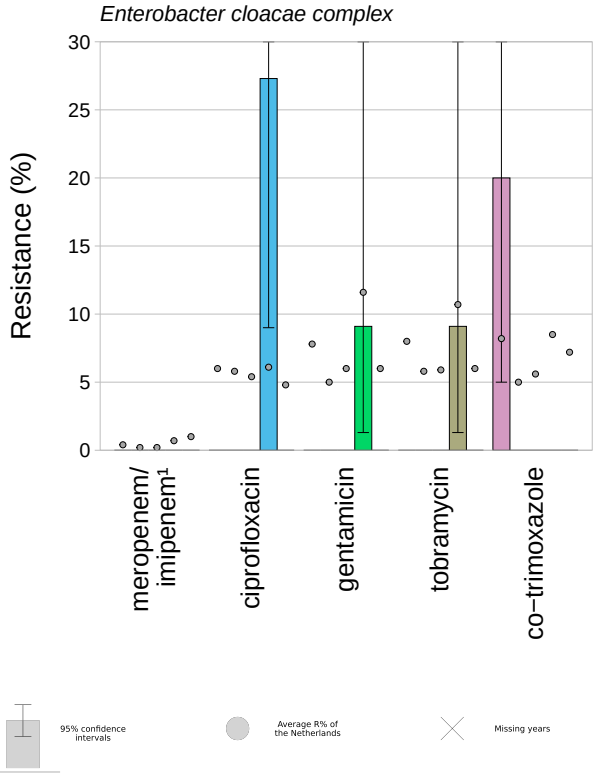

Figure 4.3.5.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *E. cloacae* complex from patients admitted to intensive care units in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-men = According to breakpoint for indications other than meningitis.*

4.3.6 *Acinetobacter* spp.

Table 4.3.6.1 Resistance levels among diagnostic isolates of *Acinetobacter* spp. from patients admitted to intensive care units, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
meropenem/imipenem non-men	4	0	0 (NA - NA)	104	6 (3 - 12)
ciprofloxacin	3	0	0 (NA - NA)	103	6 (3 - 12)
gentamicin	4	0	0 (NA - NA)	107	7 (4 - 14)
tobramycin	4	0	0 (NA - NA)	106	5 (2 - 11)
co-trimoxazole	4	0	0 (NA - NA)	109	7 (4 - 14)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
non-men = According to breakpoint for indications other than meningitis.

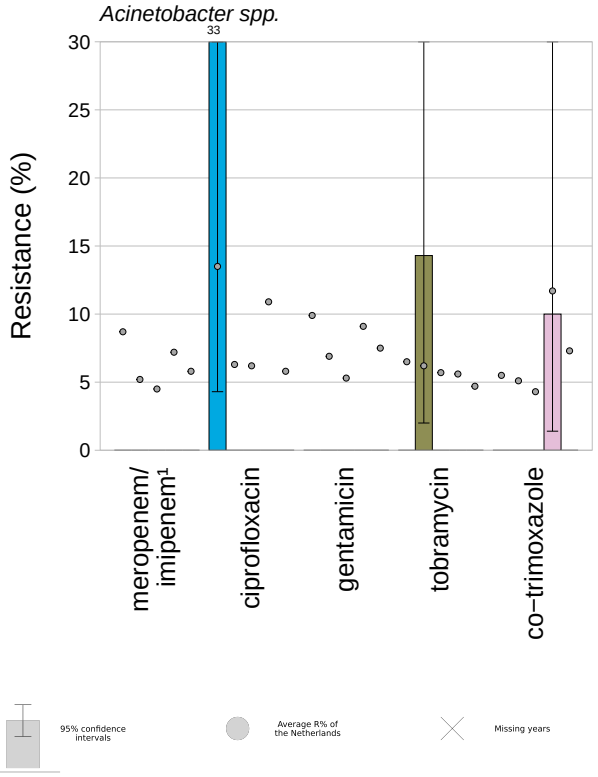

Figure 4.3.6.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *Acinetobacter* spp. from patients admitted to intensive care units in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *non-men = According to breakpoint for indications other than meningitis.*

4.3.7 *Enterococcus faecalis* and *Enterococcus faecium*

Table 4.3.7.1 Resistance levels among diagnostic isolates of *E. faecalis* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
vancomycin	14	0	0 (NA - NA)	494	0 (0 - 0)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.

Table 4.3.7.2 Resistance levels among diagnostic isolates of *E. faecium* from patients admitted to inpatient departments (excl. intensive care units), ISIS-CAR 2022

	Aruba			the Netherlands	
Antibiotic	N	R	R% (95%-CI)	N	R% (95%-CI)
amoxicillin/ampicillin	1	1	100 (100 - 100)	739	87 (84 - 89)
vancomycin	1	0	0 (NA - NA)	779	0 (0 - 1)
linezolid	1	0	0 (NA - NA)	715	0 (0 - 1)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.

