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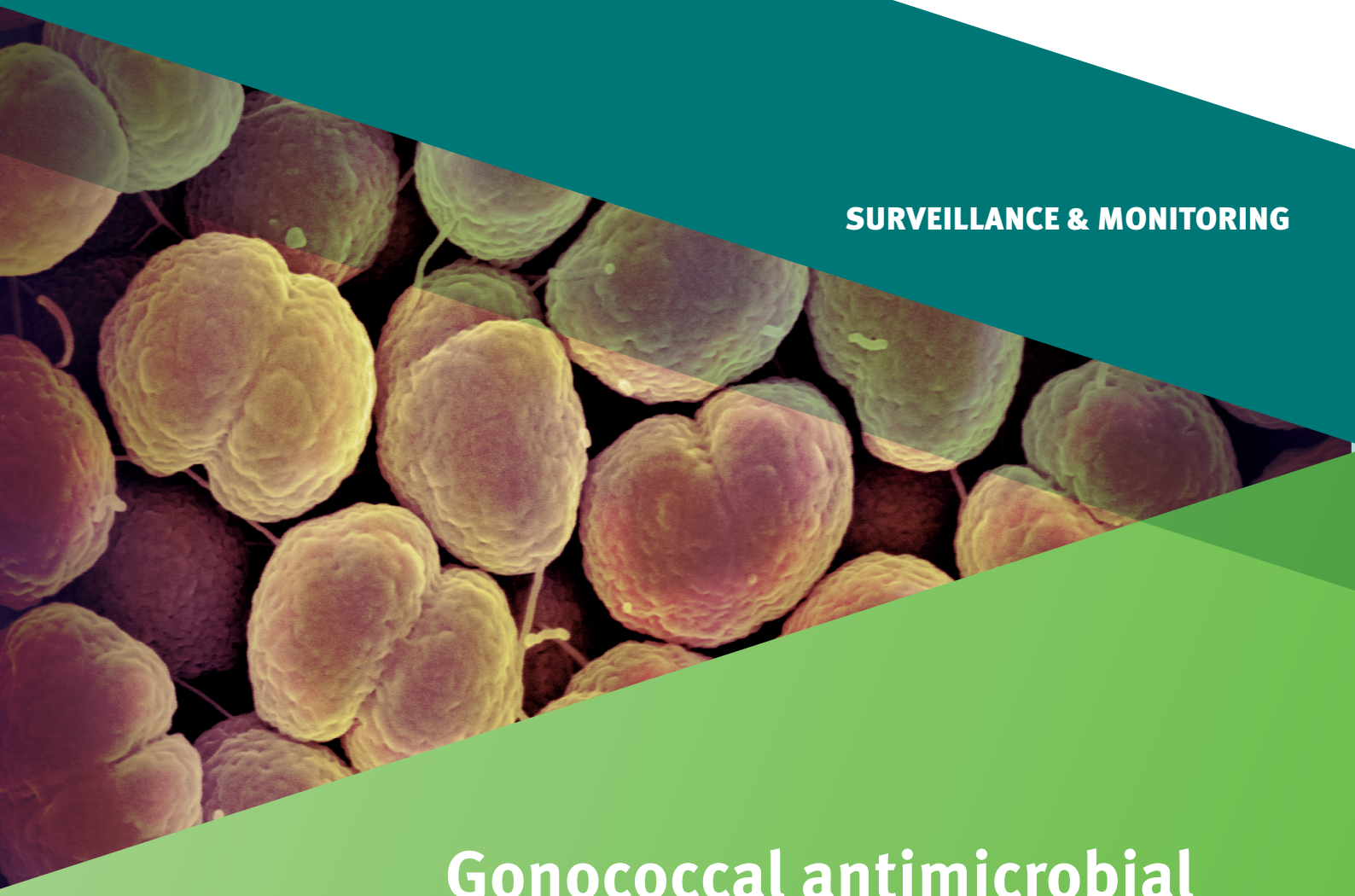

Gonococcal antimicrobial susceptibility surveillance in the European Union/European Economic Area

Summary of results for 2024

ECDC SURVEILLANCE REPORT

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Summary of results for 2024

This report was commissioned by the European Centre for Disease Prevention and Control (ECDC), coordinated by Csaba Ködmön, and produced by Örebro University Hospital, Örebro, Sweden and UK Health Security Agency, London, United Kingdom (UK).

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Acknowledgements

We would like to thank the members of the European Sexually Transmitted Infections (STI) network for their active participation in Euro-GASP:
Austria: Ziad El-Khatib, Sonja Pleininger, Stefanie Schindler; Belgium: Irith De Baetselier, Amaryl Lecompte, Dominique Van Beckhoven, Dorien Van den Bossche; Bulgaria: Ivva Philipova; Croatia: Tajana Juzbasić, Tatjana Nemeth Blažić, Tatjana Unukić; Cyprus: Olga Apostolou, Panayiota Maikanti Charalambous, Despo Pieridou; Czech Republic: Vladislav Jakubů, Hana Zákoucká, Helena Žemličková; Denmark: Steen Hoffmann, Maria Wessman; Estonia: Marlen Timm, Kairi Tõnsau; Finland: Jari Jalava, Suvi Korhonen, Jukka Torvikoski; France: Beatrice Bercot, Emilie Chazelle, Gilles Delmas, Cheick Kounta; Germany: Dagmar Heuer, Klaus Jansen, Regina Selb; Greece: Vivi Miriagou, Dimitra Paraskeva; Vasilios Raftopoulos; Hungary: Eszter Balla; Iceland: Lena Rós Ásmundsdóttir, Anna Margret Gudmundsdottir, Kristjan Orri Helgason, Marianna Thordardottir; Ireland: Mark Campbell, Brendan Crowley, Derval Igoe, Angeline McIntyre, Sinead Saab; Italy: Paola Stefanelli, Barbara Suligoi; Latvia: Gatis Pakarna; Liechtenstein: Esther Walser-Domjan; Lithuania: Aurelija Petrutiene; Luxembourg: Monique Perrin; Malta: Robert Cassar, Julie Haider, Francesca Mifsud; Netherlands: Alje Van Dam, Daan Notermans, Maartje Visser; Norway: Bente Børud, Hilde Kløvstad; Poland: Beata Młynarczyk-Bonikowska; Portugal: Maria José Borrego; Romania: Denisa Janta; Slovak Republic: Alexandra Bražinová, Peter Pavlik; Slovenia: Julija Germ, Tanja Kustec; Spain: Raquel Abad, Javier Gómez Castellá, Julio Vazquez Moreno; Sweden: Susanne Jacobsson, Daniel Schröder, Magnus Unemo.

Suggested citation: European Centre for Disease Prevention and Control. Gonococcal antimicrobial susceptibility surveillance in the European Union/European Economic Area, 2024. Stockholm: ECDC; 2026

Stockholm, 2026

ISBN 978-92-9498-887-4

doi 10.2900/0820781

Catalogue number TQ-01-26-032-EN-N

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Abbreviations

AMR	Antimicrobial resistance
CI	Confidence interval
Doxy-PEP	Doxycycline post-exposure prophylaxis
ECDC	European Centre for Disease Prevention and Control
ECOFF	Epidemiological cut-off value
EEA	European Economic Area
EQA	External quality assessment
EU	European Union
EUCAST	European Committee on Antimicrobial Susceptibility Testing
Euro-GASP	European Gonococcal Antimicrobial Surveillance Programme
HIV	Human immunodeficiency virus
HL-AziR	High-level azithromycin resistance (MIC ≥256 mg/L)
MDR	Multidrug-resistant
MIC	Minimum inhibitory concentration
MSM	Men who have sex with men
OR	Odds ratio
STI	Sexually transmitted infection
TESSy	The European Surveillance System
UK	United Kingdom
UKHSA	UK Health Security Agency
WGS	Whole genome sequencing
WHO	World Health Organization
XDR	Extensively drug-resistant
ÖUH	Örebro University Hospital

Executive summary

Gonorrhoea is the second-most reported bacterial sexually transmitted infection (STI) in the European Union/European Economic Area (EU/EEA), with more than 106 000 cases recorded in 2024. The surveillance of *Neisseria gonorrhoeae* antimicrobial susceptibility in the European Union/European Economic Area (EU/EEA) is essential for detecting emerging and increasing antimicrobial resistance as the quality-assured data produced can be used to inform treatment guidelines. Since 2009, this surveillance has been co-ordinated by the European Centre for Disease Prevention and Control (ECDC).

During 2024, as in previous years, the European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP) followed an annual decentralised and centralised testing model, requesting participating laboratories to collect gonococcal isolates during the period September–November 2024. Susceptibility testing (MIC gradient strip test, mostly Etest, or agar dilution) was performed on all isolates for the following antimicrobials (where available): ceftriaxone, cefixime, azithromycin, ciprofloxacin and tetracycline as well as testing for β-lactamase production for detection of high-level penicillin resistance. Since 2023, testing has been undertaken for tetracycline to monitor the impact of doxycycline post-exposure prophylaxis (doxy-PEP) in the EU/EEA. Decentralised testing took place on the premise that participating laboratories fulfil set quality criteria. In 2024, 24 EU/EEA Member States participated in Euro-GASP, 19 via decentralised testing. Data on 4 516 isolates were submitted to the European Surveillance System (TESSy), 3 371 of which were analysed for this report (trimmed dataset).

Key changes in 2024 compared to the report of the 2023 data

- Ceftriaxone resistance detected in the analysed 2024 dataset: two ceftriaxone-resistant *Neisseria gonorrhoeae* isolates were identified in 2024 (Luxembourg and Norway), whereas one was detected in the 2023 dataset; an additional resistant isolate was reported outside the trimmed dataset.
- Extensively drug-resistant (XDR) gonorrhoea was more prominent: all ceftriaxone-resistant isolates detected in 2024 were classified as extensively drug-resistant, increasing concern regarding last-line treatment options.
- Persistently high azithromycin resistance: the proportion of isolates with azithromycin MICs above the epidemiological cut-off (ECOFF) remains high for 2024 (19.1%), even though it has decreased compared to 2023 (23.2%). Isolates with an azithromycin MIC above the ECOFF were detected in 23/24 countries in 2024.
- Ciprofloxacin resistance remains stable, but high: approximately two-thirds of isolates continue to be resistant to ciprofloxacin, indicating a sustained high plateau rather than further increase.
- Implications for doxy-PEP: high tetracycline resistance is explicitly discussed in relation to doxycycline post-exposure prophylaxis, confirming that doxy-PEP is unlikely to reduce gonorrhoea incidence at population level.

1 Introduction

1.1 Background

Gonorrhoea is the second-most reported bacterial sexually transmitted infection in the European Union/European Economic Area (EU/EEA), with more than 106 000 cases recorded in 2024 [1]. The emergence and spread of antimicrobial resistance (AMR) in *Neisseria gonorrhoeae* is a serious threat to the treatment and control of gonorrhoea. Ceftriaxone, the extended-spectrum cephalosporin, is the last remaining option for effective empiric first-line antimicrobial monotherapy and is the main therapeutic agent currently recommended in Europe [2–5]. The 2020 European gonorrhoea treatment guideline recommends combination treatment with high-dose ceftriaxone (1 g) plus azithromycin (2 g) or high-dose ceftriaxone (1 g) monotherapy, but only in well controlled settings (see guidelines for details [3]). Surveillance of susceptibility to these agents is essential to ensure effective case management and monitor current and emerging trends in AMR [3–10].

ECDC has co-ordinated epidemiological and microbiological surveillance activities for STIs in Europe since 2009. The microbiological components, mainly focusing on the European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP), have been outsourced and are supported by an international network led by Örebro University Hospital (ÖUH) (Sweden) and the UK Health Security Agency (UKHSA) (United Kingdom). Activities have included:

- centralised and decentralised *N. gonorrhoeae* isolate collection and antimicrobial susceptibility testing;
- establishment of the European Surveillance System (TESSy) reporting for Euro-GASP surveillance data;
- external quality assessment (EQA) schemes;
- molecular typing of *N. gonorrhoeae* (whole-genome sequencing (WGS) since 2013);
- laboratory capacity assessment across the European Union/European Economic Area (EU/EEA);
- training on STI diagnostic and typing methods.

