



UK Health  
Security  
Agency

# **Antimicrobial resistance in *Neisseria gonorrhoeae* in England and Wales**

Key findings from the Gonococcal  
Resistance to Antimicrobials Surveillance  
Programme (GRASP 2020)

Data to June 2021

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## Foreword

The Gonococcal Resistance to Antimicrobials Surveillance Programme (GRASP) is run by the UK Health Security Agency (UKHSA), formerly known as Public Health England (PHE). The UKHSA is an executive agency sponsored by the Department of Health and Social Care and became fully operational on 1 October 2021.

## Key points

Between 2019 and 2020 *Neisseria gonorrhoeae* isolates collected through GRASP showed:

- a decrease in reduced susceptibility (minimum inhibitory concentration (MIC) >0.03 mg/L) to ceftriaxone, the current first-line therapy, from 2.9% in 2019 to 1.4% in 2020
- the modal ceftriaxone MIC remained stable at 0.008 mg/L in 2020
- the modal MIC for isolates from gay, bisexual, and other men who have sex with men (MSM) remained higher (0.015 mg/L) than those from both women and heterosexual men (0.008 mg/L)
- no cases of ceftriaxone resistance (MIC >0.125 mg/L) were confirmed by the UKHSA Antimicrobial Resistance in STIs (AMRSTI) national reference laboratory on direct referral in 2020 – however only 18.2% of isolates with suspected ceftriaxone resistance were referred to UKHSA

Between 2019 and 2020, testing of gonococcal isolates collected through the GRASP sentinel surveillance system also showed:

- azithromycin resistance remained stable with a marginal reduction from 9.3% to 8.7%
- cefixime resistance remained stable with a marginal reduction from 0.8% to 0.6%
- ciprofloxacin resistance increased from 42.7% to 44.3%
- penicillin resistance decreased from 17.9% to 9.6%
- tetracycline resistance increased from 62.9% to 65.1%

The stabilisation of azithromycin (MIC >0.5 mg/L) and cefixime (MIC >0.125 mg/L) resistance and the substantial decline in the proportion of isolates resistant to penicillin (MIC >1 mg/L) in 2020 represents a change in the trend in antimicrobial resistance observed from 2016 to 2019. As in previous years, no spectinomycin resistance (MIC >64 mg/L) was detected in 2020 and the modal gentamicin MIC remained low (4 mg/L).

Prescribing data demonstrated excellent adherence to the UK guideline for managing infection with *N. gonorrhoeae*, with 97.6% of individuals receiving the recommended first-line of ceftriaxone 1g intramuscular (IM) monotherapy in 2020.

The effectiveness of first-line treatment for gonorrhoea continues to be threatened by the development of antimicrobial resistance. However, the ongoing decline in reduced ceftriaxone susceptibility, together with decreasing penicillin resistance and stable rates of azithromycin and cefixime resistance are encouraging developments.

## Recommendations

All primary diagnostic laboratories should test gonococcal isolates for susceptibility to ceftriaxone and refer suspected resistant isolates (MIC >0.125 mg/L) to the UKHSA AMRSTI national reference laboratory for confirmatory testing and follow-up. Sexual health practitioners should ensure that all individuals diagnosed with gonorrhoea are treated and managed according to [national guidelines](#), including the need to perform a test of cure, and should be alert to changes in recommended first-line therapies. Possible cases of treatment failure should be reported to the UKHSA via the [HIV and STI Data Exchange](#).

Consistent and correct use of condoms can significantly reduce the risk of sexually transmitted infections (STIs). Regular testing for HIV and STIs is also essential for good sexual health among the sexually active population. Similarly, open access to rapid treatment and partner notification at sexual health services is vital to reducing the risk of complications and further transmission.

In March 2020, the UK government took steps to reduce transmission of SARS-CoV-2 through introducing social distancing measures. This led to the reconfiguration of sexual and reproductive health service delivery (1). In response to the coronavirus (COVID-19) pandemic, the Association of Directors of Public Health published recommendations on the prioritisation of sexual and reproductive health services (2). The British Association for Sexual Health and HIV (BASHH) also released guidance on sex, social distancing and COVID-19, encouraging asymptomatic individuals to use online STI testing platforms and order a self-sampling kit, where possible (3). Further advice regarding accessing sexual and reproductive health care during the COVID-19 pandemic can be found at [Sexwise](#).

The prioritisation of STI testing and treatment should continue to follow national guidance and take account of the local context. While a resurgence in sexual health service provision was observed from June to September 2020 following the easing of national lockdown restrictions,

the number of consultations, vaccinations, tests, and diagnoses reported by sexual health services was considerably lower in the summer of 2020 compared to corresponding months in 2019 (4). The impact of the COVID-19 response on routine service provision must therefore continue to be considered.

Anyone having condomless sex with new or casual partners should have an STI screen annually, including an HIV test (1). In addition:

- women under 25 years who are sexually active should be screened for chlamydia on change of sexual partner or annually and
- gay, bisexual, and other men who have sex with men should test for HIV and STIs annually or every 3 months if having condomless sex with new or casual partners

## Introduction

Gonorrhoea, caused by the bacterium *Neisseria gonorrhoeae*, is the second-most commonly diagnosed STI in England. If untreated, gonorrhoea can lead to complications, such as chronic pelvic pain, pelvic inflammatory disease, ectopic pregnancy and infertility in women.

Gonorrhoea diagnoses in England have risen sharply between 2015 and 2019, increasing by 72.2% (41,180 to 70,922), and by 25.6% between 2018 and 2019 (56,472 to 70,922) (1). However, a reduction of 19.5% was seen between 2019 and 2020 (70,922 to 57,084); this coincided with a 25% decrease in sexual health screens over the same period caused by the disruption in service provision during the COVID-19 pandemic. Nevertheless, gonorrhoea continues to be concentrated among specific population groups; MSM and people of Black Caribbean ethnicity experience disproportionately high rates of gonorrhoea diagnoses (1).

Ceftriaxone is an extended-spectrum cephalosporin (ESC) that is currently recommended in the UK as the first-line therapy for gonorrhoea (1g intramuscular (IM) monotherapy) (5). Where antimicrobial susceptibility is known prior to treatment, ciprofloxacin, a fluoroquinolone, is recommended as an alternative first-line therapy (500 mg orally as a single dose). These antibiotics were newly recommended as first-line treatments in January 2019 in the UK by BASHH in an effort to delay the emergence of antimicrobial resistance (AMR). The updated guidance represented a major change from the 2011 guidelines, which advised using dual therapy with ceftriaxone 500 mg IM and azithromycin 1g orally as first-line treatment. ESCs are among few remaining antimicrobials which can be effectively used as first-line monotherapy for gonorrhoea.

Ongoing monitoring of AMR, comprising the culture of isolates, test-of-cure and the maintenance of comprehensive and enhanced surveillance is vital for the detection of emerging trends and to ensure that first-line treatments for gonorrhoea remain effective. Ineffective treatment facilitates onward transmission and the development of sequelae.

This report presents trends in gonococcal susceptibility to therapeutically relevant antimicrobials and explores the recent epidemiology of *N. gonorrhoeae* AMR in England and Wales. The Gonococcal Resistance to Antimicrobial Surveillance Programme (GRASP) includes a suite of surveillance systems to detect and monitor AMR in *N. gonorrhoeae* and to record potential treatment failures; these include the GRASP sentinel surveillance system, analysis of real-time laboratory data and reports of suspected treatment failure.

## The GRASP sentinel surveillance system

GRASP sentinel surveillance data are obtained annually from a network of 27 sexual health clinics (SHCs) across England and Wales and their 21 associated laboratories. Owing to exceptional circumstances in 2020, 25 SHCs (23 in England, 2 in Wales) and 19 laboratories participated in the programme. The geographical distribution of the 25 participating SHCs is shown in [Figure 1](#).

Participating laboratories are requested to collect *N. gonorrhoeae* isolates over a two-month period (usually in July and August). All collected *N. gonorrhoeae* isolates are sent to the UKHSA AMRSTI national reference laboratory for antimicrobial susceptibility testing. Antimicrobial susceptibility data are linked securely to pseudonymised GUMCAD STI surveillance system data to obtain demographic and clinical patient data. The GUMCAD STI surveillance system is a disaggregated, patient-level dataset of all STI tests and diagnoses at sexual health services in England ([6](#)). In addition, enhanced demographic, clinical and behavioural data are submitted by participating SHCs to supplement GUMCAD data. Two sample test of proportion are used to define antimicrobial susceptibility trends over time and all analyses are performed with Stata V.15.1 (StataCorp LP, College Station, Texas, USA).

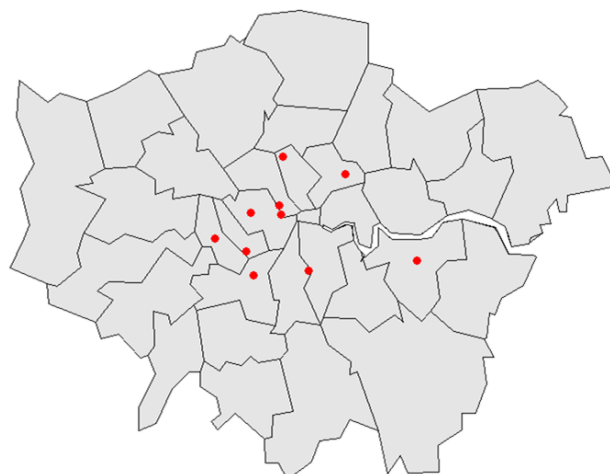
Full details on the datasets and methodology used for the GRASP sentinel surveillance system can be accessed online ([7](#)).

**Figure 1. Map showing 25 sentinel sexual health clinics participating in GRASP 2020 across a. England and Wales and b. London (shown at larger scale)**

a. England and Wales



b. London



## Real-time laboratory data

Data from the GRASP sentinel surveillance system are supplemented year-round by real-time laboratory data, reported through the Second-Generation Surveillance System (SGSS) and by the UKHSA AMRSTI national reference laboratory ([Appendix 1](#)).

### SGSS

SGSS is an application that stores and manages laboratory data and notifications, capturing routine surveillance data on infectious diseases and antimicrobial resistance. Positive test results and antimicrobial resistance data are submitted on a voluntary basis from 147 laboratories who receive specimens from a range of healthcare providers, including SHCs, general practitioners (GPs) and hospitals across England, Wales and Northern Ireland ([8](#)). Within GRASP, SGSS data are used to monitor real-time trends in *N. gonorrhoeae* diagnoses and antimicrobial resistance in England.

### AMRSTI national reference laboratory

Laboratories are asked to refer *N. gonorrhoeae* isolates with suspected ceftriaxone resistance (MIC >0.125 mg/L) to the UKHSA AMRSTI national reference laboratory for antimicrobial susceptibility testing and confirmation. The UKHSA AMRSTI national reference laboratory primarily acts as a reference and diagnostic service for laboratories in England, but also receives samples from Wales and Northern Ireland.

### Treatment failures

Information on suspected treatment failures is reported to UKHSA via the [HIV and STI Data Exchange](#).