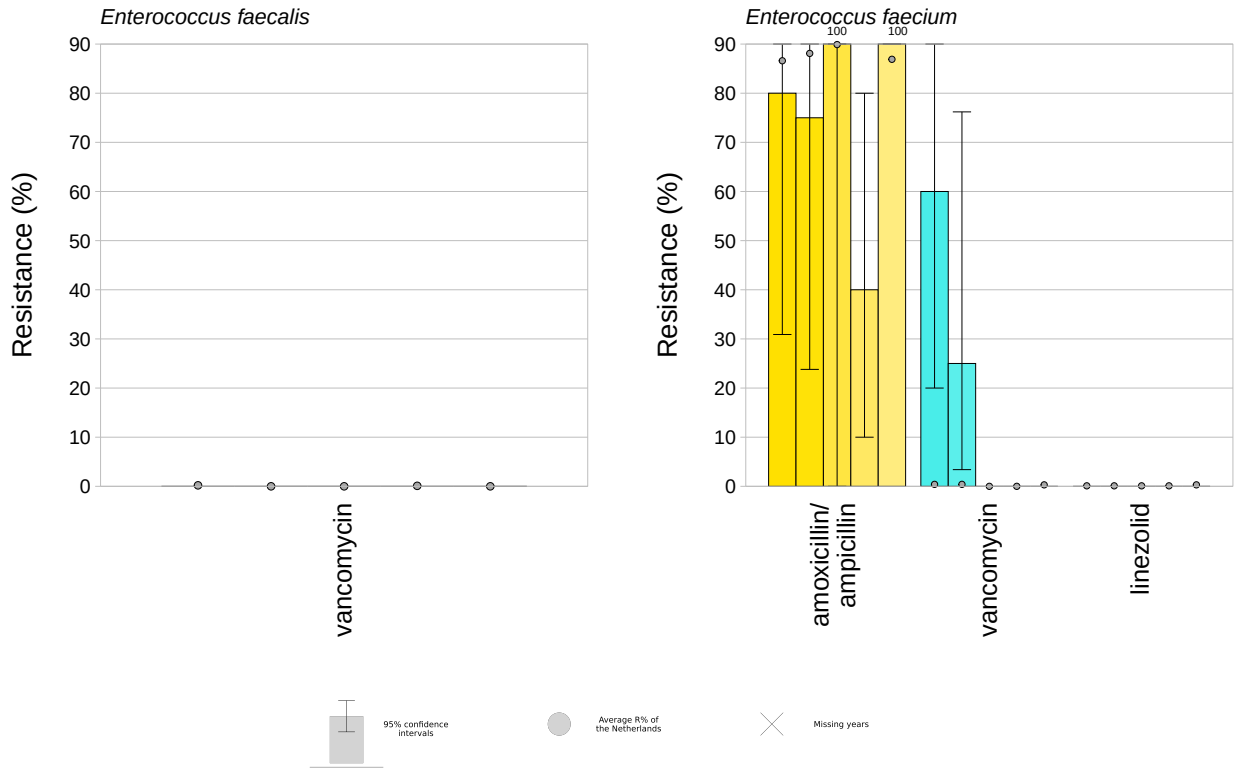

Figure 4.3.7.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *E. faecalis* and *E. faecium* from patients admitted to intensive care units in ISIS-CAR*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

4.3.8 *Staphylococcus aureus*

Table 4.3.8.1 Resistance levels among diagnostic isolates of *S. aureus* from patients admitted to intensive care units, ISIS-CAR 2022

Antibiotic	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
gentamicin	11	0	0 (NA - NA)	1572	2 (1 - 3)
clindamycin incl. inducible resistance[1]	15	4	27 (10 - 53)	1612	15 (13 - 17)
doxycycline/tetracycline screen	15	2	13 (3 - 41)	1445	4 (3 - 5)
linezolid	15	1	7 (1 - 35)	1566	0 (0 - 0)
co-trimoxazole	15	0	0 (NA - NA)	1609	2 (1 - 3)
MRSA	15	0	0 (NA - NA)	1615	4 (3 - 5)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
screen = According to breakpoint for screening.
MRSA = Methicillin resistance Staphylococcus aureus. For estimation method of MRSA see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information.

[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*

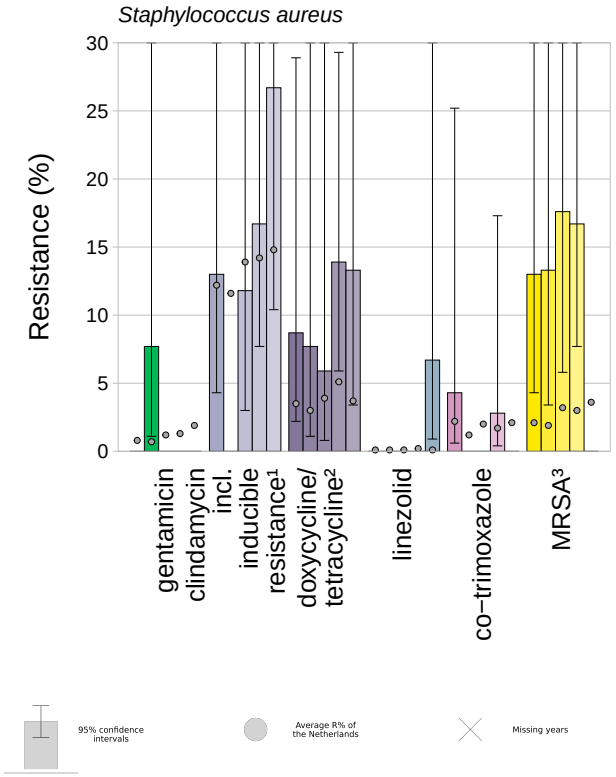

Figure 4.3.8.1 Trends in antibiotic resistance (from left to right 2018 to 2022) among diagnostic isolates of *S. aureus* patients admitted to intensive care units in ISIS-CAR*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
[1] *To estimate clindamycin resistance including induced resistance, the laboratory S/I/R interpretation was used (see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information).*
[2] *screen = According to breakpoint for screening.*
[3] *MRSA = Methicillin resistance Staphylococcus aureus. For estimation method of MRSA see section 4.1.1 'calculation of resistance levels' of the Nethmap 2022 report for more detailed information.*

5 Highly resistant microorganisms (HRMO)

In this section, resistance levels for the following HRMOs are presented: CRE/CPE (section 5.1), VRE (section 5.2), MRSA (section 5.3), CRPA/CPPA/MDR-PA (section 5.4) and ESBL (section 5.5).