1.2 Objectives

The overall aim of Euro-GASP is to strengthen the surveillance of gonococcal antimicrobial susceptibility in EU/EEA countries to provide quality-assured data to inform gonorrhoea treatment guidelines and strengthen countries' laboratory capacity for isolation and characterisation of *N. gonorrhoea* isolates. The objectives are:

- To monitor the susceptibility of *N. gonorrhoeae* isolates in participating countries by conducting surveillance for antimicrobial resistance in gonococci.
- To support participating countries in developing technical skills and capacity for high-quality antimicrobial susceptibility testing and molecular typing, including WGS.
- To support participating countries in improving the quality of epidemiological data reported through Euro-GASP.
- To assess the accuracy of quantitative *N. gonorrhoeae* antimicrobial susceptibility testing reported by participating laboratories and the comparability of results between laboratories through an EQA scheme, to identify needs for targeted capacity building.
- To perform analysis of WGS data of *N. gonorrhoeae* isolates to better understand the geographical and temporal distribution patterns of public health relevant strains of *N. gonorrhoeae* in the EU/EEA, including associations between genotype, antimicrobial resistance and case characteristics.
- To assess the quality of *N. gonorrhoeae* molecular typing data generated by participating laboratories through an EQA scheme and a bioinformatic ring trial, and the comparability of results between laboratories to identify needs for targeted capacity building.
- To provide training on STI laboratory diagnostics, *N. gonorrhoeae* susceptibility testing and molecular typing including WGS.

This report presents the results from the 2024 gonococcal antimicrobial susceptibility sentinel surveillance in the EU/EEA.

2 Methods

2.1 Participating laboratories and isolate collection

Euro-GASP member laboratories from 30 EU/EEA countries were invited to collect *N. gonorrhoeae* isolates from consecutive cases to ensure the representativeness for each individual country. The official collection window was from September to November 2024, but countries could extend the collection window if necessary, in order to reach the isolate target. Participating countries were requested to collect 100 isolates each. In countries where this number represented less than 10% of the total reported cases, the requested sample size was 200 isolates. This applied to Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, the Netherlands, Norway, Portugal, Spain and Sweden. Countries were restricted to the target number of isolates to ensure that the dataset was representative of the EU/EEA. If data were submitted for more than 100 or 200 isolates, the data were trimmed. To do this, isolates from each country were ordered chronologically from September to December, and in reverse chronological order from August to January. They were included in order until the applicable maximum per country was reached.

Euro-GASP collection criteria and methodology remained the same as in previous years [11-13]. Isolates from five (13.7%) countries were tested centrally at ÖUH, Sweden, while the remaining 19 (86.3%) countries performed antimicrobial susceptibility testing in their own laboratories. All Euro-GASP laboratories are invited to participate in an annual EQA programme [14-16] to ensure comparability of data. Countries that perform decentralised testing must have fulfilled established quality criteria prior to commencing their own testing.

2.2 Antimicrobial susceptibility testing

Antimicrobial susceptibility testing was mainly performed using MIC gradient strip tests (mainly Etest) for ceftriaxone, cefixime, azithromycin, ciprofloxacin, and tetracycline. A smaller fraction of isolates (n=184) was tested using agar dilution for cefixime and tetracycline. Due to the expanding use of doxycycline post-exposure prophylaxis (doxy-PEP) [17-19] in the EU/EEA, tetracycline susceptibility testing was added in 2023. Production of penicillinase resulting in high-level penicillin resistance was tested using nitrocefin, as previously described [11-13]. The results were interpreted using current breakpoints from the European Committee on Antimicrobial Susceptibility Testing (EUCAST): cefixime/ceftriaxone resistance, MIC >0.125 mg/L; azithromycin epidemiological cut-off value (ECOFF), MIC >1 mg/L; ciprofloxacin resistance, MIC >0.06 mg/L; and tetracycline resistance, MIC >0.5 mg/L [20]. Gentamicin and spectinomycin were removed from the routine antimicrobial panel in 2014 as these antimicrobials are not in routine use for treatment. These are only tested in 'snapshot' studies every three years, with 2022 being the most recent 'snapshot' study year [12].

2.3 Data collection and analysis

The following data were collected for each isolate, where available: specimen site, sex, age, route of transmission, previous gonorrhoea diagnosis, HIV status, country of birth, probable country of infection and treatment used. All antimicrobial susceptibility and epidemiological data were uploaded to TESSy by Member States, validated and approved.

To evaluate the reporting completeness of epidemiological data for each country, the number of records with missing data or 'Unknown' reported for each variable were subtracted from the total number of isolates received, and this number was used to calculate a percentage completeness value (number of responses/total isolates received x 100). An overall response rate for each country was then calculated by taking the average of the percentage completeness for all nine epidemiological fields.

2.4 Statistical analysis

Statistical analysis was performed using Stata v18.0. The Z-test was used to determine the difference between epidemiological and AMR data collected in 2024 versus 2023, and a Mann-Whitney U test was used to test whether the differences in age distribution were statistically significant. Where datasets contained sufficient numbers, the odds ratios (OR) and 95% confidence intervals (CI) were calculated and Pearson's $\chi 2$ test was used to measure if these ORs differed significantly from one. For small cell numbers, Fisher's exact test was performed. Statistical significance for all tests was assumed when $p < 0.05$. Using a forward step-wise approach, the most significant and strongest associations from the univariate analysis were added to a multivariable logistic regression model sequentially. Infection site was not included in the multivariable analyses as clinical sampling practice is not uniform across all countries.

In the maps, the 5% threshold for antimicrobial resistance in *N. gonorrhoeae* was used according to the benchmark set by the World Health Organization (WHO) to guide treatment decisions [2].

3 Results

In 2024, 4 516 gonococcal isolates were submitted to TESSy by 24 EU/EEA countries (listed in Table 3), with countries submitting between four and 710 isolates each. This represents a decrease of 753 isolates (14.3%) compared to 2023. In 2024, similar as in 2023, the dataset was trimmed to ensure compliance with the Euro-GASP reporting protocol regarding number of isolates per country (see methods). Overall, 1 145 isolates were excluded from 11 countries, ranging from one to 510 isolates per country.

The trimmed 2024 dataset included 3 371 isolates from 24/30 EU/EEA countries, equating to 86.4% of the target of 3 900 isolates for these 24 participating countries. Luxembourg participated in 2024, after not participating in 2023. Croatia, Latvia, Liechtenstein, Lithuania, and Romania did not participate with 2024 or 2023 data. Estonia did not participate in 2024 but did submit data in 2023. The number of isolates included per country in 2024 ranged from four to 200 in the trimmed data. Overall, 2 661 (78.9%) isolates were collected during the official collection period (September to November). Five countries collected isolates only during the official collection period, while the remaining 19 extended beyond this window to attempt to reach the target number of isolates.

3.1 Epidemiological data

The overall completeness of all epidemiological data was 55.8%, which is in line with 55.7% in 2023, representing a minor improvement in 2024 and 2023 compared to the decline in completeness observed from 2018 (62.1%) to 2022 (53.3%). The completeness was highest for sex (99.3%) and lowest for treatment (25.7%). The completeness of the following variables increased significantly in 2024 relative to 2023: previous gonorrhoea diagnosis (29.2%, p <0.001), country of birth (46.7%, p <0.001), and probable country of infection (36.9%, p=0.020). Whereas completeness of reporting for site of infection (84.8%, p <0.001) and HIV status (28.6%, p=0.020) decreased relative to 2023. No significant changes were observed among the remaining variables. Full details on the completeness of epidemiological variables are available in Annex 1.

As in previous years, the majority (82.1%) of isolates collected in 2024 were from males and 17.9% from females (Table 1). The majority of cases (73.8%) were among cases ≥25 years old, which is an increase relative to 2023 (70.4%, p=0.002) (Table 1). Data on sex and route of transmission were available for 59.5% (n=2 006) of cases (Table 1; Annex 1). Among these cases, 46.1% of the isolates were from men who have sex with men (MSM), 24.2% from heterosexual males and 29.8% from females**,** which was comparable to the proportion observed in 2023 (Table 1). The most common site of infection was urogenital, as in previous years, however the proportion increased from 73.6% in 2023 to 76.6% in 2024 (p=0.008) (Table 1). The proportion of pharyngeal specimens decreased correspondingly from 9.3% in 2023 to 6.9% in 2024 (p=0.001) while the proportion of anorectal (14.8%) and 'other' specimens, including eye, blood, joint fluid, and cerebrospinal fluid samples (1.7%), remained at the same level as 2023 (Table 1). Information on previous gonorrhoea diagnosis was available for 29.2% (n=983) of cases (Annex 1). Among cases with information on previous gonorrhoea diagnosis, 41.3% had had a previous infection, which was an increase relative to 2023 (33.3%, p <0.001) and preceding years (Table 1). Among 965 cases (28.6%) with a known HIV status (Annex 1), 11.1% were living with HIV in 2024, which was not different to 2023 (9.7%, p=0.332). Of those cases living with HIV who had a known transmission route (n=84), in 2024, 96.4% were MSM. The probable country of infection was available for 1 245 cases (36.9%) from 15 different countries (Annex 1). Overall, 8.3% of these cases were probably acquired outside the reporting country, which was comparable to 2023 (p=0.567) (Table 1).

Table 1. Case characteristics reported for Euro-GASP gonococcal isolates, 2015–2024

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Total number of isolates	2134	2660	3248	3299	4166	3291	3541	4396	3184	3371
Sex										
Male	1 736 (81.8)	2 256 (85.1)[a]	2 737 (84.5)	2 795 (85.3)	3 389 (83.0)	2 762 (84.4)	3 023 (86.1)	3 534 (80.9)	2 614 (82.6)	2 742 (82.1)
Female	385 (18.2)	395 (14.9)	502 (15.5)	483 (14.7)	695 (17.0)	509 (15.6)	488 (13.9)	837 (19.1)	549 (17.4)	597 (17.9)
Unknown	13	9	9	21	82	20	30	25	21	32
Age (years)										
<25	617 (29.5)	720 (27.5)	898 (28.2)	925 (28.4)	1133 (28.4)	844 (25.8)	814 (23.2)	1244 (28.4)	938 (29.6)	874 (26.2)
≥25	1 476 (70.5)	1 902 (72.5)	2 283 (71.8)	2 332 (71.6)	2 853 (71.6)	2 428 (74.2)	2 690 (76.8)	3 130 (71.6)	2 228 (70.4)	2 467 (73.8)
Unknown	41	38	67	42	180	19	37	22	18	30
Route of transmission and sex										
Females	385 (26.4)	395 (22.9)	502 (22.6)	483 (21.3)	695 (29.5)	509 (28.1)	488 (23.5)	837 (34.0)	549 (29.1)	597 (29.8)
Heterosexual males	419 (28.7)	632 (36.7)	663 (29.9)	595 (26.3)	588 (24.9)	455 (25.1)	519 (25.0)	491 (20.0)	459 (24.3)	485 (24.2)
MSM	657 (45.0)	696 (40.4)[a]	1055 (47.5)[b]	1186 (52.4)	1074 (45.6)	847 (46.8)[c]	1069 (51.5)	1133 (46.0)	881 (46.6)	924 (46.1)
Unknown	673	937	1028	1035	1809	1480	1465	1935	1295	1365
Site of infection										
Genital	1 517 (72.9)	1 943 (75.5)	2 166 (72.8)	2 155 (70.4)	2 578 (68.1)	2 175 (71.6)	2 296 (69.9)	2 894 (69.0)	2 224 (73.6)	2 189 (76.6)
Pharyngeal	180 (8.7)	165 (6.4)	254 (8.5)	259 (8.5)	368 (9.7)	182 (6.0)	304 (9.2)	503 (12.0)	282 (9.3)	198 (6.9)
Anorectal	280 (13.5)	366 (14.2)	435 (14.6)	570 (18.6)	743 (19.6)	608 (20.0)	642 (19.5)	747 (17.8)	451 (14.9)	422 (14.8)
Other	103 (5.0)	100 (3.9)	120 (4)	77 (2.5)	97 (2.6)[d]	72 (2.4)[e]	45 (1.4)[f]	52 (1.2)[g]	64 (2.1)[h]	48 (1.7)[i]
Unknown	54	86	273	238	380	254	254	200	163	514
Previous gonorrhoea										
Yes	157 (17.5)	171 (17.2)	235 (21.8)	264 (26.9)	251 (24.7)	140 (23.6)	176 (24.0)	242 (27.8)	262 (33.3)	406 (41.3)
No	739 (82.5)	824 (82.8)	845 (78.2)	718 (73.1)	767 (75.3)	452 (76.4)	558 (76.0)	629 (72.2)	525 (66.7)	577 (58.7)
Unknown	1238	1665	2168	2317	3148	2699	2807	3525	2397	2388
HIV status										
Positive	132 (15.3)	156 (15.9)	188 (15.4)	224 (15.7)	179 (14.1)	124 (12.3)	133 (10.8)	126 (8.8)	97 (9.7)	107 (11.1)
Negative	733 (84.7)	823 (84.1)	1 029 (84.6)	1 204 (84.3)	1 088 (85.9)	887 (87.7)	1 099 (89.2)	1 308 (91.2)	898 (90.3)	858 (88.9)
Unknown	1 269	1 681	2 031	1 871	2 899	2 280	2 309	2 962	2 189	2 406
Probable country of infection										
Same as reporting country	800 (92.2)	614 (87.0)	795 (88.6)	1155 (87.6)	1167 (89.8)	1089 (94.7)	1169 (94.0)	1015 (93.4)	1005 (92.4)	1142 (91.7)
Different from reporting country	68 (7.8)	92 (13.0)	102 (11.4)	163 (12.4)	133 (10.2)	61 (5.3)	75 (6.0)	72 (6.6)	83 (7.6)	103 (8.3)
Unknown	1 266	1 954	2 351	1 981	2 866	2 141	2 297	3 309	2 096	2 126