## Sentinel surveillance sample

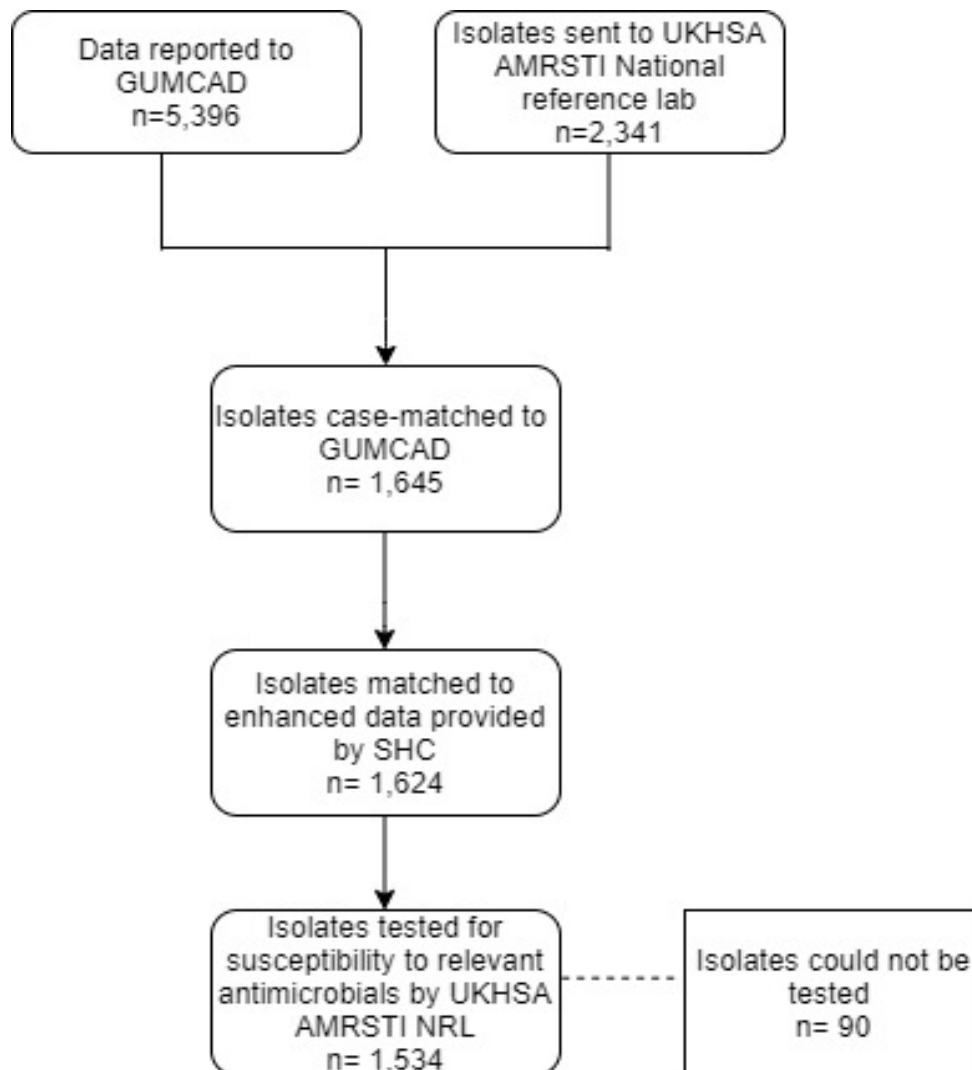
### Sentinel surveillance sampling frame

The sentinel surveillance collection usually takes place in July and August every year. However due to the COVID-19 pandemic, the collection took place from August to October 2020. From 1 August to 31 October 2020, 5,396 diagnoses were reported to GUMCAD by the 23 SHCs in England participating in GRASP, as shown in [Figure 2](#). Over the same period, 2,341 *N. gonorrhoeae* isolates were sent to the UKHSA AMRSTI national reference laboratory for antimicrobial susceptibility testing from these clinics, a 15.1% decrease relative to the previous GRASP collection, which ran from 1 July to 31 August 2019. Isolates were included in analyses



if they, a) could be case-matched to a GRASP participating SHC within the GUMCAD STI surveillance system (n=1,645), b) could be matched to enhanced data provided by these SHCs (n=1,624), and c) had been successfully tested for susceptibility to 8 therapeutically relevant antimicrobials by the UKHSA AMRSTI national reference laboratory (n=1,534). In 2020, 65.5% (1,534 out of 2,341) of isolates submitted to the UKHSA AMRSTI national reference laboratory were included in the GRASP analysis compared to 61.7% in 2019 (1,701 out of 2,756). Where more than one isolate was collected from an individual, the following hierarchy was applied for testing: 1) male rectal, 2) male urethral, 3) female cervical and, 4) any other site. Among the 1,534 tested and case-matched isolates, the anatomical site of specimen collection was therefore mainly urethral (47.0%), followed by rectal (27.1%), cervical (14.1%) and pharyngeal (7.7%) (7).

**Figure 2. Sentinel surveillance sampling frame flowchart in GRASP 2020**



## Sentinel surveillance sample

Among 1,534 individuals with a *N. gonorrhoeae* isolate included in the sentinel surveillance sample, 1,181 (77.0%) were male, of whom 66.5% (785 out of 1,181) were MSM ([Table 1](#)). Most individuals were White (56.0%), and the modal age group was 25 to 34 years (40.7%), with age ranging from 15 to 75 years old across all those in the sample. Just under half (48.2%) were resident in London.

Among all individuals, 12.3% were living with HIV, and 94.7% (178 out of 188) of these were MSM. Almost a fifth (19.0%) had previously been diagnosed with gonorrhoea and 20.3% were concurrently diagnosed with chlamydia. Individuals commonly reported having sex with one or no sexual partners in the 3 months prior to their gonorrhoea diagnosis, with 2.2% of all individuals reporting having had a sexual partner abroad (outside the UK) in the same time interval. However, the number of sexual partner information was not reported for 33.2% of individuals.

Under half (44.1%) of individuals were reported to have received a test-of-cure, compared to 57.9% in 2019.

Compared to all individuals diagnosed with gonorrhoea nationally over the same period, women were under-represented in sentinel system data relative to GUMCAD (18.1% vs 24.8%;  $p < 0.001$ ), while heterosexual men (25.8% vs 19.4%;  $p < 0.001$ ) were over-represented ([9](#)). There was no difference in the proportion of MSM included in the sentinel system data relative to GUMCAD (51.2 vs 49.8;  $p = 0.28$ ). Individuals included in the GRASP sentinel surveillance data were more likely to be of Black ethnicity (14.2% vs 11.9%;  $p < 0.01$ ) compared to the population attending SHCs nationally.

**Table 1. Characteristics of individuals in the GRASP sentinel surveillance system, by gender and sexual orientation, 2020†**

	MSM	Het. Men	Women	Not reported	Total
Number of individuals	785	396	278	75	1,534
	n (% of N)	n (% of N)	n (% of N)	n (% of N)	n (% of N)
<b>Age group (years)</b>					
15 to 19	12 (1.5%)	38 (9.6%)	53 (19.1%)	9 (12.0%)	112 (7.3%)
20 to 24	113 (14.4%)	112 (28.3%)	100 (36.0%)	15 (20.0%)	340 (22.2%)
25 to 34	344 (43.8%)	154 (38.9%)	99 (35.6%)	27 (36.0%)	624 (40.7%)

	<b>MSM</b>	<b>Het. Men</b>	<b>Women</b>	<b>Not reported</b>	<b>Total</b>
35 to 44	204 (26.0%)	56 (14.1%)	21 (7.6%)	17 (22.7%)	298 (19.4%)
≥45	112 (14.3%)	36 (9.1%)	4 (1.4%)	7 (9.3%)	159 (10.4%)
Not reported	0 (0.0%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	1 (0.1%)
<b>Ethnicity</b>					
White	547 (69.7%)	130 (32.8%)	152 (55.4%)	28 (37.3%)	859 (56.0%)
Black Caribbean	36 (4.6%)	59 (14.9%)	17 (6.1%)	3 (4.0%)	115 (7.5%)
Black African	17 (2.2%)	39 (9.8%)	10 (3.6%)	3 (4.0%)	69 (4.5%)
Black Other	15 (1.9%)	13 (3.3%)	6 (2.2%)	0 (0.0%)	34 (2.2%)
Asian (incl. Chinese)	50 (6.4%)	19 (4.8%)	4 (1.4%)	7 (9.3%)	80 (5.2%)
Other Ethnic Group	32 (4.1%)	11 (2.8%)	5 (1.8%)	3 (4.0%)	51 (3.3%)
Mixed Ethnic Group	40 (5.1%)	32 (8.1%)	31 (11.2%)	4 (5.3%)	107 (7.0%)
Not Known	48 (6.1%)	93 (23.5%)	51 (18.3%)	27 (36.0%)	219 (14.3%)
<b>Residence</b>					
Outside London	266 (33.9%)	286 (72.2%)	213 (76.6%)	13 (17.3%)	778 (50.7%)
London	508 (64.7%)	109 (27.5%)	61 (21.9%)	61 (81.3%)	739 (48.2%)
Not reported	11 (1.4%)	1 (0.3%)	4 (1.4%)	1 (1.3%)	17 (1.1%)
<b>HIV status</b>					
Negative	604 (76.9%)	359 (90.7%)	241 (86.7%)	66 (88.0%)	1,270 (82.8%)
Positive	178 (22.7%)	4 (1.0%)	4 (1.4%)	2 (2.7%)	188 (12.3%)
Not reported	3 (0.4%)	33 (8.3%)	33 (11.9%)	7 (9.3%)	76 (5.0%)
<b>Site of infection (a)</b>					
Genital	342 (43.6%)	369 (93.2%)	259 (93.2%)	48 (64.0%)	1,018 (66.4%)
Rectal	529 (67.4%)	12 (3.0%)	32 (11.5%)	32 (42.7%)	605 (39.4%)
Throat	367 (46.8%)	22 (5.6%)	78 (28.1%)	18 (24.0%)	485 (31.6%)
Other site	20 (2.5%)	32 (8.1%)	0 (0.0%)	0 (0.0%)	52 (3.4%)
Multiple sites	378 (48.2%)	39 (9.8%)	77 (27.7%)	21 (28.0%)	515 (33.6%)
<b>Symptoms</b>					
No	265 (33.8%)	31 (7.8%)	74 (26.6%)	20 (26.7%)	390 (25.4%)
Yes	410 (52.2%)	350 (88.4%)	164 (59.0%)	45 (60.0%)	969 (63.2%)
Not reported	110 (14.0%)	15 (3.8%)	40 (14.4%)	10 (13.3%)	175 (11.4%)
<b>Any concurrent STI (b)</b>					
Chlamydia	158 (20.1%)	72 (18.2%)	65 (23.4%)	17 (22.7%)	312 (20.3%)

	MSM	Het. Men	Women	Not reported	Total
Syphilis	23 (2.9%)	3 (0.8%)	2 (0.7%)	1 (1.3%)	29 (1.9%)
Herpes	13 (1.7%)	1 (0.3%)	1 (0.4%)	0 (0.0%)	15 (1.0%)
Warts	2 (0.3%)	0 (0.0%)	1 (0.4%)	1 (1.3%)	4 (0.3%)
LGV	11 (1.4%)	0 (0.0%)	0 (0.0%)	1 (1.3%)	12 (0.8%)
Hepatitis C	1 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.1%)
New HIV	1 (0.1%)	1 (0.3%)	0 (0.0%)	1 (1.3%)	3 (0.2%)
<b>Previously diagnosed with gonorrhoea</b>					
No	572 (72.9%)	257 (64.9%)	227 (81.7%)	67 (89.3%)	1,123 (73.2%)
Yes	182 (23.2%)	67 (16.9%)	34 (12.2%)	8 (10.7%)	291 (19.0%)
Not reported	31 (3.9%)	72 (18.2%)	17 (6.1%)	0 (0.0%)	120 (7.8%)
<b>Total sexual partners (past 3 months)</b>					
0 to 1	143 (18.2%)	176 (44.4%)	160 (57.6%)	16 (21.3%)	495 (32.3%)
2 to 5	212 (27.0%)	154 (38.9%)	70 (25.2%)	26 (34.7%)	462 (30.1%)
6 to 10	26 (3.3%)	12 (3.0%)	3 (1.1%)	5 (6.7%)	46 (3.0%)
11 or more	16 (2.0%)	2 (0.5%)	2 (0.7%)	1 (1.3%)	21 (1.4%)
Not reported	388 (49.4%)	52 (13.1%)	43 (15.5%)	27 (36.0%)	510 (33.2%)
<b>Sex abroad (past 3 months)</b>					
No	381 (48.5%)	330 (83.3%)	232 (83.5%)	48 (64.0%)	991 (64.6%)
Yes	16 (2.0%)	14 (3.5%)	3 (1.1%)	0 (0.0%)	33 (2.2%)
Not reported	388 (49.4%)	52 (13.1%)	43 (15.5%)	27 (36.0%)	510 (33.2%)
<b>Test of cure</b>					
No	248 (31.6%)	142 (35.9%)	63 (22.7%)	6 (8.0%)	459 (29.9%)
Yes	337 (42.9%)	157 (39.6%)	157 (56.5%)	25 (33.3%)	676 (44.1%)
Not reported	200 (25.5%)	97 (24.5%)	58 (20.9%)	44 (58.7%)	399 (26.0%)

† 'Not reported' refers to instances where information was unknown or not stated.