5.1 Carbapenem-resistant and carbapenemase-producing *Enterobacterales* (CRE/CPE)

The percentages of carbapenem-resistant and carbapenemase-producing *E. coli*, *K. pneumoniae*, *Enterobacter cloacae* complex, and other *Enterobacterales* were estimated based on positivity for confirmation tests, or, if data from these tests were lacking, on re-interpretation of testvalues for meropenem/imipenem according to EUCAST 2022. Only diagnostic isolates (i.e. infection-related and thus non-screening samples) were included. Further information on these methods can be found in Chapter 4.7.1 'Carbapenem-resistant and carbapenemase-producing *Enterobacterales*' of the Nethmap 2022 report, available on the website of the RIVM.

Table 5.1.0.1 Carbapenem-resistant or carbapenem-producing *E. coli*, ISIS-CAR 2022

	Aruba			the Netherlands	
Type of setting	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	377	0	0 (NA - NA)	109486	0 (0 - 0)
Outpatient departments	212	0	0 (NA - NA)	18434	0 (0 - 0)
Inpatient departments excl. intensive care units	501	0	0 (NA - NA)	25836	0 (0 - 0)
Intensive care units	17	0	0 (NA - NA)	1077	0 (0 - 0)
Total	1107	0	0 (NA - NA)	154833	0 (0 - 0)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
The percentage of carbapenem-resistant or carbapenem-producing E. coli was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for meropenem/imipenem, based on re-interpretation of testvalues according to EUCAST 2022.

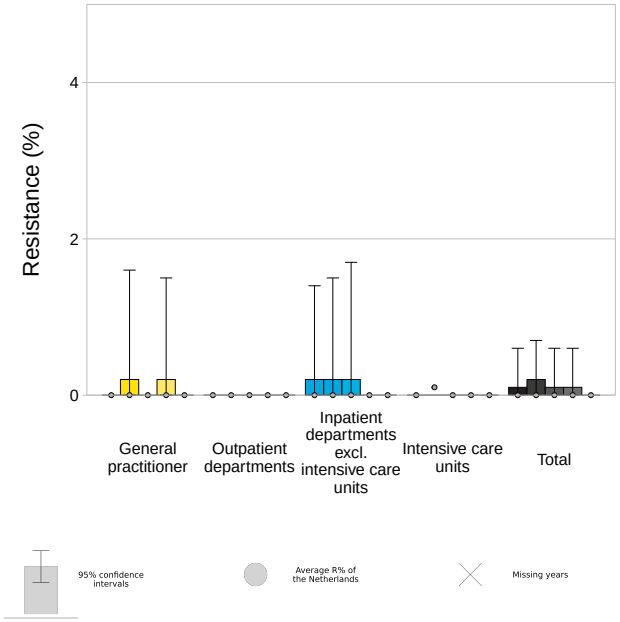

Figure 5.1.0.1 Carbapenem-resistant or carbapenem-producing *E. coli* compared to the total number of *E.coli* isolates in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
The percentage of carbapenem-resistant or carbapenem-producing E. coli was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for meropenem/imipenem, based on re-interpretation of testvalues according to EUCAST 2022.
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

Table 5.1.0.2 Carbapenem-resistant or carbapenem-producing *K. pneumoniae*, ISIS-CAR 2022

Type of setting	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	83	0	0 (NA - NA)	15132	0 (0 - 0)
Outpatient departments	71	0	0 (NA - NA)	4114	0 (0 - 0)
Inpatient departments excl. intensive care units	179	0	0 (NA - NA)	5469	0 (0 - 1)
Intensive care units	14	0	0 (NA - NA)	320	1 (0 - 2)
Total	347	0	0 (NA - NA)	25035	0 (0 - 0)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
The percentage of carbapenem-resistant or carbapenem-producing K. pneumoniae was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for meropenem/imipenem, based on re-interpretation of testvalues according to EUCAST 2022.

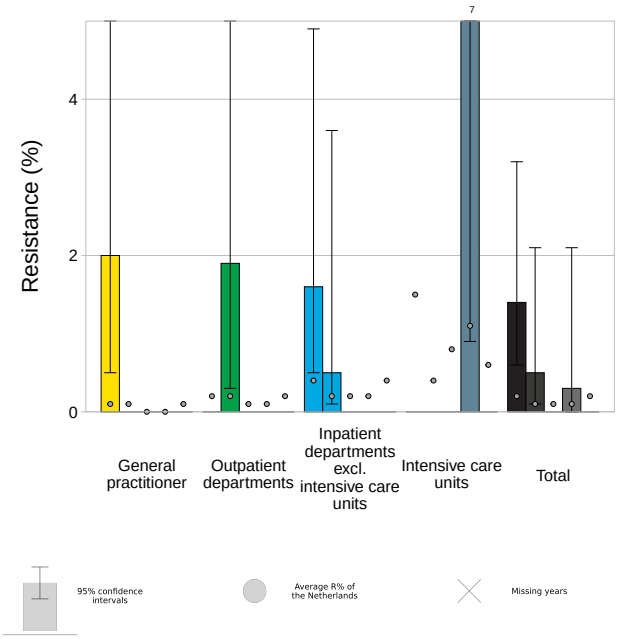

Figure 5.1.0.2 Carbapenem-resistant or carbapenem-producing *K. pneumoniae* compared to the total number of *K. pneumoniae* isolates in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
The percentage of carbapenem-resistant or carbapenem-producing K. pneumoniae was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for meropenem/imipenem, based on re-interpretation of testvalues according to EUCAST 2022.
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

Table 5.1.0.3 Carbapenem-resistant or carbapenem-producing *Enterobacter cloacae* complex, ISIS-CAR 2022

Type of setting	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	12	0	0 (NA - NA)	3695	0 (0 - 0)
Outpatient departments	35	0	0 (NA - NA)	1955	0 (0 - 0)
Inpatient departments excl. intensive care units	47	0	0 (NA - NA)	2885	0 (0 - 1)
Intensive care units	3	0	0 (NA - NA)	349	1 (0 - 2)
Total	97	0	0 (NA - NA)	8884	0 (0 - 0)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
The percentage of carbapenem-resistant or carbapenem-producing Enterobacter cloacae complex isolates was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for meropenem/imipenem, based on re-interpretation of testvalues according to EUCAST 2022.