Percentages calculated from known values. Cells shaded in blue indicate a significant difference compared to the previous year (p <0.05).

a. Includes one individual with mode of transmission reported as MSM, but with gender reported as unknown
b. Includes two individuals with mode of transmission reported as MSM, but with sex reported as unknown
c. Includes one individual with mode of transmission reported as MSM, but with sex reported as other
d. Includes three eye, one blood and four joint fluid samples – included in other site for analysis due to low numbers
e. Includes eight eye and three joint fluid samples.
f. Includes eight eye, one blood and four joint fluid samples
g. Includes 25 eye, four blood and four joint fluid samples
h. Includes 21 eye, five blood, four joint fluid, and one cerebrospinal fluid samples.
i. Includes 11 eye, one blood, nine joint fluid, and one cerebrospinal fluid sample.

Case ages ranged from two to 81 years, with a median age of 31 years (Table 2). Males (median age 31 years) were older than females (median age 26 years) (Mann Whitney, p <0.001).

Table 2. Case age distribution by sex and route of transmission, 2024*

Variable	N^	Age (years)		<25 years (N (%))
		Range	Median	
All cases	3 341	2-81	31	872 (26.2)
Females	596	3-80	26	254 (42.6)
Males#	2 731	2-81	31	618 (22.6)
Heterosexual males	485	16-71	31	128 (26.4)
MSM	922	16-77	32	162 (17.6)

** Cases with missing information on sex or age are not included in this table.*
^ Where information was available.
 # Including all males, irrespective of sexual orientation.

3.2 Antimicrobial susceptibility and resistance

Resistance to cefixime, ciprofloxacin and azithromycin (using breakpoints from the EUCAST for cefixime and ciprofloxacin and ECOFF for azithromycin) over time is summarised in Figure 1 and Table 3.

Figure 1. Percentage of resistant *Neisseria gonorrhoeae* by antimicrobial and year, Euro-GASP, 2015–2024

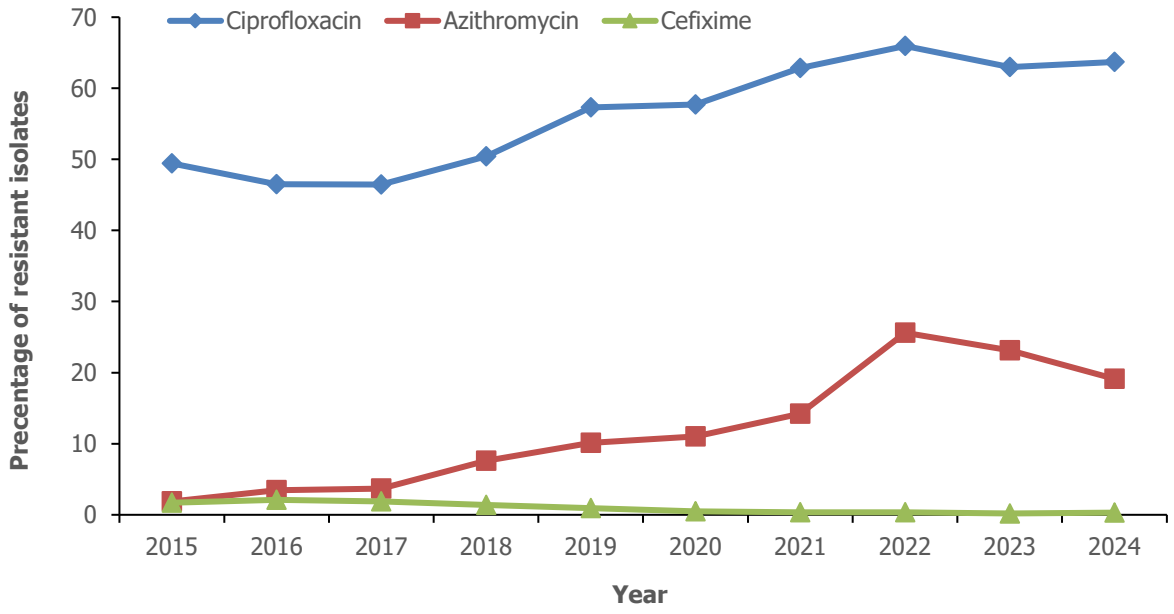


Table 3. Resistance to cefixime, ciprofloxacin and azithromycin (using resistance breakpoints from EUCAST for cefixime and ciprofloxacin and ECOFF for azithromycin) by country, Euro-GASP, 2024

Country	Number of isolates 2024	Number of isolates 2015-2024	Cefixime resistance			Azithromycin resistance			Ciprofloxacin resistance			Method of testing
			No.	%	% 2015-2024	No.	%	% 2015-2024	No.	%	% 2015-2024	
Austria	200		0	0.0		32	16.0		131	65.5		Decentralised
Belgium	188		1	0.5		38	20.2		105	55.9		Decentralised
Bulgaria	38		0	0.0		23	60.5		24	63.2		Centralised
Cyprus	4		0	0.0		0	0.0		4	100.0		Decentralised
Czech Republic	106		0	0.0		36	34.0		80	75.5		Centralised
Denmark	199		2	0.0		7	3.5		129	64.8		Decentralised
Finland	200		0	0.0		46	23.0		149	74.5		Decentralised
France	200		0	0.5		14	7.0		119	59.5		Decentralised
Germany	200		1	0.0		44	22.0		139	69.5		Decentralised
Greece	100		0	0.0		22	22.0		55	55.0		Decentralised
Hungary	200		1	1.0		47	23.5		107	53.5		Centralised
Iceland	100		0	1.0		22	22.0		79	79.0		Decentralised
Ireland	200		0	0.0		58	29.0		110	55.0		Decentralised
Italy	100		0	0.0		13	13.0		73	73.0		Decentralised
Luxembourg	80		1	0.0		21	26.3		55	68.8		Decentralised
Malta	38		0	0.0		2	5.3		30	78.9		Decentralised
Netherlands	200		0	0.0		56	28.3		111	55.8		Decentralised
Norway	200		1	0.0		46	23.0		101	50.5		Decentralised
Poland	18		0	0.0		12	66.7		9	50.0		Centralised
Portugal	200		2	0.0		17	8.5		138	69.0		Decentralised
Slovakia	100		0	0.0		18	18.0		69	69.0		Centralised
Slovenia	100		0	0.0		13	13.1		70	70.0		Decentralised
Spain	200		0	0.0		5	2.5		131	65.5		Decentralised
Sweden	200		1	0.5		51	25.5		129	64.5		Decentralised
Total:	3371											
Cefixime	3308		10	0.3								
Azithromycin	3365					643	19.1					
Ciprofloxacin	3370								2147	63.7		
95% CI				0.2-0.6			17.8-20.5			62.1-65.3		

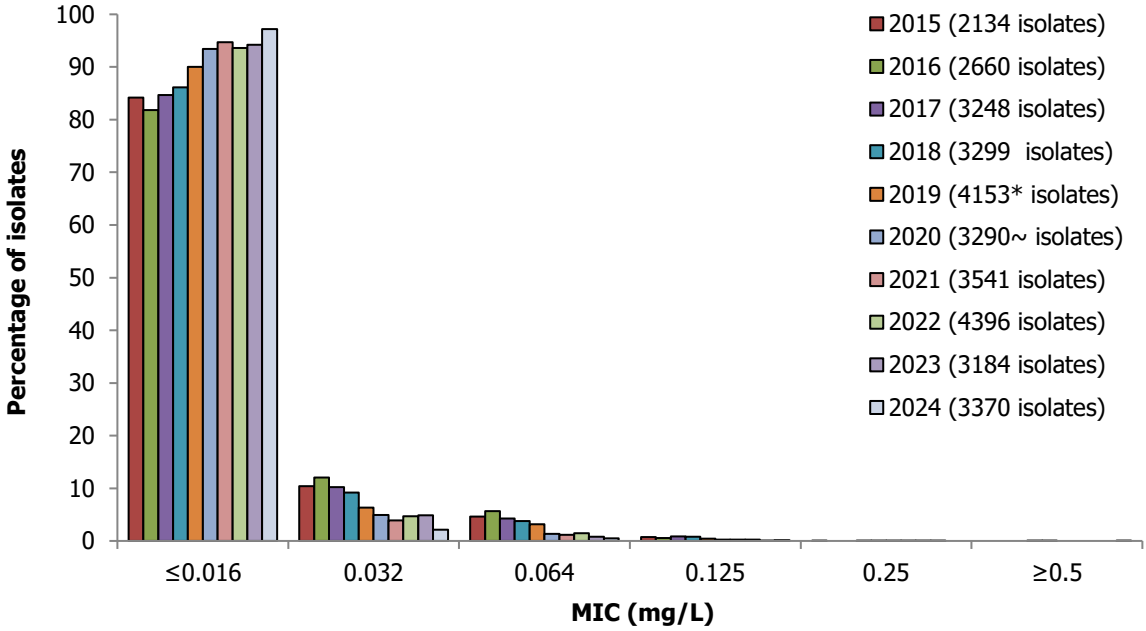
Croatia, Estonia, Latvia, Liechtenstein, Lithuania, and Romania did not report data in 2024.

3.2.1 Ceftriaxone

In 2024, two isolates within the trimmed dataset displayed ceftriaxone resistance in comparison with one isolate in 2023, two isolates in 2022, one each in 2021 and 2020, three each in 2019 and 2018, zero in both 2017 and 2016, and one in 2015 (Figure 2). The ceftriaxone resistant isolates (MIC=0.5 mg/L) were detected in Luxembourg and Norway, both were genital isolates recovered from males in their 20s with unknown route of transmission or probable country of infection. Both isolates exhibited 'high-level azithromycin resistance' (HL-AziR, MIC ≥256 mg/L) and were also resistant to cefixime (MIC=1 and 2 mg/L), ciprofloxacin (MIC=2 and 4 mg/L), and tetracycline (MIC=32 mg/L). One additional ceftriaxone-resistant isolate (MIC=0.25 mg/L) from France was submitted to TESSy in 2024, but was not part of the trimmed dataset. This isolate, which was collected from a genital sample from a heterosexual male, with Cambodia reported as probable country of infection, was also resistant to azithromycin, cefixime, ciprofloxacin and tetracycline.