Notes: (a) Numerator: individuals in GRASP 2020 dataset infected at site specified (by gender and sexual orientation).

Denominator: all individuals in GRASP 2020 dataset (by gender and sexual orientation). Not all individuals are tested for gonorrhoea at each site. Data reported are for individuals infected with at least the specified site, not exclusively this site.

(b) Numerator: individuals in GRASP 2020 dataset with any diagnosed concurrent STI (by gender and sexual orientation).

Denominator: all individuals in GRASP 2020 dataset (by gender and sexual orientation). Not all individuals are tested for each STI.

## Antimicrobial resistance

*N. gonorrhoeae* has developed resistance to all classes of antimicrobials recommended to treat the infection. [Table 2](#) outlines the antimicrobial resistance definitions used in GRASP. Antimicrobial susceptibility results were interpreted using the European Committee on Antimicrobial Susceptibility Testing (EUCAST) breakpoints ([10](#)). [Figure 3](#) and [Table 3](#) show trends in the percentage of gonococcal isolates collected through the GRASP sentinel surveillance system with resistance to selected antimicrobials from 2000 to 2020 and 2016 to 2020, respectively.

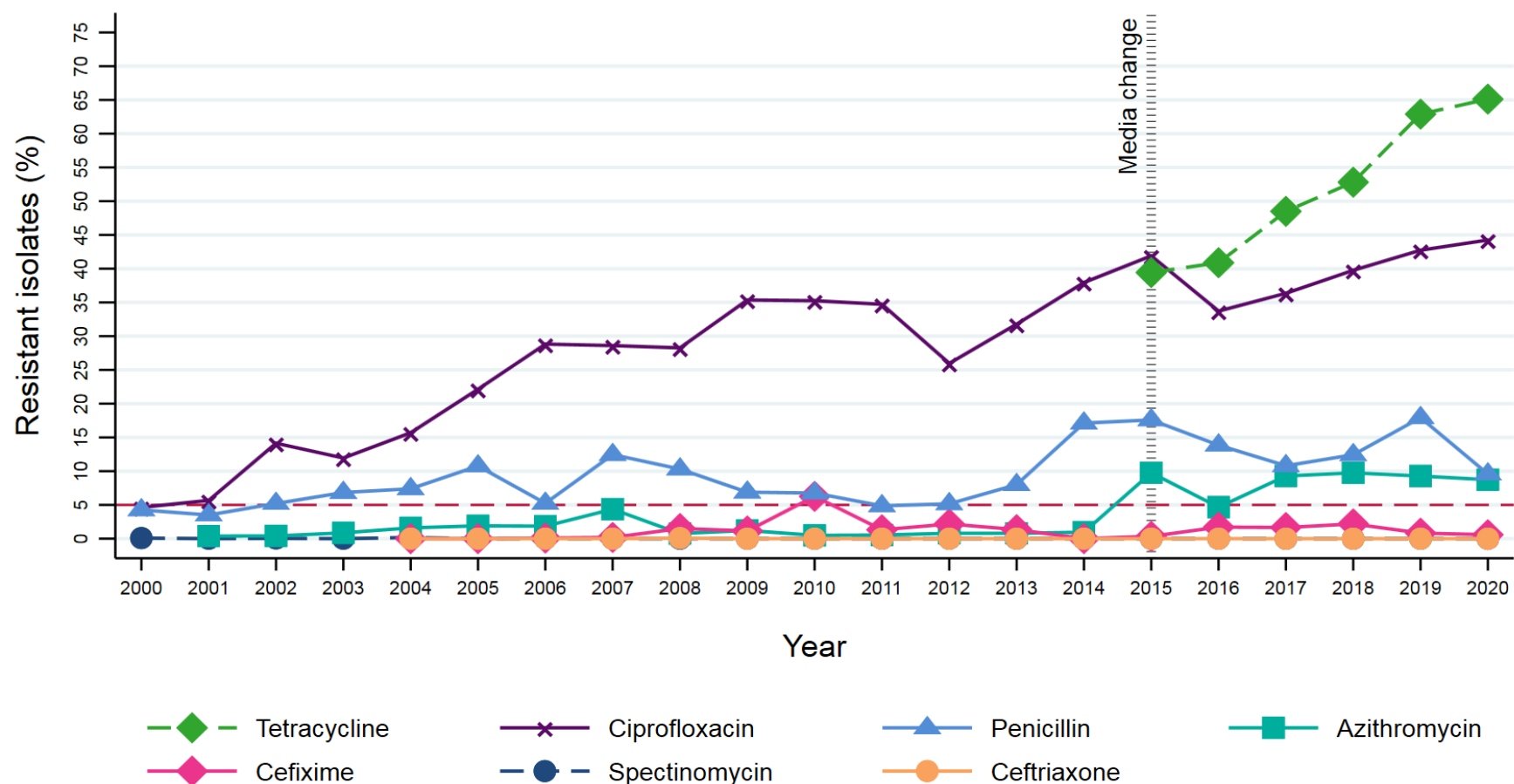
**Table 2. Antimicrobial resistance definitions**

Antimicrobial	Minimum inhibitory concentration breakpoint for resistance (mg/L)
Ceftriaxone	>0.125
Azithromycin (a)	>0.5
High-level azithromycin (b)	≥256.0
Cefixime	>0.125
Ciprofloxacin	>0.06
Penicillin	>1.0 and/or β-lactamase positive
Tetracycline	>1.0
Spectinomycin	>64.0
Gentamicin	N/A

Notes: (a) Until 2018, EUCAST had set a breakpoint of MIC 0.5 mg/L for *N. gonorrhoeae* azithromycin resistance. This has since been replaced with an 'epidemiological cut-off' of 1.0 mg/L ([10](#)). For continuity with previous GRASP reports, the previous breakpoint of 0.5 mg/L is retained as a historic reference point here.

(b) High-level azithromycin resistance is not defined by EUCAST, but the definition of ≥256 mg/L is internationally recognised.

**Figure 3. Percentage of *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system that were resistant to selected antimicrobials, England and Wales, 2000 to 2020†**



† Due to changes in the diagnostic sensitivity medium used to test antimicrobial susceptibility of sentinel surveillance isolates, MICs for the 2015 to 2020 collections are not directly comparable with those from previous years. Trends from 2000 to 2014 compared to 2015 to 2020 must be interpreted with caution (point of change indicated by vertical dashed black line), particularly for azithromycin and tetracycline (data for tetracycline are only included from 2015 onwards due to this issue) (11). The 5% threshold ( $\geq 5\%$  of infections resistant to the first-line therapy) at which the WHO recommends that first-line monotherapy guidelines should be changed is indicated by the horizontal dashed red line.

**Table 3. Percentage of *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system that were resistant to selected antimicrobials, England and Wales, 2016 to 2020**

Antimicrobial MIC (a) resistance breakpoint (mg/L)		Number of resistant isolates (%) (b)				
		2016	2017	2018	2019	2020
		N=1,284	N=1,268	N=1,456	N=1,701	N=1,534
Ceftriaxone (>0.125)		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Azithromycin (c)	(>0.5)	60 (4.7)	117 (9.3)	142 (9.8)	158 (9.3)	134 (8.7)
	(>1.0)	25 (1.9)	60 (4.7)	101 (6.9)	52 (3.1)	64 (4.2)
Cefixime (>0.125)		22 (1.7)	21 (1.7)	32 (2.2)	14 (0.8)	9 (0.6)
Ciprofloxacin (>0.06)		433 (33.7)	461 (36.4)	579 (39.8)	727 (42.7)	679 (44.3)
Penicillin (>1.0)		178 (13.9)	137 (10.8)	181 (12.4)	305 (17.9)	147 (9.6)
Tetracycline (>1.0)		525 (40.9)	615 (48.5)	769 (52.8)	1,070 (62.9)	999 (65.1)
Spectinomycin (>64.0)		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Notes: (a) Minimum inhibitory concentration (MIC).

(b) The number of isolates included in the sample may differ from previous reports as, in this report, only data for isolates matched to GRASP clinics are presented.

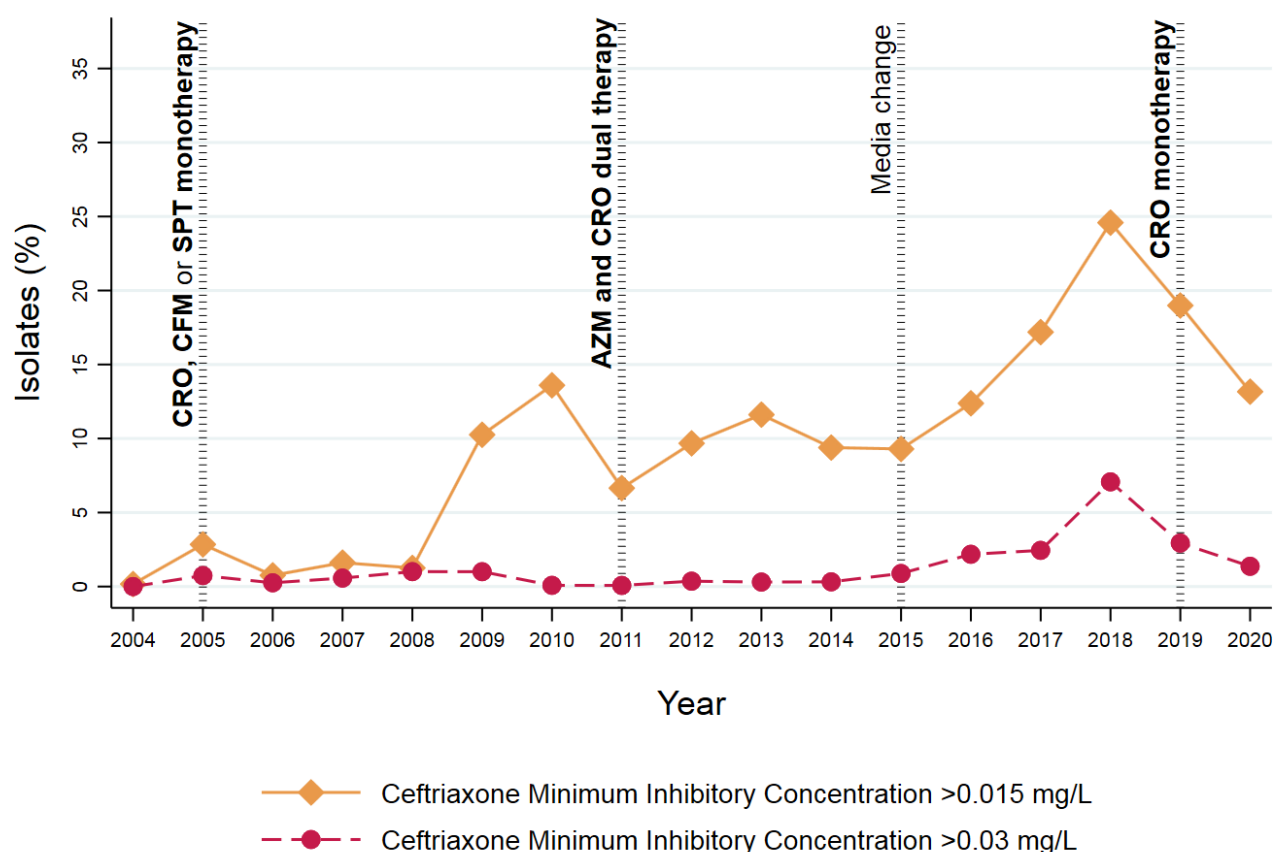
(c) Until 2018, EUCAST had a resistance breakpoint of 0.5 mg/L for azithromycin vs. *N. gonorrhoeae* (10). This has since been suspended and replaced with an 'epidemiological cut-off' of 1.0 mg/L. For continuity with previous GRASP reports, the previous breakpoint of >0.5 mg/L is retained as a historic reference point here.