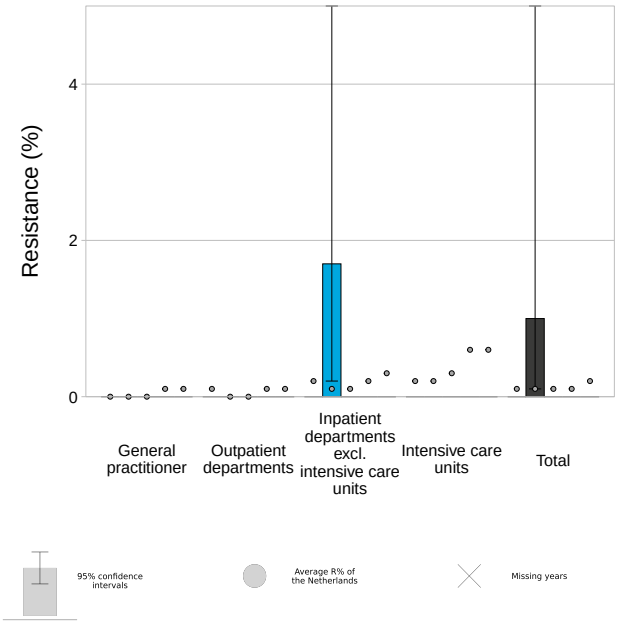

Figure 5.1.0.3 Carbapenem-resistant or carbapenem-producing *Enterobacter cloacae* complex isolates compared to the total number of *Enterobacter cloacae* complex isolates in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*,**

** A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
*** Y axis of the figures differs from the standard format.*
The percentage of carbapenem-resistant or carbapenem-producing Enterobacter cloacae complex isolates was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for meropenem/imipenem, based on re-interpretation of testvalues according to EUCAST 2022.
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

Table 5.1.0.4 Other carbapenem-resistant or carbapenem-producing *Enterobacterales*, ISIS-CAR 2022

Type of setting	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	109	0	0 (NA - NA)	27971	0 (0 - 0)
Outpatient departments	204	0	0 (NA - NA)	10084	0 (0 - 0)
Inpatient departments excl. intensive care units	305	1	0 (0 - 2)	12570	0 (0 - 0)
Intensive care units	21	1	5 (1 - 27)	1116	0 (0 - 0)
Total	639	2	0 (0 - 1)	51741	0 (0 - 0)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
The percentage of other carbapenem-resistant or carbapenem-producing Enterobacterales isolates was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for meropenem/imipenem, based on re-interpretation of testvalues according to EUCAST 2022.

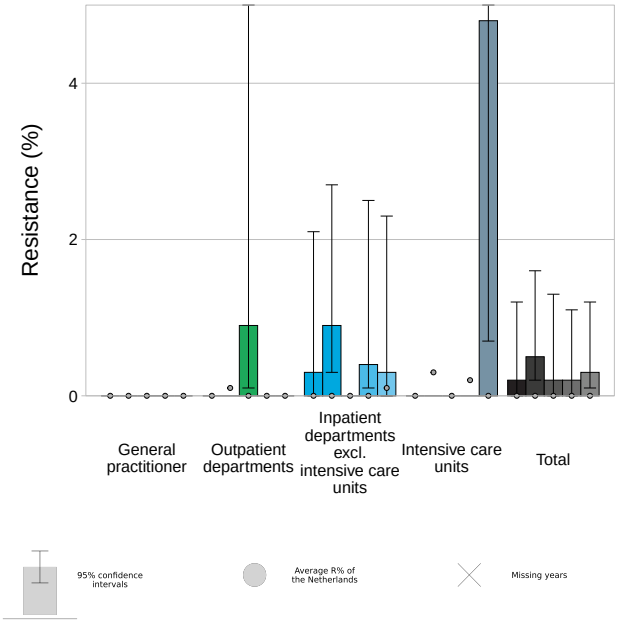

Figure 5.1.0.4 Other carbapenem-resistant or carbapenem-producing *Enterobacterales* isolates compared to the total number of *Enterobacterales* isolates in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*,**

** A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
*** Y axis of the figures differs from the standard format.*
The percentage of other carbapenem-resistant or carbapenem-producing Enterobacterales isolates was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for meropenem/imipenem, based on re-interpretation of testvalues according to EUCAST 2022.
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

5.2 Vancomycin-resistant Enterococci (VRE)

The prevalence of vancomycin resistance in *E. faecium* isolates was based on positivity of confirmation tests, or, if these tests were lacking, on re-interpretation of testvalues for amoxicillin/ampicillin and vancomycin according to EUCAST 2022, with VRE_{fm} being defined as resistant to amoxicillin/ampicillin and vancomycin. Both diagnostic isolates (i.e. infection-related and thus non-screening samples) and screening isolates were included. The first diagnostic or screening *E. faecium* isolate per patient was selected. Further information on these methods can be found in Chapter 4.7.2 'Vancomycin-resistent Enterococci' of the Nethmap 2022 report, available on the website of the RIVM.

Table 5.2.0.1 Vancomycin-resistant *E. faecium* in diagnostic isolates, ISIS-CAR 2022

	Aruba			the Netherlands	
Type of setting	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	1	0	0 (NA - NA)	450	0 (0 - 2)
Outpatient departments	1	0	0 (NA - NA)	546	0 (0 - 0)
Inpatient departments excl. intensive care units	10	0	0 (NA - NA)	2711	0 (0 - 1)
Total	12	0	0 (NA - NA)	4352	0 (0 - 1)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.