The MIC distribution for ceftriaxone has been relatively stable since 2020 (Figure 2). However, the proportion of highly susceptible isolates (MIC ≤0.016 mg/L) increased from 2023 and 2024 (94.2% to 97.2%, p <0.001) and conversely the proportion of isolates with an MIC of 0.032 mg/L decreased from 2023 and 2024 (4.9% to 2.1%, p <0.001) (Figure 2).

Figure 2. Distribution of MIC values for ceftriaxone in Euro-GASP, 2015–2024

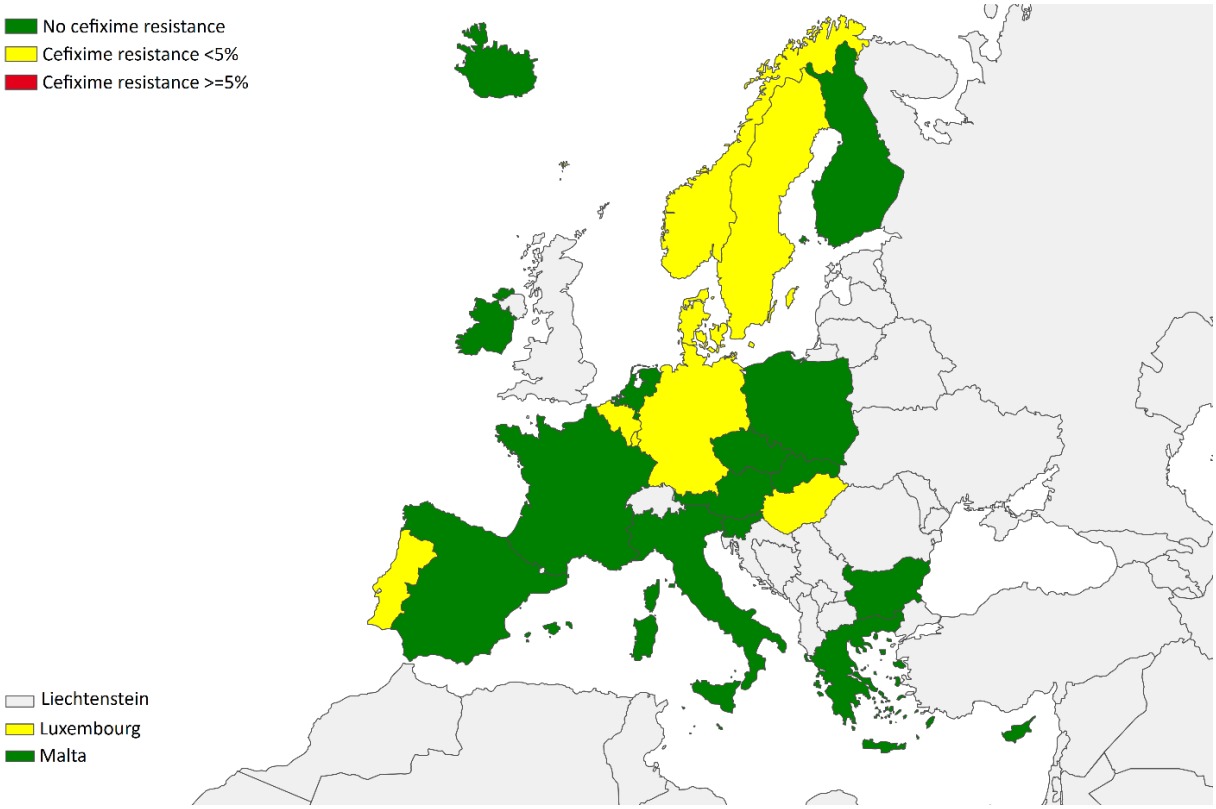


Note:
**4 166 isolates were tested in 2019; 13 isolates were reported with an MIC of ≤0.125 mg/L and were excluded from the MIC distribution analysis as they did not fit into one discrete MIC category.*
~ 3 291 isolates were tested in 2020; one had an MIC ≤0.032 mg/L and was excluded from the MIC distribution analysis as it did not fit into one discrete MIC category.

3.2.2 Cefixime

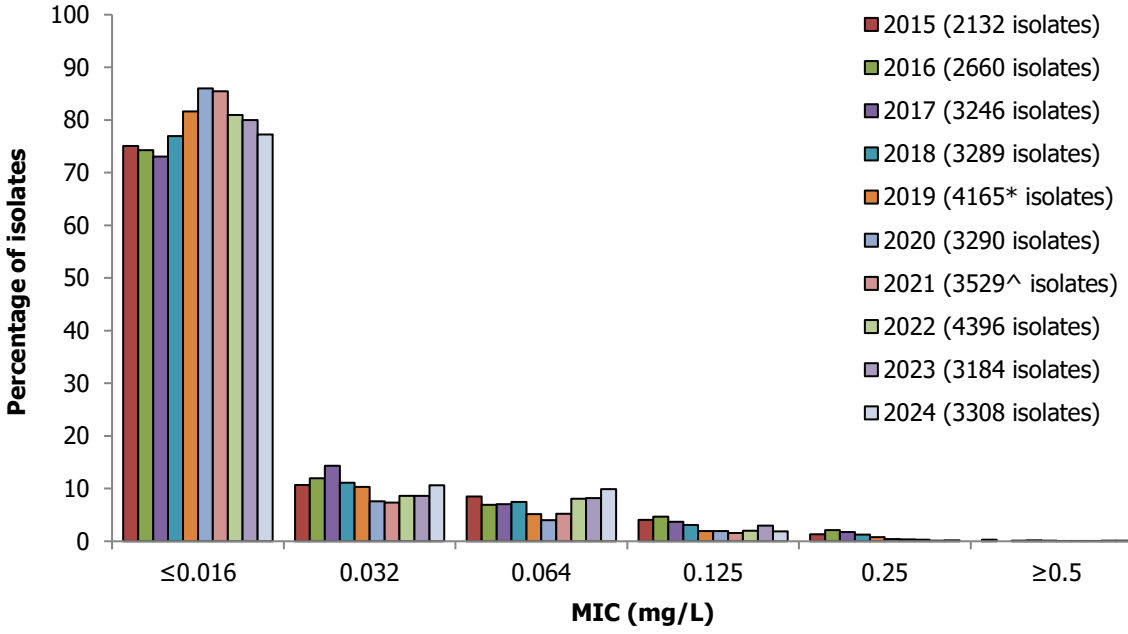
A total of ten isolates (0.3%) from eight countries were resistant to cefixime in 2024, and this level of resistance has been stable since 2020 (Figures 1 and 3, Table 3). Percentages of cefixime-resistant isolates are visualised by country in Figure 3. The cefixime MIC distribution was relatively stable compared to 2023 (Figure 4), apart from minor increases in the proportion of isolates with an MIC of 0.032 mg/L (10.6% from 8.6%, p=0.007) and an MIC of 0.064 mg/L (9.9% from 8.2%, p=0.018), and decreases in the proportion of isolates with an MIC of ≤0.016 mg/L (77.3% from 80.0%, p=0.007) and an MIC of 0.125 mg/L (1.9% from 3.0%, p=0.006).

Figure 3. Proportion of gonococcal isolates with cefixime resistance by country, EU/EEA, 2024*



** Cyprus and Poland reported fewer than 20 isolates each in 2024.*

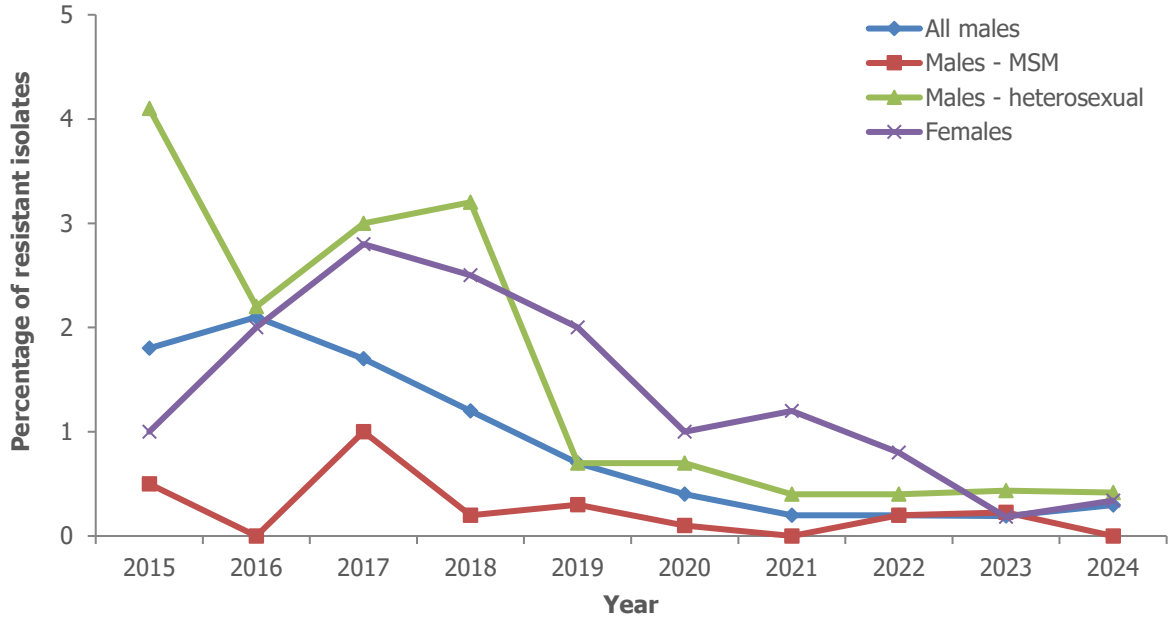
Figure 4. Distribution of MIC values for cefixime in Euro-GASP, 2015–2024



Note:
** 4 166 isolates were tested in 2019; one isolate was reported with an MIC of ≤0.125 MIC and was excluded from the MIC distribution analysis as it did not fit into one discrete MIC category.*
^3 531 isolates were tested in 2021; two isolates had an MIC of ≤0.023 mg/L and were excluded from the MIC distribution analysis as they did not fit into one discrete MIC category.

Cefixime resistance in isolates from male cases was stable in 2024 compared to 2023 (0.3% compared to 0.2%, p=0.435) (Figure 5). Between 2024 and 2023, changes in cefixime resistance in females, MSM and heterosexual males could not be assessed for statistical significance due to the small numbers of cefixime-resistant isolates. As in 2023, no significant associations were identified in the univariate analyses in 2024 (Annex 2).