## Ceftriaxone

### Sentinel surveillance system sample

Among 1,534 isolates included in the sentinel surveillance sample in 2020, none were resistant to ceftriaxone (MIC >0.125 mg/L) ([Table 3](#)). The proportion of isolates with reduced susceptibility (defined here as an MIC >0.03 mg/L) to ceftriaxone decreased from 2.9% in 2019 to 1.4% in 2020 ( $p < 0.01$ ), following successive increases from 0.3% in 2013 to 7.1% in 2018 ( $p < 0.001$ ) ([Figure 4](#)). A similar trend was observed when using a comparative measure of reduced susceptibility to ceftriaxone (MIC >0.015 mg/L), decreasing from 19.0% in 2019 to 13.2% in 2020 ( $p < 0.001$ ).

**Figure 4. Percentage of *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system with reduced susceptibility to ceftriaxone, England and Wales, 2000 to 2020†**

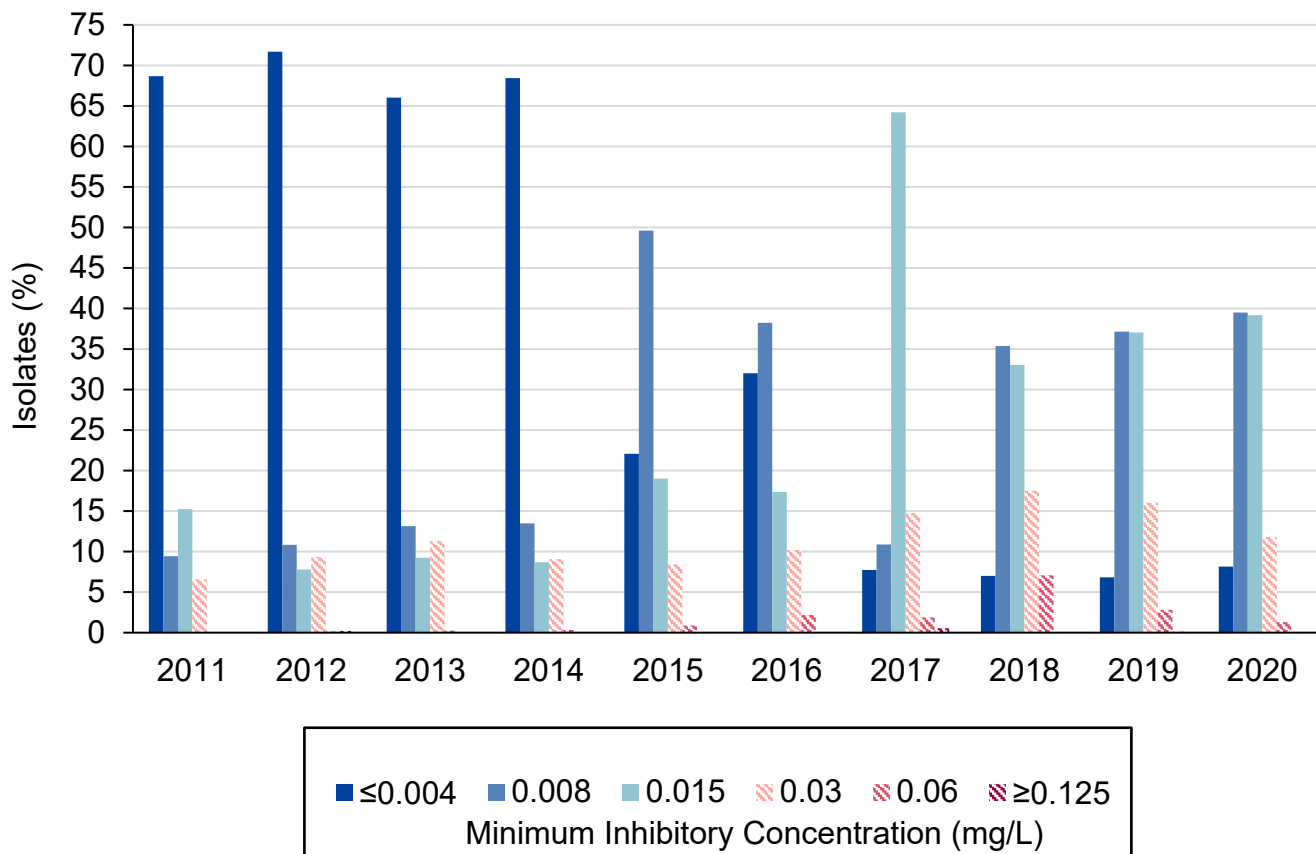


† Due to changes in the diagnostic sensitivity medium used to test antimicrobial susceptibility of sentinel surveillance isolates, MICs for the 2015 to 2020 collections are not directly comparable with those from previous years. Trends from 2004 to 2014 compared to 2015 to 2020 must be interpreted with caution (point of change indicated by vertical dashed black line) ([11](#)). Changes to the UK national guidance for the management of infection with *N. gonorrhoeae* are indicated by vertical dashed black lines with bold text. CRO: ceftriaxone; CFM: cefixime; SPT: spectinomycin; AZM: azithromycin.



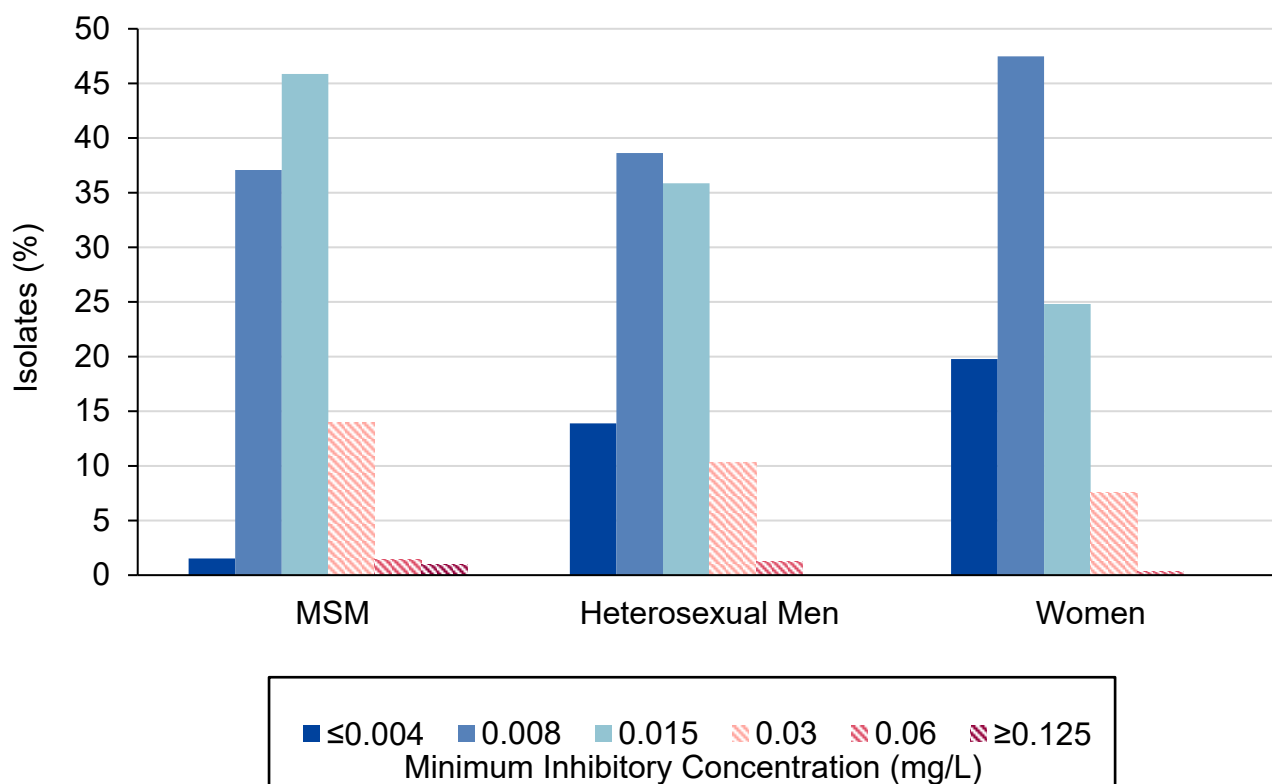
The modal ceftriaxone MIC remained stable at 0.008 mg/L from 2018 to 2020 (Figure 5). As was observed in previous years, the modal MIC was higher for isolates from MSM (0.015 mg/L) than those from heterosexual men (0.008 mg/L) and women (0.008 mg/L) (Figure 6).

**Figure 5. Distribution of ceftriaxone MICs (mg/L) for *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system, England and Wales, 2011 to 2020†**



† Due to changes in the diagnostic sensitivity medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2020 collection are not directly comparable with those from previous years. Trends from 2010 to 2014 compared to 2015 to 2020 must be interpreted with caution (11).

**Figure 6. Distribution of ceftriaxone MICs (mg/L) for *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system, by gender and sexual orientation, England and Wales, 2020**



## Real-time laboratory data

From January to June 2021, 6,883 *N. gonorrhoeae* isolates were reported to SGSS by laboratories across England, a 30.1% and 55.8% reduction relative to the same period in 2020 and 2019, respectively. The decline in the number of isolates reported may be due to the major disruption to SHC and associated laboratories' service provision caused by the COVID-19 pandemic response or a result of a genuine decline in gonorrhoea transmission (1).

The proportion of *N. gonorrhoeae* isolates that were tested for susceptibility to ceftriaxone (or cefuroxime as a proxy, see [Appendix 1](#)) in laboratories across England, as reported via SGSS, remained stable, at 99.4% in both 2020 and the first half of 2021 (data from January to June 2021; p=0.99) ([Table 4](#)).