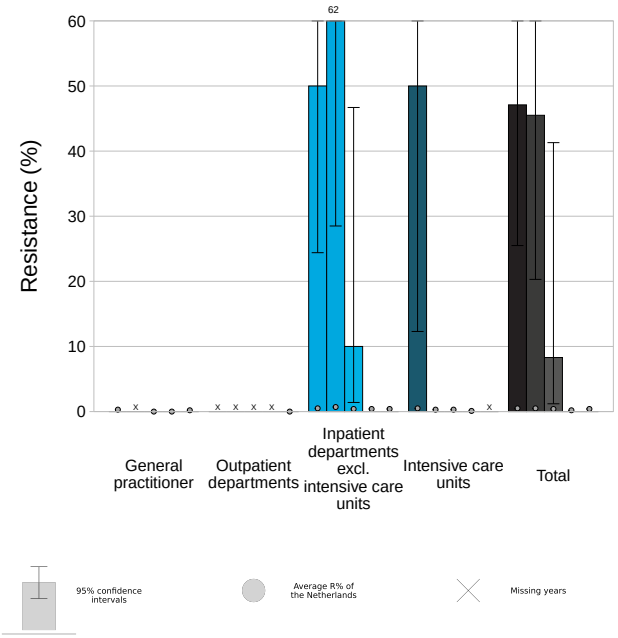

Figure 5.2.0.1 Trends in vancomycin-resistant *E. faecium* in diagnostic isolates in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*

5.3 Methicillin-resistant *Staphylococcus aureus* (MRSA)

S. aureus isolates, including MRSA, that were sampled between 2018 and 2022 were identified. The first diagnostic *S. aureus* isolate per patient per year from blood, cerebrosinal fluid, urine, lower respiratory tract, or wound/pus was selected. Prevalence of MRSA was calculated as the percentage of *S. aureus* isolates for which the MRSA confirmation test (presence of *mecA* gene, *mecC* gene or *pbp2*) was positive, or, if these tests were lacking, laboratory S/R interpretation for cefoxitin was R, or, if no data on cefoxitin test was available, the S/R laboratory interpretation for flucloxacillin/oxacillin was R. Further information on these methods can be found in Chapter 4.7.3 'Methicillin-resistant *Staphylococcus aureus* (MRSA)' of the Nethmap 2022 report, available on the website of the RIVM.

Table 5.3.0.1 Methicillin-resistant *S. aureus* (MRSA), ISIS-CAR 2022

	Aruba			the Netherlands	
Type of setting	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	77	14	18 (11 - 28)	7839	3 (2 - 3)
Outpatient departments	109	17	16 (10 - 24)	11259	2 (2 - 2)
Inpatient departments excl. intensive care units	207	40	19 (15 - 25)	11121	2 (2 - 2)
Intensive care units	14	0	0 (NA - NA)	1299	3 (3 - 5)
Total	407	71	17 (14 - 21)	31518	2 (2 - 3)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
The prevalence of MRSA isolates was based on positivity of confirmation tests (presence of mecA gene or pbp2) or if these tests were lacking, on laboratory S/R interpretation for cefoxitin. If no data on a cefoxitin test was available, the prevalence was based on laboratory S/R interpretation of flucloxacillin/oxacillin.

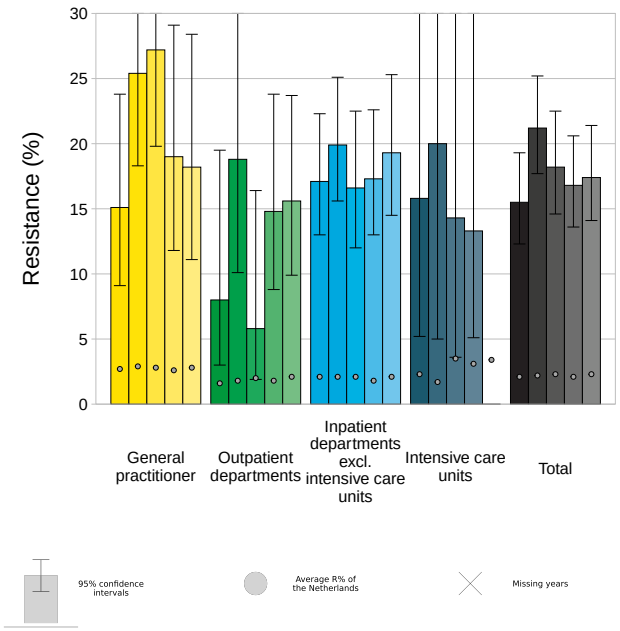

Figure 5.3.0.1 Trends in methicillin-resistant *S. aureus* isolates in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
The prevalence of MRSA isolates was based on positivity of confirmation tests (presence of mecA gene or pbp2) or if these tests were lacking, on laboratory S/R interpretation for cefoxitin. If no data on a cefoxitin test was available, the prevalence was based on laboratory S/R interpretation of flucloxacillin/oxacillin.
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

5.4 Carbapenem-resistant and carbapenemase-producing *Pseudomonas aeruginosa* (CRPA/CPPA)

For each patient the first *P. aeruginosa* isolate per year was extracted from the database. To avoid overestimation of the percentage CRPA caused by active screening for highly resistant isolates, only data on diagnostic isolates from blood, cerebrospinal fluid, urine, lower respiratory tract, and wound/pus were included in the analysis. Further information on these methods can be found in Chapter 4.7.4 'Carbapenem-resistant and carbapenemase-producing *Pseudomonas aeruginosa* (CRPA/CPPA)' of the Nethmap 2022 report, available on the website of the RIVM.

Table 5.4.0.1 Phenotypical carbapenem-resistant *P. aeruginosa* (CRPA), ISIS-CAR 2022

	Aruba			the Netherlands	
Type of setting	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	22	1	5 (1 - 26)	5469	5 (4 - 5)
Outpatient departments	78	3	4 (1 - 11)	4333	6 (5 - 6)
Inpatient departments excl. intensive care units	103	2	2 (0 - 7)	5306	5 (5 - 6)
Intensive care units	12	0	0 (NA - NA)	462	8 (6 - 11)
Total	215	6	3 (1 - 6)	15570	5 (5 - 6)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
Phenotypical carbapenem resistance was defined as resistance to meropenem and/or imipenem, based on reinterpretation of test-values according to EUCAST 2022.