Figure 5. Percentage of isolates with cefixime resistance by sex and route of transmission among males, Euro-GASP, 2015–2024

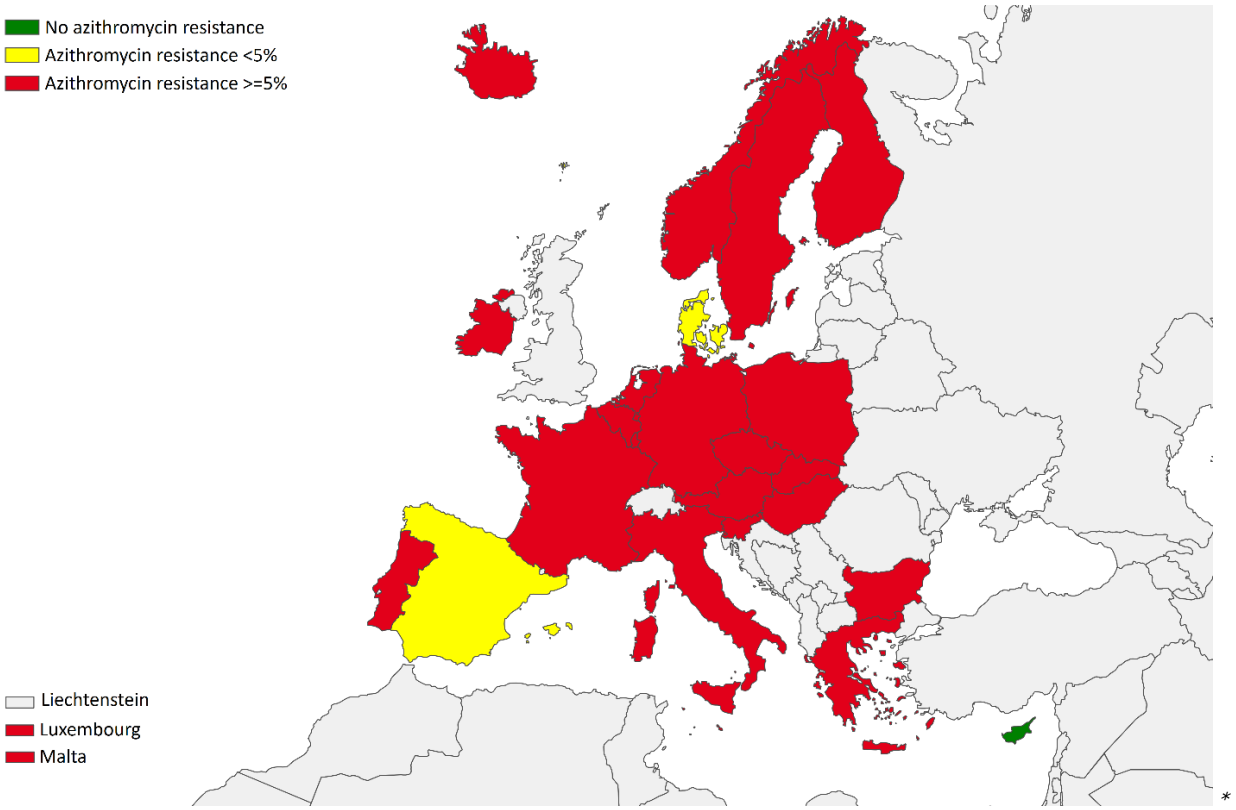


3.2.3 Azithromycin

In 2024, 643 isolates (19.1%) had an azithromycin MIC above the ECOFF (MIC >1 mg/L), which was a decrease compared to 2023 (23.2%, p <0.001) (Figure 1; Table 3). Isolates with an azithromycin MIC above the ECOFF were detected in 23/24 countries in 2024, as visualised in Figure 6.

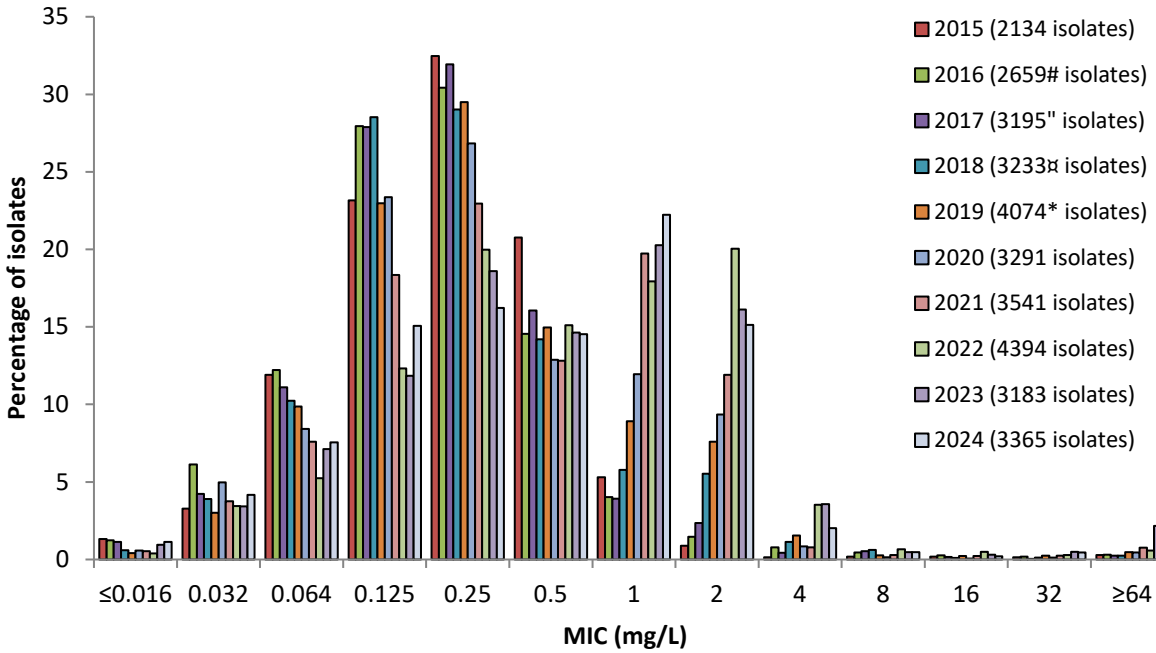
The increase in 'resistance' to azithromycin shown since 2017 and trends in the azithromycin MIC distribution were largely consistent until 2022, when these patterns were disrupted across several MIC categories and a decrease in resistance was seen in 2023 which continued in 2024 (Figure 1; Figure 7). Within the more 'susceptible' isolate population, the proportion of isolates with MICs of ≤0.016 mg/L to 0.125 mg/L all increased in 2024. Similarly, the proportion of isolates with MIC of 0.25 mg/L decreased compared to 2023 (18.6% to 16.2%, p=0.011). As regards the population with an MIC greater than or equal to the ECOFF, the proportion of isolates with an MIC of 1 mg/L increased, while all other higher MIC values showed no change or a decrease. The proportion of isolates with an MIC of 4 mg/L showed a decrease in 2024 compared to 2023 (3.6% in 2023 to 2.0% in 2024, p <0.001). There was also a decrease in the proportion of isolates with an MIC of ≥64 mg/L (2.2% in 2023 to 0.8% in 2024, p <0.001). Eighteen (0.5%) isolates showed HL-AziR (MIC ≥256 mg/L) in 2024, compared to 39 (1.2%) in 2023, 13 (0.3%) in 2022, 19 (0.5%) in 2021, 15 (0.5%) in 2020, and 15 (0.4%) in 2019. In 2024, HL-AziR isolates were reported by 11 countries (compared to 15 countries in 2023), with one to five isolates detected per country. Three (16.7%) and 15 (83.31%) HL-AziR isolates were from female and male cases, respectively. Among the 6/15 (33.3%) HL-AziR isolates with data on sex and route of transmission, one (16.7%) was from a heterosexual male, three (50.0%) from females, and two (33.3%) from MSM. Two HL-AziR isolates were also resistant to ceftriaxone and cefixime.

Figure 6. Proportion of gonococcal isolates with azithromycin MICs above the ECOFF (>1 mg/L) by country, EU/EEA, 2024*



Cyprus and Poland reported fewer than 20 isolates each in 2024.

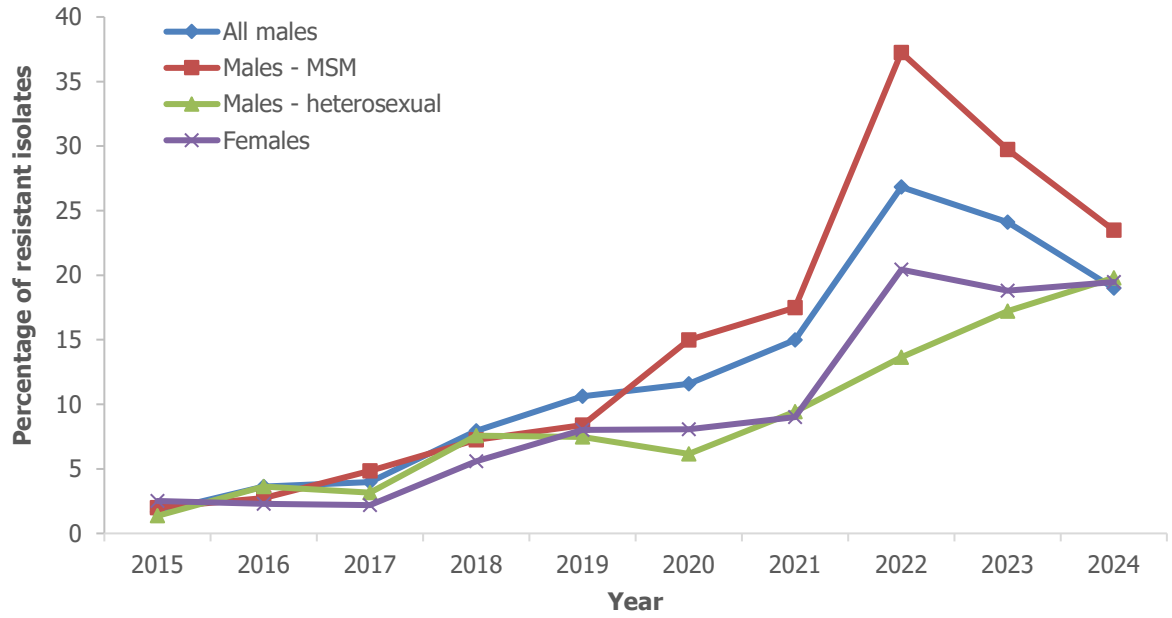
Figure 7. Distribution of MIC values for azithromycin in Euro-GASP, 2015–2024



Note: Isolates that did not fit into a discrete MIC category were excluded from the MIC distribution analysis, as outlined below.
#2 811 isolates were susceptibility tested with azithromycin in 2016; 24 isolates had an MIC≤0.032 mg/L.
"3 250 isolates were susceptibility tested with azithromycin in 2017; 52 isolates had an MIC≤0.06 mg/L.
¤3 301 isolates were susceptibility tested with azithromycin in 2018; 66 isolates had an MIC≤0.06 mg/L.
**4 151 isolates were susceptibility tested with azithromycin in 2019; one isolate had an MIC>32 mg/L, and 77 isolates had an MIC ≤0.06 mg/L.*

In 2024, isolates with an azithromycin MIC above the ECOFF (>1 mg/L) were more common in females (19.5%) than males (19.0%) for the first time since 2015 (Figure 8). Significant decreases in resistance were seen in all males between 2023 and 2024 (24.1% to 19.0%, p <0.001), and in MSM (29.7% to 23.5%, p=0.003) (Figure 8). Univariate analyses showed that azithromycin MICs above the ECOFF were associated with anorectal and pharyngeal site of infection and isolates from cases with no previously reported gonorrhoea (Annex 2). Infection site was not included in the multivariable analyses as clinical sampling practice is not uniform across all countries, leaving 'no previous gonorrhoea' as the only significantly associated case characteristic. Therefore, no multivariable analyses were carried out for azithromycin.

Figure 8. Percentage of isolates with azithromycin MIC above ECOFF (>1 mg/L) by sex and route of transmission among males, Euro-GASP, 2015–2024



3.2.4 Ciprofloxacin

Ciprofloxacin resistance (MIC >0.064 mg/L) steadily increased from 2017 (46.5%) to 2022 (65.9%) before significantly decreasing in 2023 compared to 2022 (63.0% vs. 65.9%, p=0.008) and remained stable in 2024 (63.7%) (Figure 1; Table 3). Univariate analyses indicated that ciprofloxacin resistance was associated with isolates from genital and anorectal site of infection, MSM, male heterosexual cases, and cases 25 years or older (Annex 2). Following multivariable analysis, ciprofloxacin resistance remained associated with cases 25 years and older (OR 1.63, CI 1.32-2.00, p <0.001) compared to cases under 25 years of age.