The percentage of isolates that were reported as resistant to ceftriaxone remained stable from 0.23% in 2020 to 0.16% in 2021 (p=0.28). However, from January to June 2021, only 18.2% of isolates reported as resistant to ceftriaxone by laboratories across England were referred to the UKHSA AMRSTI national reference laboratory for confirmation, despite the recommendation in the national management guidelines that all isolates with suspected ceftriaxone resistance be referred for confirmation (5).

No isolates tested for ceftriaxone susceptibility in 2020 by the UKHSA AMRSTI national reference laboratory were confirmed as resistant (MIC >0.125 mg/L). Similarly, no treatment failures for managing infection with *N. gonorrhoeae* were reported in 2020 or in the first half of 2021.

**Table 4. Ceftriaxone susceptibility testing and referral of *N. gonorrhoeae* isolates: data from primary diagnostic laboratories reported via SGSS and the UKHSA AMRSTI national reference laboratory, January 2017 to June 2021**

	2017	2018	2019	2020	2021 (a)
Reported to SGSS (Percentage tested for ceftriaxone susceptibility)	21,076 (97.8%)	24,896 (99.1%)	32,387 (99.5%)	18,308 (99.4%)	6,883 (99.4%)
Reported as ceftriaxone resistant in SGSS (Percentage of all reported)	50 (0.24%)	58 (0.24%)	57 (0.18%)	42 (0.23%)	11 (0.16%)
Reported as ceftriaxone resistant in SGSS and referred (Percentage of all reported as resistant)	16 (32.0%)	16 (27.6%)	14 (24.6%)	7 (16.7%)	2 (18.2%)
Confirmed as resistant by the national reference laboratory	1*	3	3	0	0

Notes: (a) Data to June 2021.

\* Individual presented to SHS in December 2016, but failed treatment in 2017.

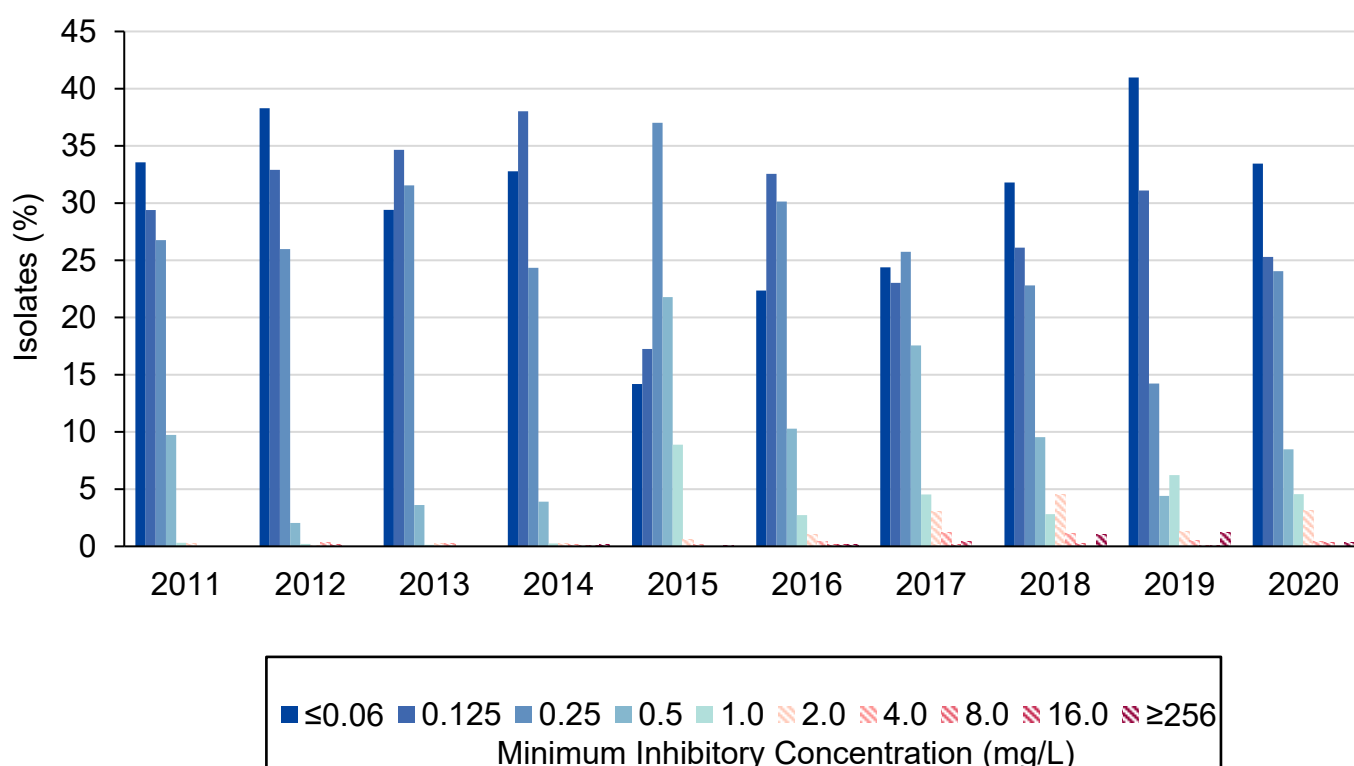
## Azithromycin

### Sentinel surveillance system sample

Resistance breakpoints for azithromycin were removed by EUCAST in 2019 and replaced with an epidemiological cut-off of 1.0 mg/L (Table 2) (10). For continuity with previous GRASP reports, the previous breakpoint of 0.5 mg/L is also retained as a historic reference point.

Between 2019 and 2020, the proportion of isolates included in the sentinel surveillance sample with azithromycin MICs >0.5 mg/L remained stable from 9.3% to 8.7% (p=0.55) (Table 3). Similarly, the proportion with azithromycin MICs >1.0 mg/L remained stable from 3.1% in 2019 to 4.2% in 2020 (p=0.09).

**Figure 7. Distribution of azithromycin MICs (mg/L) for *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system, England and Wales, 2011 to 2020†**

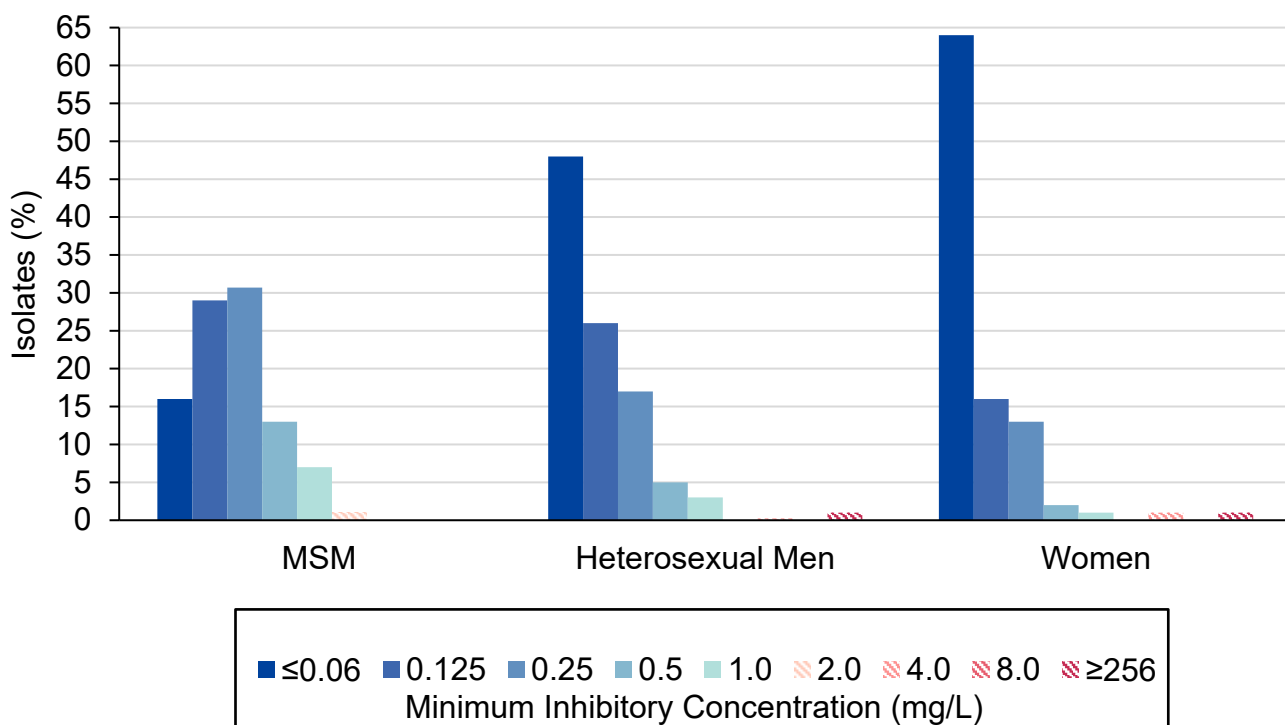


† Due to changes in the diagnostic sensitivity medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2020 collection are not directly comparable with those from previous years. Trends from 2010 to 2014 compared to 2015 to 2020 must be interpreted with caution, particularly for azithromycin (11).

The modal azithromycin MIC remained stable at ≤0.06 mg/L in 2020, the lowest dilution tested for azithromycin susceptibility, for the third successive year (Figure 7). The proportion of isolates

with azithromycin MICs  $\geq 256$  mg/L, an internationally recognised measure of high-level resistance, decreased from 1.0% in 2019 (17 isolates) to 0.3% in 2020 (5 isolates) ( $p=0.01$ ), following consecutive annual increases from 2015 (0.1%; 2 isolates).

**Figure 8. Distribution of azithromycin MICs (mg/L) for *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system, by gender and sexual orientation, England and Wales, 2020**