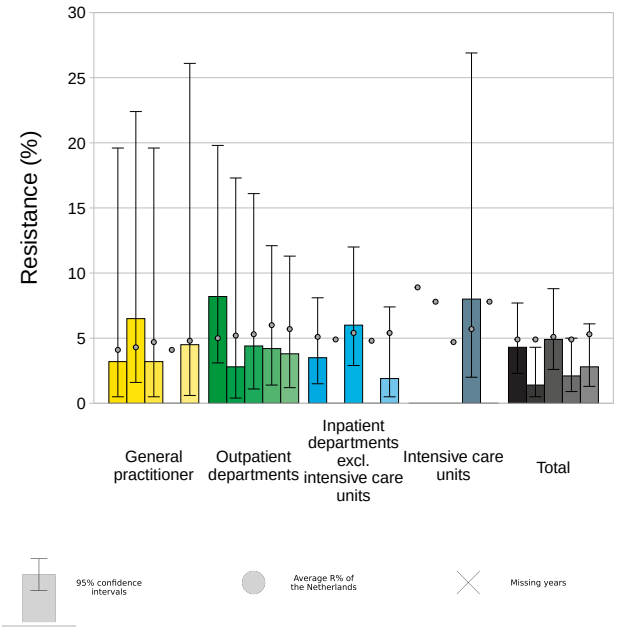

Figure 5.4.0.1 Phenotypical carbapenem-resistant *P. aeruginosa* compared to the total number of *P.aeruginosa* isolates in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
Phenotypical carbapenem resistance was defined as resistance to meropenem and/or imipenem, based on reinterpretation of test-values according to EUCAST 2022.
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

Table 5.4.0.2 Multidrug resistant *P. aeruginosa* (MDR-PA), ISIS-CAR 2022

Type of setting	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	21	1	5 (1 - 27)	5381	1 (0 - 1)
Outpatient departments	76	3	4 (1 - 12)	4146	2 (2 - 3)
Inpatient departments excl. intensive care units	102	0	0 (NA - NA)	5092	2 (2 - 2)
Intensive care units	12	0	0 (NA - NA)	433	4 (3 - 7)
Total	211	4	2 (1 - 5)	15052	2 (1 - 2)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
Multidrug resistance was defined as resistant to geq3 antimicrobial groups among fluoroquinolones, aminoglycosides, carbapenems, ceftazidime, and piperacillin-tazobactam, based on re-interpretation of test-values according to EUCAST 2022.

Table 5.4.0.3 Carbapenem resistant MDR *P. aeruginosa* (MDR-PA-CRP) compared to the total number of MDR-*P. aeruginosa* isolates, ISIS-CAR 2022

Type of setting	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	1	1	100 (100 - 100)	34	59 (42 - 74)
Outpatient departments	3	2	67 (15 - 96)	94	61 (50 - 70)
Total	4	3	75 (24 - 97)	243	63 (56 - 68)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
NA = not applicable.
Multidrug resistance was defined as resistant to geq3 antimicrobial groups among fluoroquinolones, aminoglycosides, carbapenems, ceftazidime, and piperacillin-tazobactam, based on re-interpretation of test-values according to EUCAST 2022 using the meningitis clinical breakpoint.

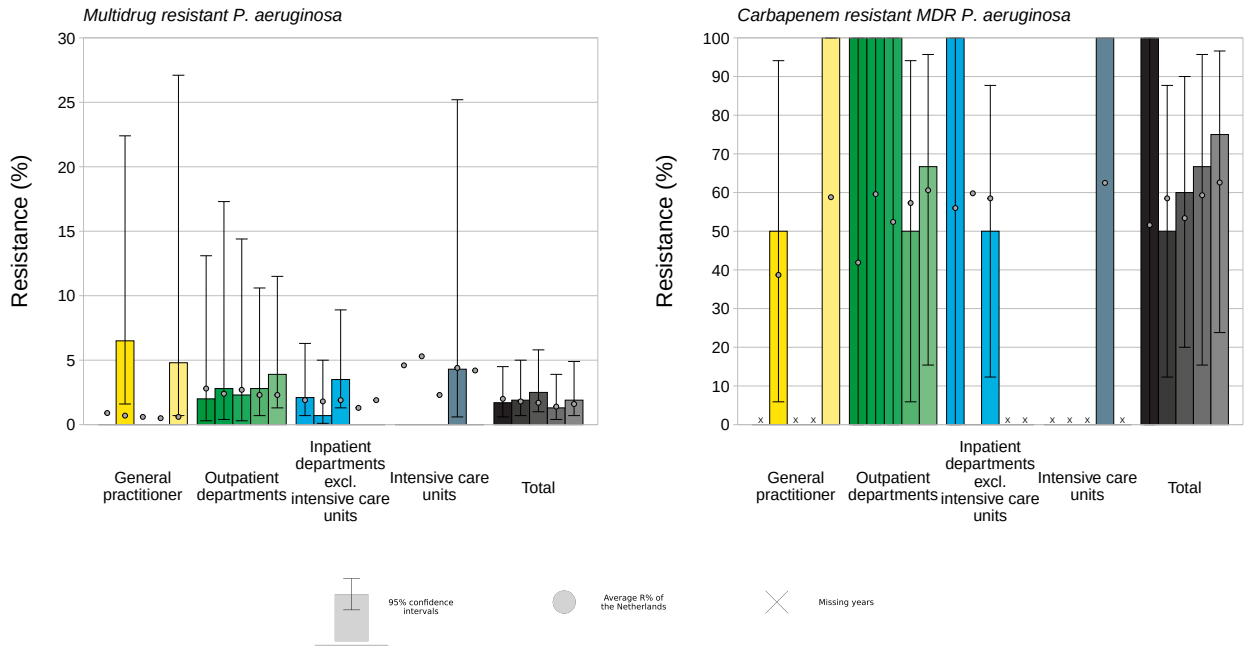

Figure 5.4.0.2 Multidrug resistant *P. aeruginosa* compared to the total number of *P. aeruginosa* isolates (left) and carbapenem resistant MDR-*P. aeruginosa* compared to the total number of MDR-*P. aeruginosa* isolates (right) in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
Multidrug resistance was defined as resistant to ≥3 antimicrobial groups among fluoroquinolones, aminoglycosides, carbapenems, ceftazidime, and piperacillin-tazobactam, based on re-interpretation of test-values according to EUCAST 2022.
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