3.2.5 Tetracycline

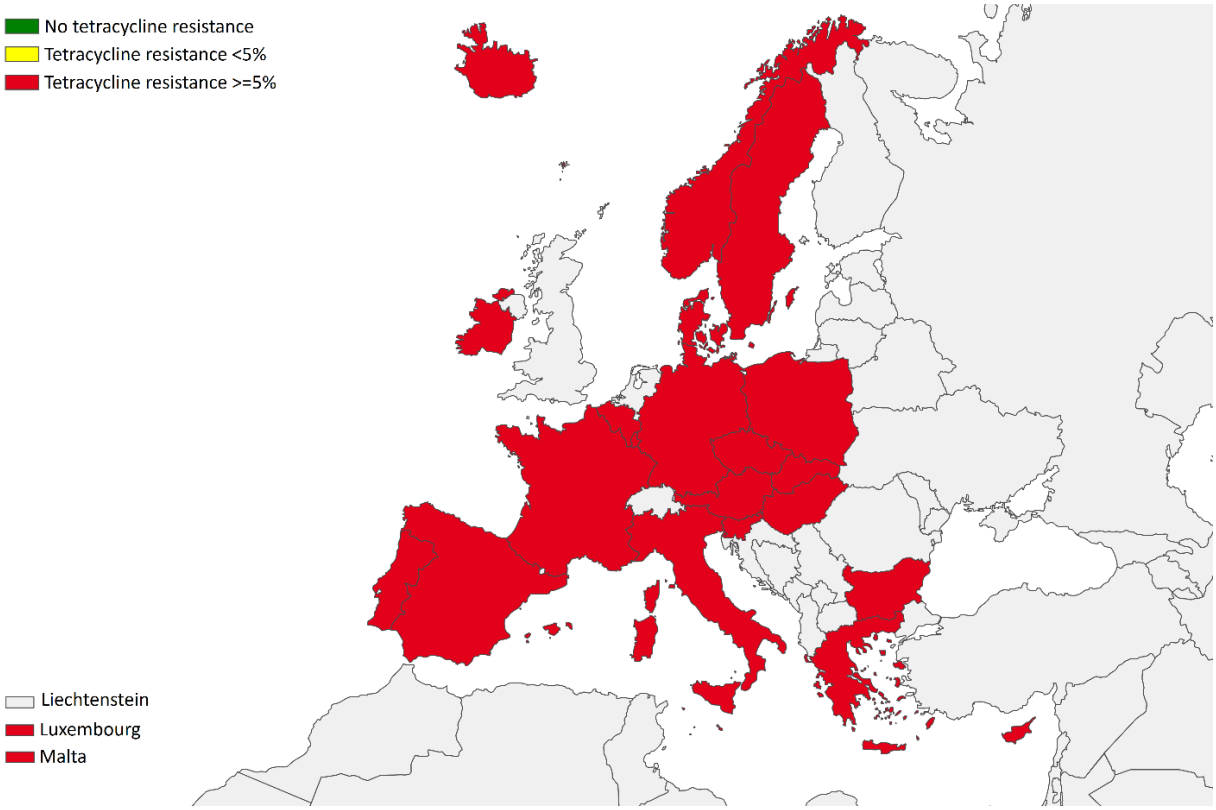
The collection of tetracycline data started in 2023, and no EU/EEA level data are available for earlier years. In 2024, tetracycline susceptibility results were available for 2 966 (88.0%) isolates from 22/24 participating countries in the trimmed dataset. Overall, 63.6% of isolates were resistant to tetracycline (MIC >0.5 mg/L) in 2024 which is an increase compared to 2023 (58.4%, p <0.001) (Table 4). Percentages of tetracycline-resistant isolates are visualised by country in Figure 9.

Table 4. Resistance to tetracycline (using resistance breakpoint from EUCAST) by country, Euro-GASP, 2023–2024*

Country	Number of isolates tested 2023	Tetracycline resistance No.	%	Number of isolates tested 2024	Tetracycline resistance No.	%	Tetracycline resistance trend
Austria	200	131	65.5	200	164	82.0	↗
Belgium	197	155	78.7	184	157	85.3	↗
Bulgaria	23	21	91.3	38	38	100.0	↗
Cyprus	0	N/A	N/A	3	1	33.3	↘
Czechia	87	65	74.7	106	97	91.5	↗
Denmark	200	59	29.5	199	45	22.6	↘
Estonia	4	0	0.0	0	N/A	N/A	-
France	200	183	91.5	200	182	91.0	→
Germany	200	190	95.0	200	188	94.0	→
Greece	100	33	33.0	100	42	42.0	↗
Hungary	196	179	91.3	200	167	83.5	↘
Iceland	44	36	81.8	100	88	88.0	↗
Ireland	200	75	37.5	200	104	52.0	↗
Italy	100	62	62.0	100	32	32.0	↘
Luxembourg	0	N/A	N/A	80	40	50.0	↗
Malta	45	2	4.4	38	19	50.0	↗
Netherlands	199	98	49.2	0	N/A	N/A	-
Norway	200	45	22.5	200	98	49.0	↗
Poland	26	25	96.2	18	18	100.0	↗
Portugal	200	190	95.0	200	195	97.5	↗
Slovakia	100	73	73.0	100	58	58.0	↘
Slovenia	100	28	28.0	100	25	25.0	→
Spain	200	22	11.0	200	33	16.5	↗
Sweden	193	87	45.1	200	96	48.0	↗
Total	**3014**	**1759**	**58.4**	**2966**	**1887**	**63.6**	↗
95% CI			56.6-60.1			61.9-65.3	

** Cyprus and Poland reported fewer than 20 isolates in 2024. Tetracycline data were unavailable for Estonia and the Netherlands in 2024, and not reported by Croatia, Finland, Latvia, Liechtenstein, Lithuania, and Romania in 2023–2024.*

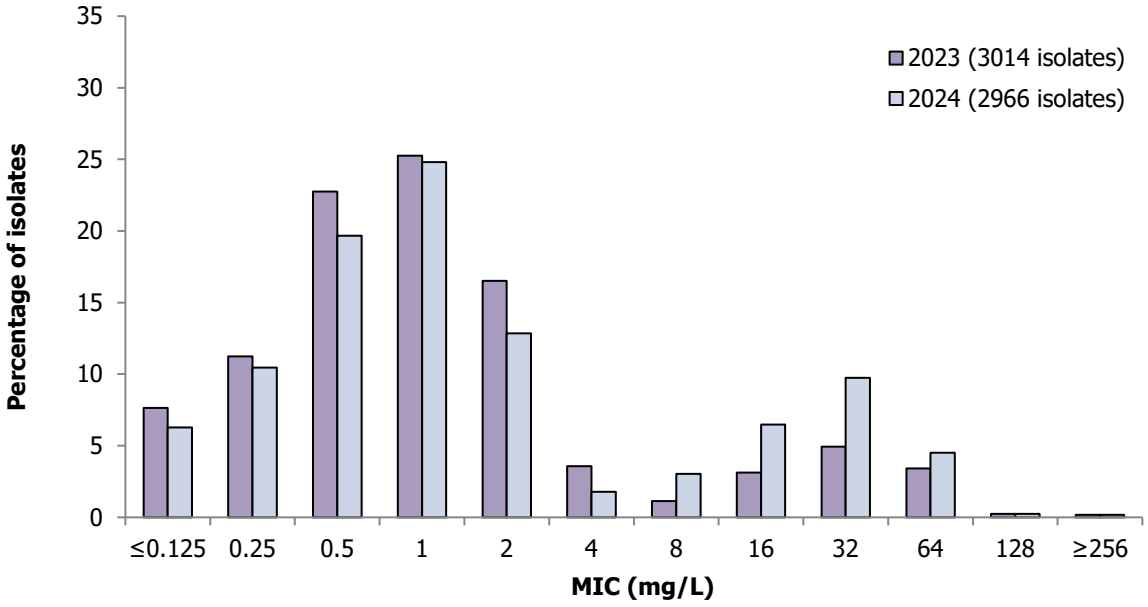
Figure 9. Proportion of gonococcal isolates with tetracycline resistance by country, EU/EEA, 2024*



** Cyprus and Poland reported fewer than 20 isolates in 2024, while tetracycline susceptibility results were not available for isolates from Estonia, Finland or the Netherlands.*

The tetracycline MIC distribution was bimodal, with the largest peak at 1 mg/L (24.8%) and a smaller secondary peak at MIC of 32 mg/L (9.7%) (Figure 10). The majority (42.5%) of isolates exhibited 'low-level' chromosomal tetracycline resistance (MIC of 1-8 mg/L), but 21.1% exhibited 'high-level' plasmid-mediated resistance (MIC >8 mg/L). Isolates with high-level tetracycline resistance were detected in 21/22 countries. A further 19.7% of isolates had MICs just below the tetracycline breakpoint (MIC of 0.5 mg/L). A decrease in 2024 compared to 2023 was seen in the proportion of isolates with an MIC of ≤0.125 mg/L (6.3% from 7.6%, p=0.039), 0.5 mg/L (19.7% from 22.8%, p=0.003), 2 mg/L (12.9% from 16.5%, p <0.001) and 4 mg/L (1.8% from 3.6%, p <0.001). Conversely, an increase in the proportion of isolates with an MIC of 8 mg/L (3.0% from 1.1%, p <0.001), 16 mg/L (6.5% from 3.1%, p <0.001), 32 mg/L (9.7% from 4.9%, p <0.001) and 64 mg/L (4.5% from 3.4%, p=0.029) was seen from 2023 to 2024 (Figure 10).

Figure 10. Distribution of MIC values for tetracycline in Euro-GASP, 2023–2024



In 2024, tetracycline resistance was higher in males than females, particularly among MSM (Table 5). Univariate analyses showed that tetracycline resistance was associated with genital and anorectal sites of infection, MSM, and cases with no previously reported gonorrhoea (Annex 2). Following multivariable analysis, tetracycline resistance remained associated with cases that had not reported previous instances of gonorrhoea (OR 2.06, CI 1.53-2.78, p <0.001). While this finding may suggest widespread circulation of tetracycline-resistant strains in the EU/EEA, it should be interpreted cautiously. Data on previous gonorrhoea diagnosis were incomplete, with only 29.2% (n = 983) of cases reporting a prior infection, potentially indicating under-reporting or unrecognised infections.

Table 5. Tetracycline resistance by sex and route of transmission among males Euro-GASP, 2024

Variable	No. tested†	No. resistant	% resistant
Females	525	275	52.4
Males*	2 417	1 597	66.1
Heterosexual males	425	204	48.0
Men who have sex with men	697	447	64.1

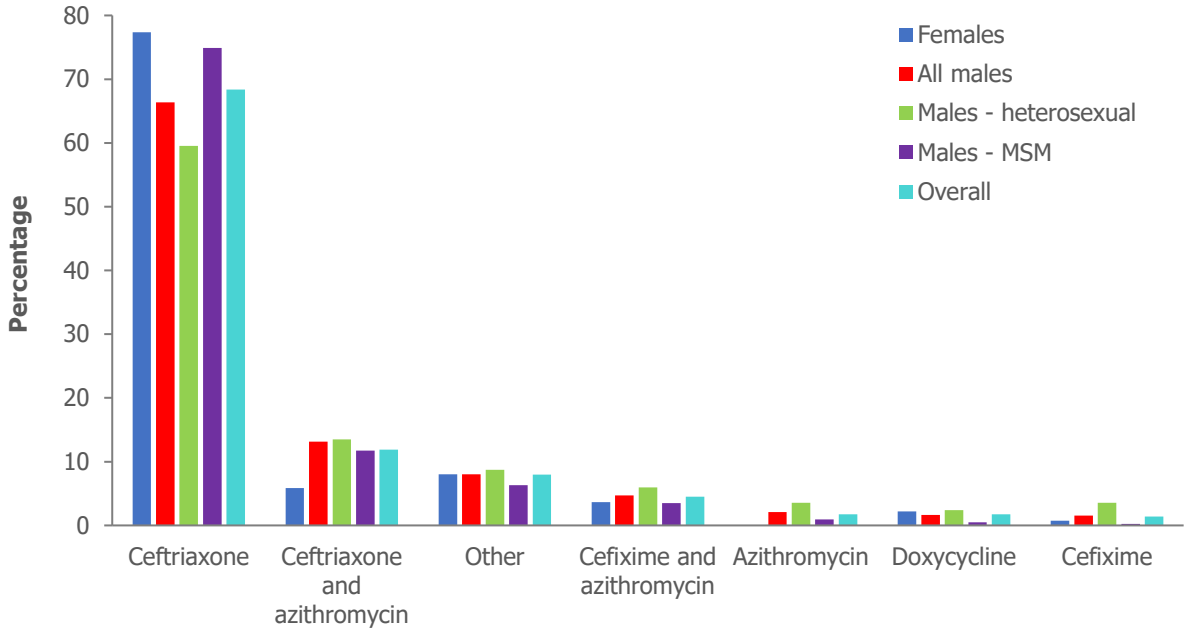
†Where information was available.
**Including all males, irrespective of sexual orientation.*

3.3 Treatments used

Treatment data were reported for 867 (25.7%) cases, all of which had information on sex and 804 (23.9%) had information on route of transmission. These cases were reported by 12 countries and details on completeness of reporting on treatment type are available in Annex 1. Data on concurrent STIs, which might have been treated during the same visit, were not available. Sixteen different combinations of antimicrobial agents and dose regimens were reported in 2024. The most commonly used treatments or combinations of treatments are shown in Figure 11. Each of these treatments were reported in ≥1% of cases and together accounted for 97.6% of analysed cases.