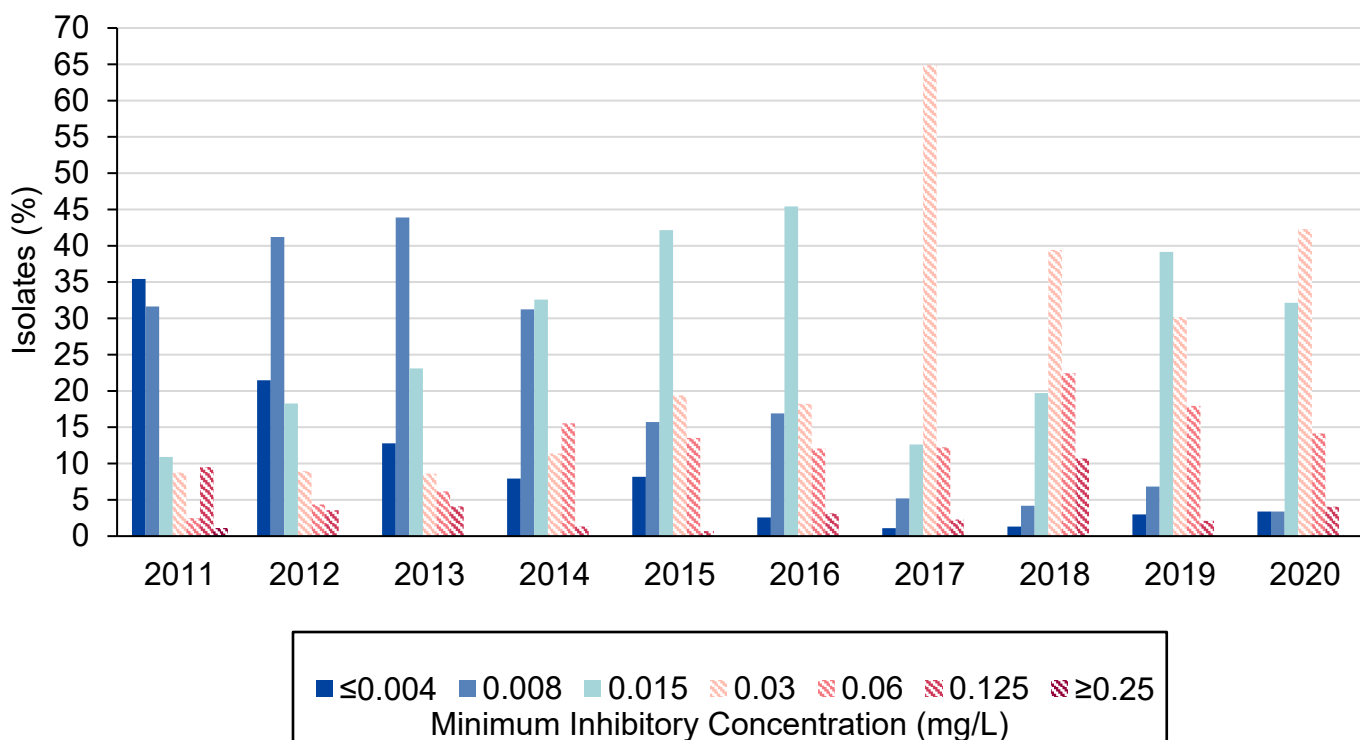
Azithromycin MICs  $>0.5$  mg/L were more common among isolates from MSM (11.5%) compared to those from heterosexual men (5.1%;  $p<0.001$ ) and women (5.4%;  $p<0.001$ ) (Figure 8). although azithromycin MICs  $\geq 256$  mg/L were only identified for isolates taken from women (1.1%; 3 isolates) and heterosexual men (1.0%, 2 isolates). Women with isolates with high-level resistance to azithromycin ranged in age from 19 to 27 years old, with a median age of 25. The age of heterosexual men with isolates with high-level resistance to azithromycin ranged from 17 to 24 years, with a median age of 20.5 years. Excluding the few cases of high-level resistance, the azithromycin MIC distribution was largely positively skewed among isolates from MSM, heterosexual men and women, with low modal MICs of either 0.25 mg/L or  $\leq 0.06$  mg/L, respectively, for isolates from all groups.

## Cefixime

The proportion of isolates included in the sentinel surveillance sample which were resistant to cefixime (MIC >0.125 mg/L) remained stable from 0.8% in 2019 to 0.6% in 2020 ( $p=0.50$ ) (Table 3). However, the modal cefixime MIC increased, from 0.015 mg/L in 2019 to 0.03 mg/L in 2020 (Figure 9).

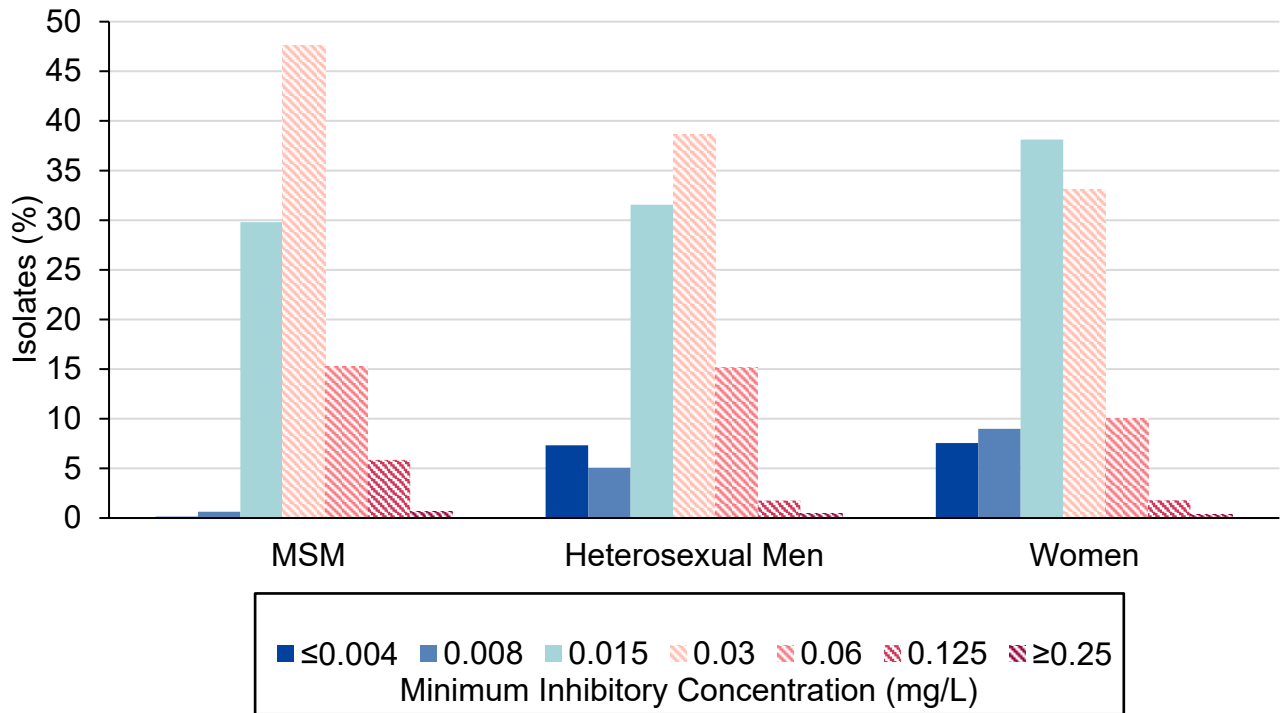
For the second successive year, the modal cefixime MIC was higher for isolates from MSM (0.03 mg/L) than those from women (0.015 mg/L) (Figure 10). The modal cefixime MIC for isolates from heterosexual men increased from 2019 to 2020, from 0.015 mg/L to 0.03 mg/L. As only 5 isolates from MSM, 2 from heterosexual men and one from a woman displayed cefixime resistance (MIC >0.125 mg/L), the proportions resistant among isolates from MSM (0.6%), heterosexual men (0.5%) and women (0.3%) were similar ( $p>0.05$ ).

**Figure 9. Distribution of cefixime MICs (mg/L) for *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system, England and Wales, 2011 to 2020†**



† Due to changes in the diagnostic sensitivity medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2020 collection were not directly comparable with those from previous years. Trends from 2010 to 2014 compared to 2015 to 2020 must be interpreted with caution (11).

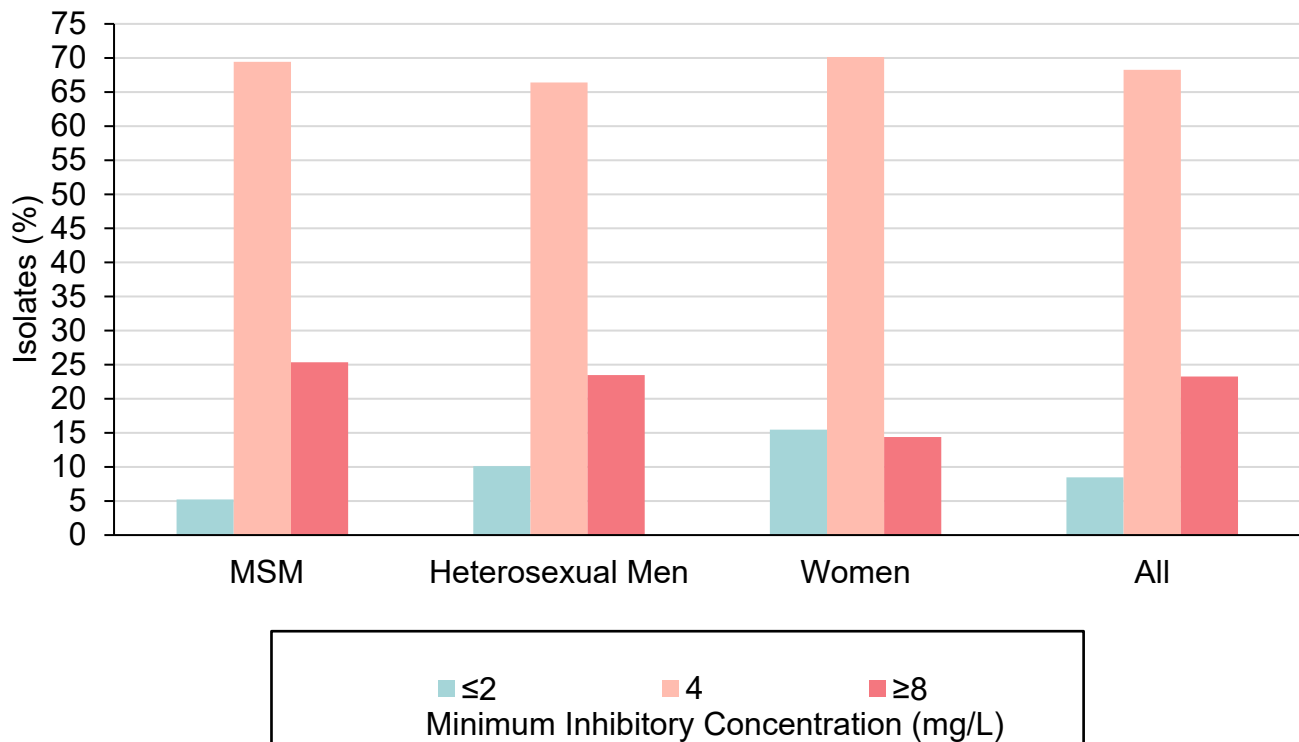
**Figure 10. Distribution of cefixime MICs (mg/L) for *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system, England and Wales, 2020**



## Gentamicin

Antimicrobial susceptibility testing for the sentinel surveillance system included gentamicin for the first time in 2019. The modal MIC for gentamicin was 4.0 mg/L in 2019 and 2020. As for ceftriaxone and azithromycin, the MIC frequency distribution suggested a lower proportion of isolates with the lowest gentamicin susceptibility among isolates from MSM compared with those from heterosexual men and women ([Figure 11](#)), although the modal MIC was identical for isolates from all groups (4 mg/L).