5.5 Extended spectrum beta-lactamases (EBSL)

The percentages of ESBL producing *E. coli* and *K. pneumoniae* were estimated based on positivity for confirmation tests, or, if data from these tests were lacking, resistance for third generation cephalosporins (cefotaxime/ceftriaxone/ceftazidime) based on EUCAST 2022 clinical breakpoints. Further information on these methods can be found in Chapter 4.7.5 'Extended spectrum beta-lactamases' of the Nethmap 2022 report, available on the website of the RIVM.

Table 5.5.0.1 Extended spectrum beta-lactamase (ESBL) producing *E. coli*, ISIS-CAR 2022

	Aruba			the Netherlands	
Type of setting	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	376	16	4 (3 - 7)	113151	3 (3 - 4)
Outpatient departments	212	16	8 (5 - 12)	19278	5 (5 - 6)
Inpatient departments excl. intensive care units	498	48	10 (7 - 13)	27317	6 (5 - 6)
Intensive care units	17	6	35 (17 - 60)	1093	6 (5 - 8)
Total	1103	86	8 (6 - 10)	160839	4 (4 - 4)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
The percentage of ESBL producing E. coli was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for third generation cephalosporins (cefotaxime/ceftriaxone/ceftazidime), based on re-interpretation of testvalues according to EUCAST 2022.

Table 5.5.0.2 Extended spectrum beta-lactamase (ESBL) producing *E. coli* resistant to 3rd generation cephalosporins compared to the total number of *E. coli* isolates with a positive or negative confirmation test for ESBL production ISIS-CAR 2022

	Aruba			the Netherlands	
Type of setting	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	15	14	93 (65 - 99)	4325	87 (86 - 88)
Outpatient departments	17	14	82 (57 - 94)	1092	87 (85 - 89)
Inpatient departments excl. intensive care units	41	39	95 (82 - 99)	1675	88 (86 - 89)
Intensive care units	4	4	100 (100 - 100)	73	86 (76 - 92)
Total	77	71	92 (84 - 96)	7165	87 (86 - 88)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.
The percentage of ESBL producing E. coli was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for third generation cephalosporins (cefotaxime/ceftriaxone/ceftazidime), based on re-interpretation of testvalues according to EUCAST 2022.

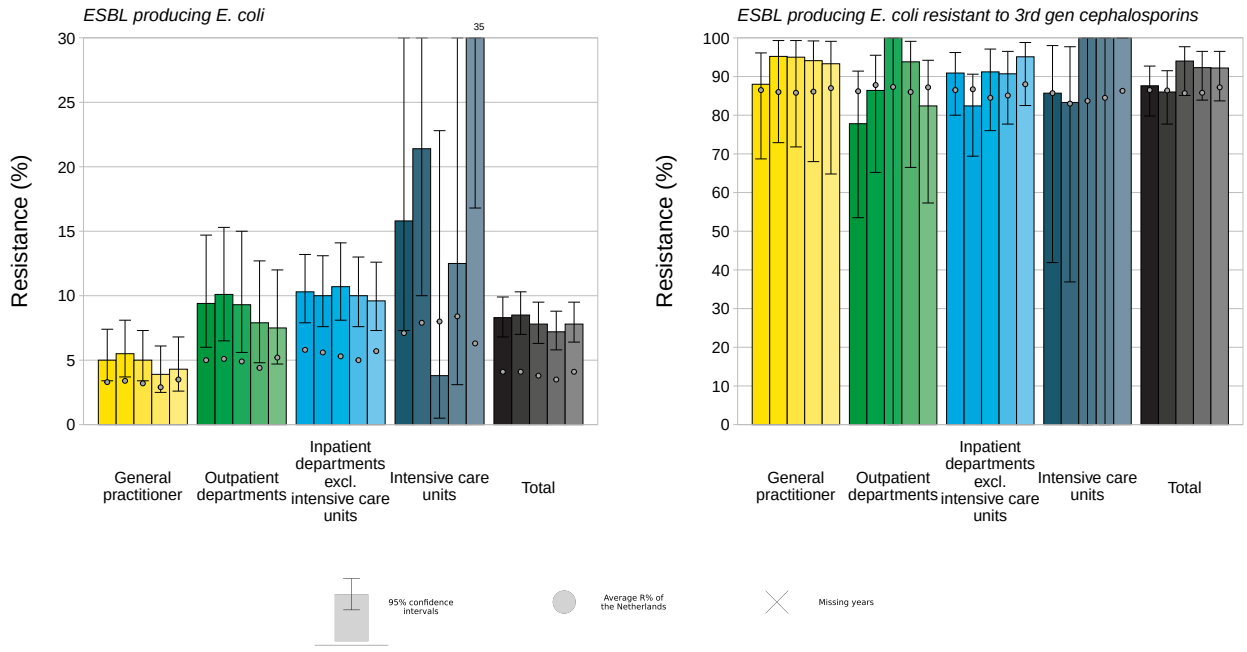

Figure 5.5.0.1 Extended spectrum beta-lactamase producing *E. coli* compared to the total number of *E.coli* isolates (left) and ESBL-producing *E. coli* resistant to 3rd generation cephalosporins compared to the total number of *E. coli* isolates with a positive or negative confirmation test for ESBL production (right) in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
The percentage of ESBL producing E. coli was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for third generation cephalosporins (cefotaxime/ceftriaxone/ceftazidime), based on re-interpretation of testvalues according to EUCAST 2022.
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