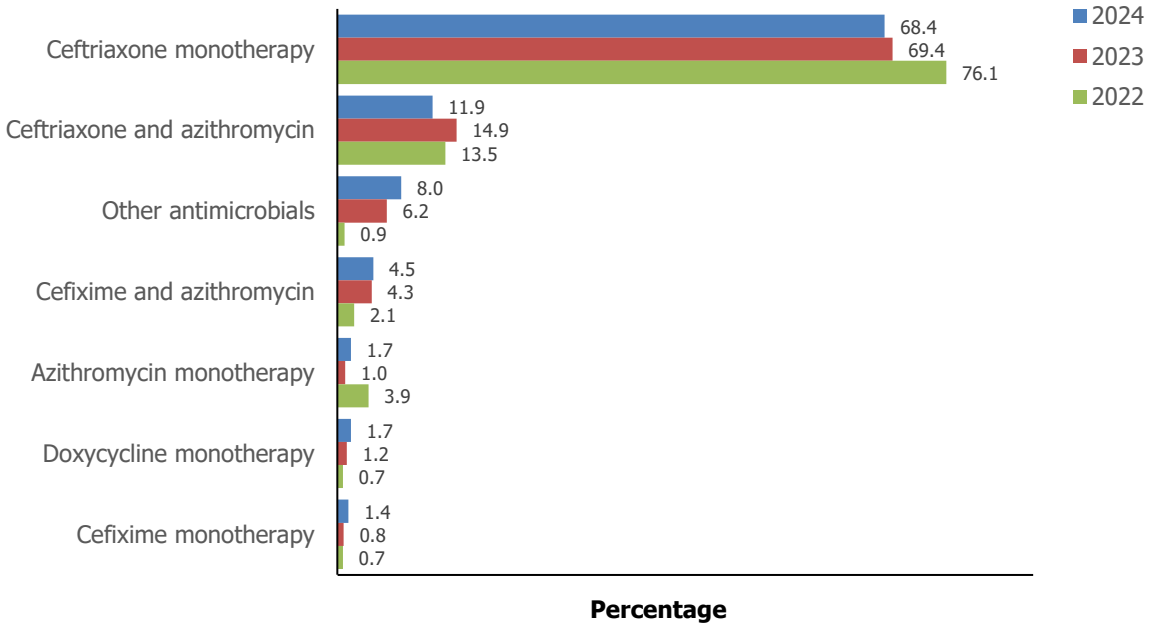
Consistent with previous years, ceftriaxone monotherapy was the most frequently reported treatment (68.4% in 2024), followed by ceftriaxone and azithromycin dual therapy (11.9%), and 'other' antimicrobials (8.0%). The fourth most common treatment in 2024 was cefixime and azithromycin dual therapy (4.5%). Azithromycin and doxycycline monotherapy shared fifth place among the most common treatments in 2024 at 1.7%, and cefixime was the sixth most frequently reported treatment at 1.4% (for comparison with previous years, see Figure 12). As shown in Figure 11, prescribed treatments differed depending on sex and the route of transmission. Females were more commonly prescribed ceftriaxone monotherapy than males (77.4% vs. 66.3%) and conversely males were more commonly prescribed ceftriaxone and azithromycin dual therapy than females (13.2% vs. 5.8%). Only males were prescribed azithromycin monotherapy (2.1% vs. 0%). It was more common for MSM to receive ceftriaxone monotherapy than heterosexual males (74.9% vs. 59.5%), whereas heterosexual males more commonly received monotherapy of azithromycin, doxycycline or cefixime.

Figure 11. Percentage of known treatments used for cases by sex and transmission route among males for the most frequently used therapies, 2024



Note: Sixteen different combinations of antimicrobials were recorded in 2024. The seven most commonly used treatments are shown, comprising all treatments reported in ≥1% of cases overall (differences in concentration of antimicrobials were grouped for analysis).

Figure 12. Percentage of known treatments used, in 2024 compared to 2023 and 2022



4 Conclusions

As in 2023, Euro-GASP antimicrobial susceptibility trends in 2024 remained stable compared to recent years [11-13, 21-24]. Reassuringly, ceftriaxone resistance remained rare. It is, however, of concern that two (0.06%) ceftriaxone-resistant isolates were detected in Luxembourg and Norway, and one additional ceftriaxone isolate from France was submitted to TESSy but was not included in the trimmed Euro-GASP data. All three isolates were resistant to multiple classes of antibiotics and were all extensively drug-resistant (XDR). Similarly, one (0.03%) ceftriaxone-resistant isolate was detected in France in 2023 [25], two (0.05%) in Austria [26] and two in Germany in 2022, with all five resistant to multiple classes of antibiotics. In 2021 and 2020, there was one (0.03%) ceftriaxone resistant isolate from Spain and one from Belgium, compared to three isolates each in 2019 (0.05%) and 2018 (0.06%), and none in 2017 and 2016. Although no ceftriaxone treatment failures were reported to the EpiPulse platform in 2024, five ceftriaxone-resistant isolates were reported by Norway (n=2), Ireland (n=1), and the United Kingdom (n=2).

Low cefixime resistance levels appear to have stabilised within the EU/EEA; 0.3% of isolates were cefixime-resistant in 2024, compared to 0.2% to 0.5% during the period 2020 to 2023, which contrasts with the previously stable higher levels of resistance observed between 2014 and 2017 (range: 1.7% to 2.1%). Cefixime-resistant isolates were reported by 8/24 (33.3%) participating countries in 2024, representing an increase on the previous year (5/24, 20.8%). In recent years, cefixime resistance was higher among females than males, however, in 2024, as in 2023, the proportion was the same in heterosexual males and females (0.3%). No cefixime resistance was observed among MSM.

The continuing low level of cephalosporin resistance is promising, but the detection of ceftriaxone-resistant isolates is worrying because ceftriaxone is the last remaining option for empiric first-line monotherapy. Among cases for whom treatment data were available, 68.4% were prescribed ceftriaxone monotherapy, while 12.9% were given ceftriaxone in combination with azithromycin, doxycycline or ciprofloxacin. Treatment data should be interpreted with caution though, as the reporting completeness for this variable remains low (25.7%) with only 12 countries providing data. Furthermore, information on the dose of ceftriaxone given was limited. It is important that countries follow the European gonorrhoea treatment guidelines which recommend ceftriaxone 1 g [3].

The percentage of isolates with an azithromycin MIC above the ECOFF (>1 mg/L) decreased for the second consecutive year in 2024; however, the overall level of azithromycin resistance remained high at 19.1%, with resistant isolates reported by 23/24 (95.8%) participating countries. In addition to the overall decrease in resistance, there was a decline in the proportion of HL-AziR isolates in 2024 (0.5%) compared with the temporary increase observed in 2023 (1.2%) following previously stable levels of 0.3% to 0.5% during the period 2020 to 2022. HL-AziR isolates were reported by 11 countries in 2024 (compared with 15 countries in 2023), with one to five isolates detected per country. Azithromycin monotherapy is not recommended unless susceptibility is confirmed. In 2024, azithromycin monotherapy was prescribed to 1.7% of cases, which was higher than in 2023 (1.0%) but lower than in 2022 (3.9%). Five of these cases carried azithromycin-resistant isolates (MIC=2 mg/L). Azithromycin monotherapy was prescribed exclusively among males and more frequently among heterosexual males (3.6%) than for MSM (0.9%).

Ciprofloxacin resistance remains high among EU/EEA countries. After increasing steadily from 46.5% in 2017 to 65.9% in 2022, it decreased in 2023 (63.0%), but remained stable in 2024 (63.7%). Ciprofloxacin is not recommended for monotherapy unless susceptibility is confirmed. In 2024, ciprofloxacin monotherapy was prescribed for 0.3% of cases, which is lower than in 2023 (0.8%) and 2022 (0.5%). However, one of these cases carried a ciprofloxacin-resistant isolate.

Tetracycline susceptibility data were collected in Euro-GASP for the second consecutive year in 2024. Tetracycline resistance was at 63.6%, representing an increase from 58.4% in 2023, and comparable to the 63.4% reported for 19 EU/EEA countries in 2022 [27]. In 2024, tetracycline-resistant isolates were reported by all participating countries (22/22, 100%) and were more common in males (66.1%) than in females (52.4%), and particularly among MSM (64.1%). Continuous monitoring of tetracycline resistance remains essential to assess the potential impact of doxy-PEP in the EU/EEA [17-19, 27-29]. However, the high prevalence of gonococcal tetracycline resistance raises concerns regarding the effectiveness of doxy-PEP in reducing gonorrhoea incidence in the region, and, as indicated by ECDC, doxycycline is not recommended for bacterial STI prophylaxis, or for population-level use, but should instead be considered on an individual basis according to clinician-assessed infection risk [29].

Overall epidemiological data completeness in 2024 was 55.8%, remaining stable compared with 2023 (55.7%). Completeness varied widely by variable, ranging from very high for sex (99.3%) to low for treatment information (25.7%). Compared with 2023, significant improvements were observed for previous gonorrhoea diagnosis, country of birth, and probable country of infection, while completeness for site of infection and HIV status declined.

With respect to case characteristics, most isolates were from males (82.1%), with females accounting for 17.9%. The proportion of cases aged ≥25 years increased significantly to 73.8% from 70.4% in 2023. Sex and route of transmission data were available for 59.5% of cases. Among these, the distribution by transmission group remained consistent with 2023, with MSM representing the largest group (46.1%). Genital infection remained the predominant site (76.6%) and increased compared with 2023 (73.6%), while pharyngeal infections declined from 9.3% in 2023 to 6.9% in 2024. The proportion of anorectal and other sites remained stable. Information on previous gonorrhoea diagnosis was available for 29.2% of cases, and among these cases repeat infection increased to 41.3% from 33.3% in 2023.