**Figure 11. Distribution of gentamicin MICs (mg/L) for *N. gonorrhoeae* isolates in the GRASP sentinel surveillance system, England and Wales, 2020**

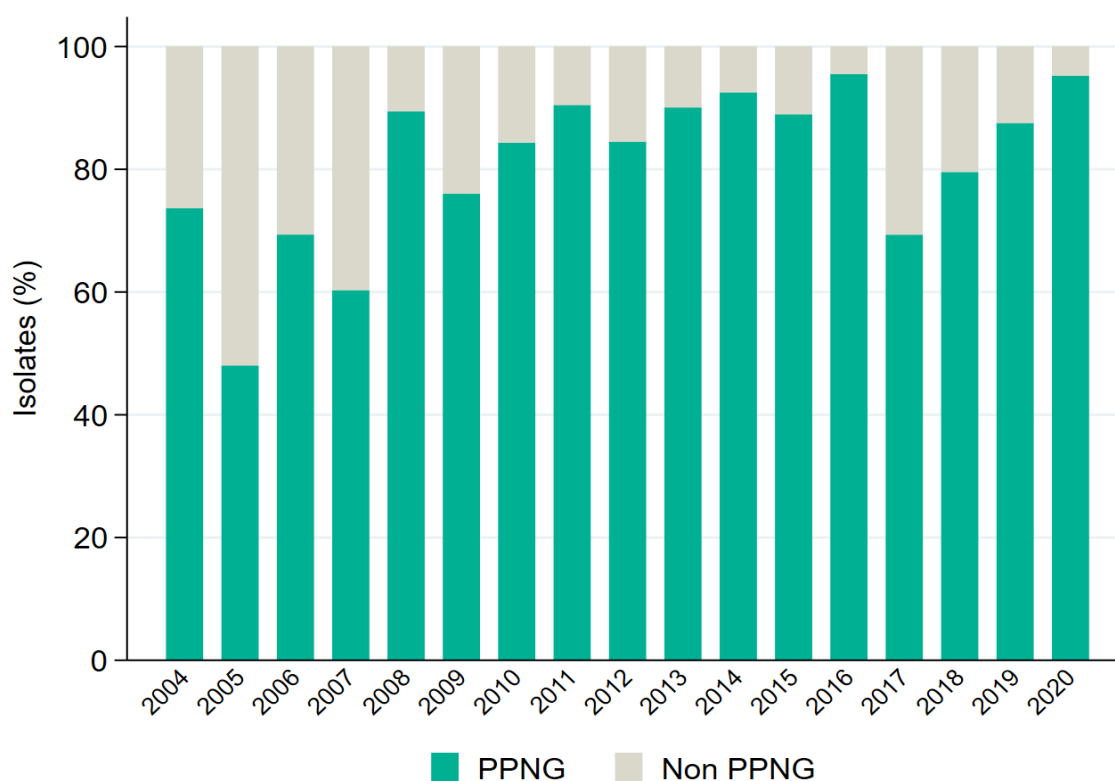




## Ciprofloxacin, penicillin, tetracycline and spectinomycin

The proportion of isolates that were resistant to each of ciprofloxacin ( $p=0.36$ ) and tetracycline ( $p=0.19$ ) marginally increased between 2019 and 2020, while the proportion that were resistant to penicillin notably decreased ( $p<0.001$ ) ([Table 3](#)). Ciprofloxacin resistance (MIC  $>0.06$  mg/L) has continually risen from 33.7% in 2016 to 44.3% in 2020 ( $p<0.001$ ), as has tetracycline resistance (MIC  $>1.0$  mg/L) from 40.9% in 2016 to 65.1% in 2020 ( $p<0.001$ ), but the small increases observed from 2019 to 2020 are suggestive of a stabilising trend. The trajectory of penicillin resistance (MIC  $>1.0$  mg/L), in particular, has altered, increasing from 10.8% in 2017 to 17.9% in 2019 ( $p<0.001$ ), but decreasing to 9.6% in 2020. However, while the overall rates of resistance appear to be slowing, resistance among isolates from MSM continues to rise rapidly ([Appendix 2](#)). As in previous years, no isolates were resistant to spectinomycin. Among isolates found to be resistant to tetracycline in 2020, 30.7% (306 out of 999) had high-level plasmid-mediated tetracycline resistance (MICs  $>8$  mg/L), a 14.5% decrease from 2019 ( $p<0.001$ ). Among isolates found to be resistant to penicillin in 2020, 95.2% (140 out of 147) were penicillinase-producing *N. gonorrhoeae* (PPNG), which have plasmid-mediated resistance, a 7.7% increase from 2019 ( $p=0.01$ ) ([Figure 12](#)).

**Figure 12. Percentage of penicillin resistant *N. gonorrhoeae* isolates that were PPNG in the GRASP sentinel surveillance sample, England Wales, 2004 to 2020†**



† Due to changes in the diagnostic sensitivity medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2020 collection are not directly comparable with those from previous years. Trends from 2004 to 2014 compared to 2015 to 2020 must be interpreted with caution ([11](#)).

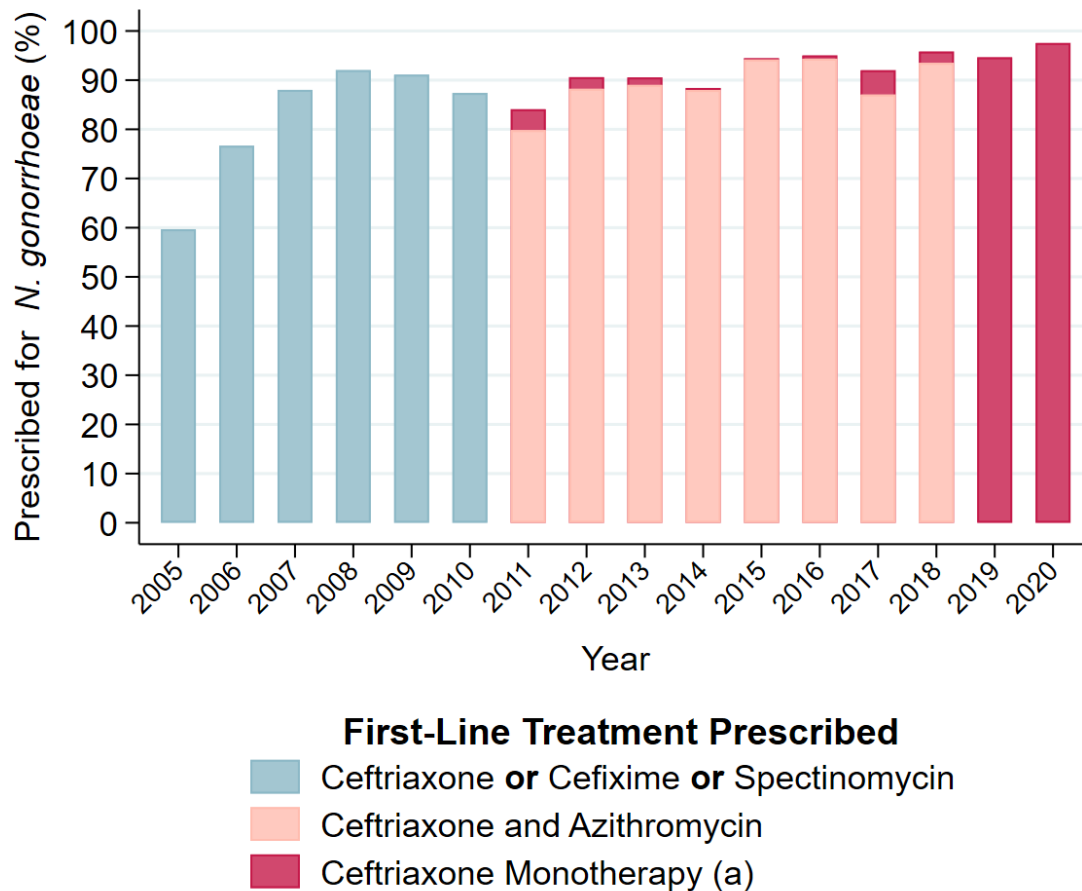
## Prescribing practices

Antimicrobial prescribing data were reported for 1,550 individuals diagnosed with gonorrhoea at SHCs participating in GRASP in 2020, irrespective of whether a *N. gonorrhoeae* isolate was available for antimicrobial susceptibility testing.

Among individuals with a reported gonorrhoea diagnosis, 97.6% (1,512 out of 1,550) received ceftriaxone (1g IM), in accordance with BASHH first-line treatment recommendations ([Figure 13](#)). Compliance with the recommendations was observed across all groups, with the majority of MSM (97.9%), heterosexual men (96.0%) and women (97.4%) receiving ceftriaxone (1g IM). For comparison, 94.6% of individuals were prescribed the first-line treatment in 2019.

Of 38 individuals prescribed treatments other than ceftriaxone monotherapy in 2020, 27 (71.0%) were prescribed an alternative monotherapy. After ceftriaxone, azithromycin 2 g was the most commonly prescribed antimicrobial for monotherapy (prescribed to 10 people), followed by ciprofloxacin (7 people), cefotaxime (4 people), doxycycline (3 people), cefixime (2 people) and azithromycin 1g (1 person). Antimicrobial susceptibility was confirmed in 4 of 7 instances where ciprofloxacin was prescribed as monotherapy, as recommended in the updated BASHH guidelines ([5](#)). The remaining 11 individuals were prescribed combination therapy. Among these, one received ceftriaxone 500 mg and azithromycin 1g, in accordance with the guidance prior to 2019. Five further people received cefixime and azithromycin, 2 received cefotaxime and doxycycline, 2 received azithromycin and doxycycline and one received azithromycin and spectinomycin.

**Figure 13. Prescribing Practices in England and Wales: Percentage Prescribed Recommended First-Line Treatment, 2005 to 2020†**



† Prior to 2016, the denominator includes only isolates within the sentinel surveillance system. Since 2016, the denominator includes all diagnoses made in GRASP clinics (including those without an isolate) where prescription data were available. Individuals prescribed "other" and "unknown" antibiotics were categorised based on known treatments given.

Notes: (a) New treatment guidelines for gonorrhoea in the UK were published in January 2019 (see the BASHH guidelines [webpage](#)), recommending 1g ceftriaxone monotherapy instead of ceftriaxone (500 mg IM) in combination with azithromycin (1g oral). Although ceftriaxone monotherapy was not recommended as first-line treatment in the guidelines for the period of 2011 to 2018, it is presented to illustrate the use of the main alternative first-line treatment in practice.

## Discussion

No cases of ceftriaxone resistance were observed among *N. gonorrhoeae* isolates captured within the GRASP sentinel surveillance system in 2020. Trend data have therefore been inferred from reduced susceptibility to ceftriaxone (MIC >0.03 mg/L), which has decreased for the second successive year, halving from 7.1% in 2018, to 2.9% in 2019, to 1.4% in 2020. Similarly, the UKHSA AMRSTI national reference laboratory confirmed no cases of ceftriaxone resistance in 2020 upon direct referral. In recent years, reported cases of ceftriaxone resistance in *N. gonorrhoeae* in England and Wales have been associated with international travel, so the introduction of travel restrictions in 2020 in response to the COVID-19 pandemic may have contributed to the absence of resistant cases identified last year.

Resistance to cefixime, an ESC recommended in the UK as an alternative regimen for gonorrhoea if IM treatment is contraindicated or refused, remained stable from 0.8% in 2019 to 0.6% in 2020 among isolates included in the sentinel surveillance system, the lowest rate recorded since 2007. However, the modal cefixime MIC increased from 0.015 mg/L in 2019 to 0.03 mg/L in 2020, as was observed in 2017 and 2018 prior to the update to the UK treatment guidance. Interestingly, the modal cefixime MIC was newly raised (0.03 mg/L) among isolates from heterosexual men in 2020, equalling the modal cefixime MIC observed for isolates from MSM and contrasting to historical trends seen for ceftriaxone and azithromycin, which typically showed higher modal MICs among isolates from MSM compared to heterosexual men and women. Therefore, while improvements in ceftriaxone susceptibility, together with decreasing cefixime resistance, are encouraging developments in the effort to maintain the effectiveness of gonorrhoea treatment, the overall shift towards decreased susceptibility to cefixime warrants continued surveillance of resistance to ESCs.

Although infrequently used to manage gonorrhoea, resistance to penicillin reduced for the first time since 2017, decreasing from 17.9% in 2019 to 9.6% in 2020. The reduction in penicillin resistance was observed for isolates from MSM and heterosexual men only. Stabilising trends were also observed for azithromycin, as well as ciprofloxacin and tetracycline from 2019 to 2020; for the third year, the azithromycin MIC distribution was positively skewed for isolates collected in the sentinel surveillance system, with the modal MIC remaining stable at  $\leq 0.06$  mg/L. Improvements in tetracycline susceptibility were particularly pertinent given the sharp, annual increases in tetracycline resistance reported across consecutive years from 2015 to 2019. However, ciprofloxacin (61.4%), penicillin (12.8%) and tetracycline (79.2%), azithromycin resistance (11.4%, MIC >0.5 mg/L) continue to be more common among isolates from MSM compared to heterosexual men and women, indicating that resistance is not universally abating ([Appendix 2](#)). Further, although a resistance breakpoint does not exist for gentamicin, the MIC distribution showed isolates from MSM were less susceptible to gentamicin compared to those from heterosexual men and women.