Table 5.5.0.3 Extended spectrum beta-lactamase (ESBL) producing *K. pneumoniae*, ISIS-CAR 2022

Type of setting	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	83	2	2 (1 - 9)	15632	3 (3 - 4)
Outpatient departments	71	1	1 (0 - 9)	4312	6 (5 - 6)
Inpatient departments excl. intensive care units	177	7	4 (2 - 8)	5705	8 (7 - 9)
Intensive care units	14	1	7 (1 - 37)	328	15 (11 - 19)
Total	345	11	3 (2 - 6)	25977	5 (5 - 5)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

The percentage of ESBL producing K. pneumoniae was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for third generation cephalosporins (cefotaxime/ceftriaxone/ceftazidime), based on re-interpretation of testvalues according to EUCAST 2022.

Table 5.5.0.4 Extended spectrum beta-lactamase (ESBL) producing *K. pneumoniae* resistant to 3rd generation cephalosporins compared to the total number of *K. pneumoniae* isolates with a positive or negative confirmation test for ESBL production ISIS-CAR 2022

Type of setting	Aruba			the Netherlands	
	N	R	R% (95%-CI)	N	R% (95%-CI)
General practitioner	3	2	67 (15 - 96)	579	83 (80 - 86)
Outpatient departments	1	1	100 (100 - 100)	265	85 (80 - 89)
Inpatient departments excl. intensive care units	9	7	78 (42 - 94)	482	86 (83 - 89)
Intensive care units	1	1	100 (100 - 100)	46	93 (82 - 98)
Total	14	11	79 (51 - 93)	1372	85 (83 - 87)

Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.

The percentage of ESBL producing K. pneumoniae was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for third generation cephalosporins (cefotaxime/ceftriaxone/ceftazidime), based on re-interpretation of testvalues according to EUCAST 2022.

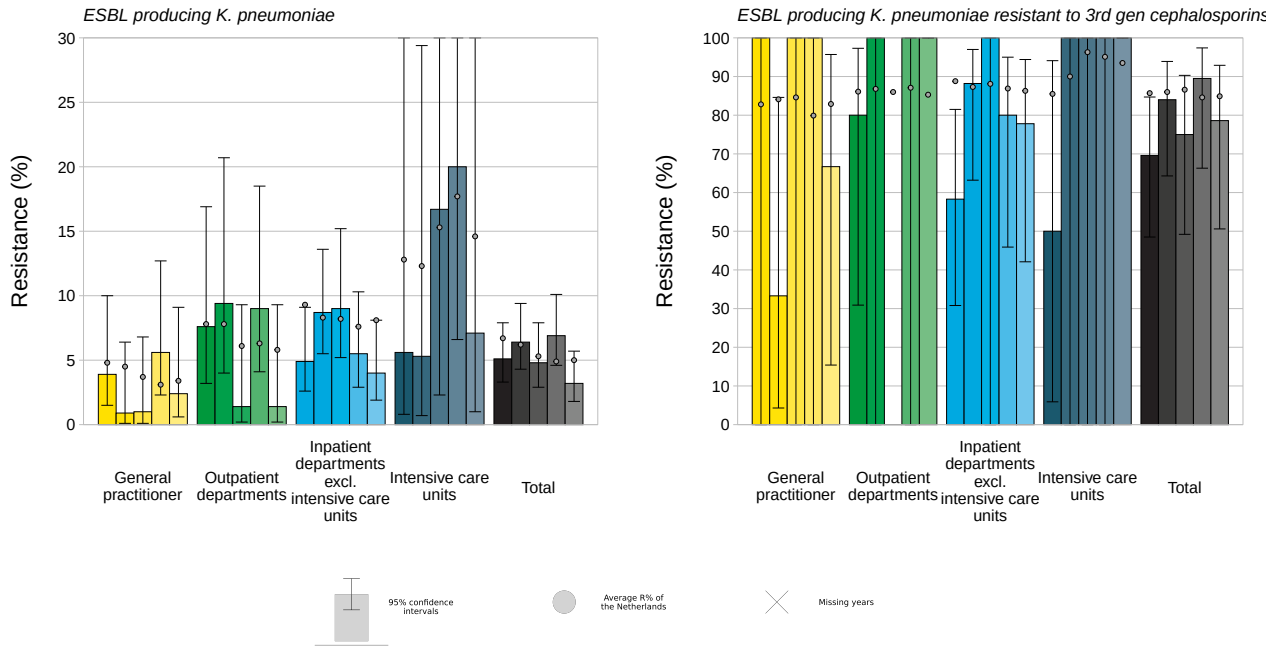

Figure 5.5.0.2 Extended spectrum beta-lactamase producing *K. pneumoniae* compared to the total number of *K. pneumoniae* isolates (left) and ESBL-producing *K. pneumoniae* resistant to 3rd generation cephalosporins compared to the total number of *K. pneumoniae* isolates with a positive or negative confirmation test for ESBL production (right) in Aruba (from left to right 2018 to 2022), based on ISIS-CAR data*,**

* *A hack took place between the period November 2019 and April 2020 rendering Aruba data from that period unreliable. Data were restored and corrected as much as possible but errors may still be present.*
** *Y axis of the figures differs from the standard format.*
The percentage of ESBL producing K. pneumoniae was estimated based on positivity of confirmation tests, or, if data from these tests were lacking, resistance for third generation cephalosporins (cefotaxime/ceftriaxone/ceftazidime), based on re-interpretation of testvalues according to EUCAST 2022.
Warning: Number of isolates for at least one of the organism-antibiotic-year combinations is lower than 100. Data can be difficult to interpret as is reflected by the wide confidence intervals. Interpret with caution.