The continued detection of ceftriaxone resistance and the large proportion of gonococcal isolates with azithromycin MICs above the ECOFF underscore the importance of the European response plan for controlling the threat of multi-drug-resistant (MDR) and XDR *N. gonorrhoeae* in Europe [30], with indicators reviewed in 2020 [31,32] and 2024. Indicator monitoring carried out in 2024 compared progress made by 30 EU/EEA countries between 2019 and 2023. The results suggested that, although some progress has been made at both the EU/EEA and national levels, the ability of the EU/EEA to respond to the threat of MDR/XDR gonorrhoea has weakened overall. The response plan should continue to be implemented and monitored to help identify and report treatment failures and ensure that gonorrhoea remains a treatable infection. Euro-GASP has a major role in fulfilling the objectives of the response plan, which include:

- **Strengthen surveillance of gonococcal antimicrobial susceptibility in EU/EEA countries** by providing sufficient epidemiological information to inform national treatment guidelines and public health interventions. Overall completeness of variables was 55.8% in 2024. Significant improvements in reporting are urgently required for multiple variables if statistical analysis of the linked antimicrobial susceptibility and epidemiological data are to be robust.
- **Ensure that appropriate capacity for culture and antimicrobial susceptibility testing in EU/EEA countries is available or further developed**. Training in STI diagnostics and antimicrobial susceptibility testing is provided and Member State experts (or related staff) are encouraged to participate. A Euro-GASP STI and AMR training course was delivered in December 2024, with participants from 10 EU/EEA countries and four Western Balkan countries. The results of indicator monitoring carried out in 2024 suggested that access to and use of gonococcal culture and AST decreased at the national level between 2019 and 2023, which is an issue that needs to be addressed.
- **Effectively disseminate results from AMR surveillance** in order to increase awareness and inform authorities, professional societies, clinicians and other healthcare workers and persons at risk of the threat of MDR and XDR *N. gonorrhoeae*. In addition to being published in this annual report, Euro-GASP AMR surveillance data are freely accessible online via the ECDC Surveillance Atlas [24], which is updated annually prior to the publication of the annual surveillance data report. Findings are also contextualised within broader EU/EEA STI monitoring efforts, as presented in the recent ECDC report on national responses to STI epidemics in EU/EEA countries, 2024 [33]. Data from the project are frequently published in peer-reviewed journals and presented at international conferences.
- **Introduce strategies to reduce the burden of gonorrhoea**, such as implementation of appropriate gonorrhoea management, prevention, control and AMR policies/guidelines, including enhanced focus on high-risk groups, as well as mandatory reporting of gonorrhoea. The use of recommended therapies to treat gonorrhoea is advocated by the Euro-GASP project. Response plan indicator monitoring carried out in 2024 found that 27/30 (90%) of EU/EEA countries had case management guidelines in place, all of which recommended antimicrobial agents listed in the 2020 European treatment guideline [3]. Encouragingly, the 2024 Euro-GASP data also showed that there was continued use of ceftriaxone, with or without azithromycin, in 80.3% of treatments initiated (68.4% ceftriaxone alone; 11.9% plus azithromycin). Nevertheless, it is a major concern that some cases continue to be inappropriately treated (e.g. with azithromycin, doxycycline or ciprofloxacin monotherapy), in particular in those cases with resistant strains.

The representation of EU/EEA countries in Euro-GASP 2024 was good; however, six countries did not participate (Croatia, Estonia, Latvia, Liechtenstein, Lithuania and Romania), and two countries submitted fewer than 20 isolates each (Cyprus and Poland). Efforts to encourage countries to participate in Euro-GASP are ongoing, as is work to improve the reporting of epidemiological variables. The lack of reporting, particularly certain epidemiological variables, limits the precision and validity of estimates when population group sample sizes are small, affecting a subset of analyses presented in this report.

Euro-GASP detected stabilising or decreasing trends in susceptibility to cefixime, azithromycin, and ciprofloxacin in 2024. It is, however, of concern that resistance levels to azithromycin, ciprofloxacin, and tetracycline remain high overall and that ceftriaxone-resistant isolates continue to be detected. Ceftriaxone treatment failures are documented [34], together with sustained transmission of 'high-level azithromycin-resistant' (MIC ≥256 mg/L) strains [35]. International spread of gonococcal strains with resistance to ceftriaxone and/or azithromycin has also been detected [5,25,26,34-42]. In this context, continuous implementation of quality-assured antimicrobial surveillance activities and monitoring of the response plan, is essential. Finally, novel therapy regimens urgently need to be developed to ensure gonorrhoea remains a treatable infection. Moreover, it is promising that two novel antimicrobials zoliflodacin (Nuzolvence) [43,44] and gepotidacin (Blujepa) [45] have recently passed phase 3 clinical trials for the treatment of uncomplicated urogenital gonorrhoea.

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Annex 1. Percentage completeness of epidemiological variables

Table A1. Completeness of epidemiological variable reporting, 2024

Country	Number of isolates	Sex	Age	Route of transmission	Site of infection	Treatment	Previous gonorrhoea	Country of birth	Probable country of infection	HIV status	Overall response rate
Austria	200	100	99	0	95	0	24.5	0	0	7.5	**36.2**
Belgium	188	99.5	99.5	39.9	98.4	13.3	46.3	46.3	23.9	36.7	**56**
Bulgaria	38	100	100	84.2	97.4	84.2	84.2	97.4	73.7	84.2	**89.5**
Cyprus	4	100	100	0	100	0	0	0	0	25	**36.1**
Czechia	106	100	100	81.1	84	84	81.1	84	82.1	83	**86.6**
Denmark	199	100	100	79.4	0	68.3	100	99	79.4	20.6	**71.9**
Finland	200	100	100	74.5	0	0	0	94.5	73	0	**49.1**
France	200	99	99	38	100	43	44.5	32.5	43.5	83	**64.7**
Germany	200	99	100	22.5	91.5	23.5	22.5	14	20.5	7	**44.5**
Greece	100	99	93	79	83	86	70	84	79	6	**75.4**
Hungary	200	100	100	22.5	100	0	0	93	0	0	**46.2**
Iceland	100	100	100	53	79	0	0	95	0	0	**47.4**
Ireland	200	100	100	64.5	100	4	28	26	6.5	29.5	**50.9**
Italy	100	100	98	83	86	70	89	92	51	80	**83.2**
Luxembourg	80	81.2	81.2	0	85	0	0	0	0	0	**27.5**
Malta	38	97.4	100	100	100	78.9	100	100	100	100	**97.4**
Netherlands	200	100	100	96	100	100	0	99.5	0	94	**76.6**
Norway	200	100	100	0	99	0	0	0	0	0	**33.2**
Poland	18	100	100	94.4	100	0	11.1	100	100	83.3	**76.5**
Portugal	200	100	100	15.5	100	0	1	11.5	0	2	**36.7**
Slovakia	100	100	100	60	100	58	96	96	59	76	**82.8**
Slovenia	100	100	99	23	100	0	42	0	0	73	**48.6**
Spain	200	100	100	87.5	100	0	0.5	0	100	0	**54.2**
Sweden	200	100	100	96.5	99.5	0	0	0	97.5	0	**54.8**
Average completeness	**3 371**	**99.3**	**99.1**	**51.6**	**84.8**	**25.7**	**29.2**	**46.7**	**36.9**	**28.6**	**55.8**

Cell shading: green, 100%; red, 0%; light red, below average; white, above average but <100%.

Annex 2. Statistical tables

Table A2. Univariate association of cefixime resistance/susceptibility and case characteristics, Euro-GASP, 2024

	Cefixime resistance N (%, 95% CI)	P value
Site of infection (n=2 794)		
Genital (2 166)	5 (0.2, 0.1-0.5)	0.176*
Anorectal (391)	0 (0.0, 0.0-0.1)	
Pharyngeal (189)	2 (1.1, 0.3-3.8)	
Other (48)	0 (0.0, 0.0-7.4)	
Sexual orientation and sex (n=1 949)		
MSM (883)	0 (0.0, 0.0-0.4)	0.116*
Male heterosexual (479)	2 (0.4, 0.1-1.5)	
Female (587)	2 (0.3, 0.1-1.2)	
Previous gonorrhoea (n=982)		
Yes (406)	1 (0.2, 0.0-1.4)	1.000*
No (576)	1 (0.2, 0.0-0.1)	
HIV status (n=908)		
Positive (100)	0 (0.0, 0.0-3.7)	1.000*
Negative (808)	2 (0.2, 0.1-0.9)	
Age (n=3 278)		
<25 years (848)	5 (0.6, 0.3-1.4)	0.138*
≥25 years (2 430)	5 (0.2, 0.1-0.5)	

** Expected value for at least one cell < 5, so Fisher's Exact test performed.*

Table A3. Univariate association of azithromycin MICs above/below ECOFF (>1 mg/L) and case characteristics, Euro-GASP, 2024

	Azithromycin resistance N (%, 95% CI)	Odds ratio	95% CI	P value
Site of infection (n=2 851)				
Genital (2 183)	392 (18.0, 16.4-19.6)	Reference		
Anorectal (422)	105 (24.9, 21.0-29.2)	1.51	1.18-1.94	**<0.001**
Pharyngeal (198)	61 (30.8, 24.8-37.6)	2.03	1.47-2.81	**<0.001**
Other (48)	7 (14.6, 7.2-27.2)	0.78	0.35-1.75	0.546
Sexual orientation and sex (n=2 005)				
MSM (924)	217 (23.5, 20.9-26.3)	1.27	0.99-1.64	0.064
Male heterosexual (485)	96 (19.8, 16.5-23.6)	1.02	0.76-1.38	0.892
Female (596)	116 (19.5, 16.5-22.8)	Reference		
Previous gonorrhoea (n=982)				
Yes (405)	62 (15.3, 12.1-19.1)	Reference		
No (577)	125 (21.7, 18.5-25.2)	1.53	1.09-2.14	**0.013**
HIV status (n=962)				
Positive (106)	19 (17.9, 11.8-26.3)	Reference		
Negative (856)	185 (21.6, 19.0-24.5)	1.26	0.75-2.13	0.381
Age (n=3 335)				
<25 years (873)	177 (20.3, 17.7-23.1)	1.10	0.91-1.34	0.330
≥25 years (2 462)	462 (18.8,17.3-20.4)	Reference		

Table A4. Univariate association of ciprofloxacin resistance/susceptibility and case characteristics, Euro-GASP, 2024

	Ciprofloxacin resistance N (%, 95% CI)	Odds ratio	95% CI	P value
Site of infection (n=2 856)				
Genital (2 188)	1 371 (62.7, 60.6-64.7)	1.34	1.00-1.80	**0.049**
Anorectal (422)	273 (64.7,60.0-69.1)	1.47	1.04-2.07	**0.029**
Pharyngeal (198)	110 (55.6, 48.6-62.3)	Reference		
Other (48)	33 (68.8, 54.7-80.1)	1.76	0.89-3-46	0.097
Sexual orientation and sex (n=2 005)				
MSM (924)	586 (63.4, 60.3-66.5)	1.25	1.01-1.55	**0.036**
Male heterosexual (485)	313 (64.5, 60.2-68.7)	1.31	1.03-1.68	**0.030**
Female (596)	346 (58.1, 54.1-62.0)	Reference		
Previous gonorrhoea (n=983)				
Yes (406)	255 (62.8, 58.0-67.4)	Reference		
No (577)	374 (64.8, 60.8-68.6)	1.09	0.84-1.42	0.518
HIV status (n=964)				
Positive (107)	74 (69.2, 59.9-77.1)	1.32	0.85-2.03	0.213
Negative (857)	540 (63.0, 59.7-66.2)	Reference		
Age (n=3 340)				
<25 years (873)	479 (54.9, 51.6-58.1)	Reference		
≥25 years (2 467)	1 651 (66.9, 65.0-68.8)	1.66	1.42-1.95	**<0.001**

Table A5. Univariate association of tetracycline resistance/susceptibility and case characteristics, Euro-GASP, 2024

	Tetracycline resistance N (%, 95% CI)	Odds ratio	95% CI	P value
Site of infection (n=2 652)				
Genital (2 115)	1 434 (67.8, 65.8-69.8)	2.18	1.59-3.00	**<0.001**
Anorectal (322)	216 (67.1, 61.8-72.0)	2.11	1.43-3.12	**<0.001**
Pharyngeal (167)	82 (49.1, 41.6-56.6)	Reference		
Other (48)	31 (64.6, 50.4-76.6)	1.89	0.97-3.70	0.059
Sexual orientation and sex (n=1 647)				
MSM (697)	447 (64.1, 60.5-67.6)	1.94	1.51-2.48	**<0.001**
Male heterosexual (425)	204 (48.0, 43.3-52.7)	Reference		
Female (525)	275 (52.4, 48.1-56.6)	1.19	0.92-1.54	0.180
Previous gonorrhoea (n=982)				
Yes (406)	201 (49.5, 44.7-54.4)	Reference		
No (576)	388 (67.4, 63.4-71.1)	2.10	1.61-2.75	**<0.001**
HIV status (n=774)				
Positive (89)	63 (70.8, 60.6-79.2)	1.17	0.72-1.90	0.526
Negative (685)	462 (67.4, 63.8-70.8)	Reference		
Age (n=2 936)				
<25 years (765)	478 (62.5, 59.0-65.8)	Reference		
≥25 years (2 171)	1 395 (64.2, 62.2-66.2)	1.08	0.91-1.28	0.381

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of the European Union