Good antimicrobial stewardship is essential for retaining gonorrhoea as a treatable infection. Prescribing data collected through the sentinel surveillance system demonstrate excellent compliance with the UK guidelines, with nearly all individuals receiving the recommended first-line therapy of ceftriaxone 1 g IM monotherapy. However, it is of concern that there was a reduction in the proportion of patients who received test-of-cure, possibly due to service disruption caused by COVID-19, therefore every effort should be made to prioritise test-of-cure.

## Conclusion

Although the effectiveness of first-line treatment for gonorrhoea continues to be threatened by the development of antimicrobial resistance, the decline in reduced susceptibility to ceftriaxone, in addition to stable rates of azithromycin and cefixime resistance, and reduction in penicillin resistance, are encouraging developments in the effort to maintain these antimicrobials as therapeutic options.

No cases of ceftriaxone resistance were identified in England and Wales in 2020, a year in which international travel was restricted in response to the COVID-19 pandemic. As ceftriaxone resistance has been associated with international travel which reduced markedly during 2020, no resistant cases in England and Wales were detected that year. A high level of vigilance is required to facilitate the timely detection of emerging trends in resistance and ensure the continuing effectiveness of first-line treatments. Culture of isolates, test-of-cure and partner notification (otherwise known as contact tracing) of sexual partners remain vital, as does the maintenance of strong adherence to treatment guidelines and use of the UKHSA AMRSTI national reference laboratory for confirmatory antimicrobial susceptibility testing.

# Appendices

## 1. Real-time laboratory data

Data on *N. gonorrhoeae* isolates tested for antimicrobial susceptibility from January 2017 to June 2021 were retrieved from SGSS. SGSS is a centralised repository of communicable disease test results for every specimen tested by laboratories in England, Northern Ireland and Wales, including those of *N. gonorrhoeae*. There are 2 sub-repositories within SGSS that hold data on antimicrobial susceptibility: the communicable disease reporting (CDR) repository and the antimicrobial resistance (AMR) repository. Data were extracted from both repositories and duplicate records were removed (where the same record is found in both the CDR and AMR repository). Episodes of infection were defined and enumerated after removing reports for multiple specimens and specimen sites within a 6-week period per patient. If more than one isolate was collected from a patient, where resistance or antimicrobial susceptibility testing profiles differed, the resistant code was preferentially kept. Isolates with an ocular specimen site were removed prior to restricting isolates to one episode per 6-week period.

In primary diagnostic laboratories, ceftriaxone and cefixime susceptibility is often inferred by testing cefuroxime as a proxy cephalosporin. If a gonococcus is found to be susceptible to cefuroxime it may thus be reported susceptible to ceftriaxone or cefixime. If, conversely, the isolate is resistant to cefuroxime, resistance to ceftriaxone or cefixime cannot be inferred and laboratories should use a gradient strip method to determine the ceftriaxone or cefixime MIC. Therefore, where the ceftriaxone or cefixime susceptibility results were missing and cefuroxime susceptibility was reported, susceptibility to ceftriaxone or cefixime result was recorded. Where the ceftriaxone or cefixime susceptibility results were missing and resistance to cefuroxime was reported, the ceftriaxone or cefixime result was recorded as missing since there was no way to verify whether ceftriaxone resistance was present.

Isolates reported to SGSS as ceftriaxone resistant by laboratories across England were linked to the UKHSA AMRSTI national reference laboratory database based on available patient information. This was used to calculate the percentage of isolates successfully referred to and confirmed as resistant (or not) by the UKHSA AMRSTI national reference laboratory.

## 2. Antimicrobial resistance by individuals' characteristics

**Table 5. Antimicrobial resistance by individuals' characteristics for MSM, sentinel surveillance system, 2020**

	Total MSM	Azithromycin	Ciprofloxacin	Penicillin	Tetracycline
Resistant isolates	785	90	482	100	622
<b>Age group (years)</b>					
15 to 19	12	3 (25.0%)	7 (58.3%)	0 (0.0%)	12 (100.0%)
20 to 24	113	11 (9.7%)	58 (51.3%)	11 (9.7%)	89 (78.8%)
25 to 34	344	35 (10.2%)	213 (61.9%)	58 (16.9%)	264 (76.7%)
35 to 44	204	30 (14.7%)	128 (62.7%)	23 (11.3%)	168 (82.4%)
45 or more	112	11 (9.8%)	76 (67.9%)	8 (7.1%)	89 (79.5%)
<b>Ethnicity</b>					
White	547	70 (12.8%)	334 (61.1%)	72 (13.2%)	428 (78.2%)
Black Caribbean	36	2 (5.6%)	19 (52.8%)	2 (5.6%)	30 (83.3%)
Black African	17	2 (11.8%)	9 (52.9%)	3 (17.6%)	15 (88.2%)
Black Other	15	2 (13.3%)	10 (66.7%)	3 (20.0%)	12 (80.0%)
Asian (including Chinese)	50	5 (10.0%)	34 (68.0%)	7 (14.0%)	41 (82.0%)
Other Ethnic Group	32	3 (9.4%)	23 (71.9%)	1 (3.1%)	26 (81.3%)
Mixed Ethnic Group	40	3 (7.5%)	27 (67.5%)	5 (12.5%)	32 (80.0%)
Not reported	48	3 (6.3%)	26 (54.2%)	7 (14.6%)	38 (79.2%)



Antimicrobial resistance in *Neisseria gonorrhoeae* in England and Wales

	Total MSM	Azithromycin	Ciprofloxacin	Penicillin	Tetracycline
<b>Residence</b>					
Outside London	266	23 (8.6%)	142 (53.4%)	32 (12.0%)	191 (71.8%)
London	508	65 (12.8%)	337 (66.3%)	67 (13.2%)	423 (83.3%)
Not reported	11	2 (18.2%)	3 (27.3%)	1 (9.1%)	8 (72.7%)
<b>HIV status</b>					
Negative	604	71 (11.8%)	369 (61.1%)	78 (12.9%)	481 (79.6%)
Positive	178	18 (10.1%)	113 (63.5%)	22 (12.4%)	140 (78.7%)
Not reported	3	1 (33.3%)	0 (0.0%)	0 (0.0%)	1 (33.3%)
<b>Symptoms</b>					
No discharge and or dysuria	265	31 (11.7%)	174 (65.7%)	44 (16.6%)	215 (81.1%)
Discharge and or dysuria	410	41 (10.0%)	236 (57.6%)	40 (9.8%)	314 (76.6%)
Not reported	110	18 (16.4%)	72 (65.5%)	16 (14.5%)	93 (84.5%)
<b>Previously diagnosed with gonorrhoea</b>					
No	572	67 (11.7%)	364 (63.6%)	76 (13.3%)	459 (80.2%)
Yes	182	21 (11.5%)	102 (56.0%)	23 (12.6%)	143 (78.6%)
Not reported	31	2 (6.5%)	16 (51.6%)	1 (3.2%)	20 (64.5%)
<b>Total sexual partners (past 3 months)</b>					
None to one	143	12 (8.4%)	88 (61.5%)	14 (9.8%)	109 (76.2%)
2 to 5	212	21 (9.9%)	119 (56.1%)	23 (10.8%)	153 (72.2%)

Antimicrobial resistance in *Neisseria gonorrhoeae* in England and Wales

	<b>Total MSM</b>	<b>Azithromycin</b>	<b>Ciprofloxacin</b>	<b>Penicillin</b>	<b>Tetracycline</b>
6 to 10	26	2 (7.7%)	19 (73.1%)	5 (19.2%)	23 (88.5%)
11 or more	16	3 (18.8%)	9 (56.3%)	4 (25.0%)	12 (75.0%)
Not reported	388	52 (13.4%)	247 (63.7%)	54 (13.9%)	325 (83.8%)
<b>Sex abroad (past 3 months)</b>					
Yes	381	36 (9.4%)	227 (59.6%)	44 (11.5%)	286 (75.1%)
No	16	2 (12.5%)	8 (50.0%)	2 (12.5%)	11 (68.8%)
Not reported	388	52 (13.4%)	247 (63.7%)	54 (13.9%)	325 (83.8%)

Notes: No isolates were resistant to ceftriaxone or spectinomycin in the 2020 sentinel surveillance collection.

Data are not included for cefixime due to small numbers (n=5).

Percentages are row %.

**Table 6. Antimicrobial resistance by individuals' characteristics for heterosexual men and women, sentinel surveillance system, 2020**

	<b>Total heterosexual men and women</b>	<b>Azithromycin</b>	<b>Ciprofloxacin</b>	<b>Penicillin</b>	<b>Tetracycline</b>
Resistant isolates	674	35	156	40	324
<b>Age group (years)</b>					
15 to 19	91	4 (4.4%)	11 (12.1%)	3 (3.3%)	37 (40.7%)
20 to 24	212	12 (5.7%)	42 (19.8%)	8 (3.8%)	81 (38.2%)
25 to 34	253	12 (4.7%)	64 (25.3%)	13 (5.1%)	126 (49.8%)
35 to 44	77	5 (6.5%)	22 (28.6%)	11 (14.3%)	53 (68.8%)
45 or more	40	2 (5.0%)	17 (42.5%)	5 (12.5%)	26 (65.0%)
Not reported	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)
<b>Ethnicity</b>					
White	284	24 (8.5%)	62 (21.8%)	22 (7.7%)	122 (43.0%)
Black Caribbean	76	4 (5.3%)	19 (25.0%)	2 (2.6%)	40 (52.6%)
Black African	49	0 (0.0%)	10 (20.4%)	1 (2.0%)	31 (63.3%)
Black Other	19	2 (10.5%)	6 (31.6%)	2 (10.5%)	12 (63.2%)
Asian (including Chinese)	23	0 (0.0%)	10 (43.5%)	4 (17.4%)	13 (56.5%)
Other Ethnic Group	16	0 (0.0%)	4 (25.0%)	1 (6.3%)	8 (50.0%)
Mixed Ethnic Group	63	1 (1.6%)	11 (17.5%)	5 (7.9%)	27 (42.9%)

Antimicrobial resistance in *Neisseria gonorrhoeae* in England and Wales

	<b>Total heterosexual men and women</b>	<b>Azithromycin</b>	<b>Ciprofloxacin</b>	<b>Penicillin</b>	<b>Tetracycline</b>
Not reported	144	4 (2.8%)	34 (23.6%)	3 (2.1%)	71 (49.3%)
<b>Residence</b>					
Outside London	499	18 (3.6%)	94 (18.8%)	29 (5.8%)	221 (44.3%)
London	170	16 (9.4%)	62 (36.5%)	11 (6.5%)	102 (60.0%)
Not reported	5	1 (20.0%)	0 (0.0%)	0 (0.0%)	1 (20.0%)
<b>HIV status</b>					
Negative	600	30 (5.0%)	145 (24.2%)	37 (6.2%)	292 (48.7%)
Positive	8	1 (12.5%)	4 (50.0%)	2 (25.0%)	7 (87.5%)
Not reported	66	4 (6.1%)	7 (10.6%)	1 (1.5%)	25 (37.9%)
<b>Symptoms</b>					
No discharge and or dysuria	105	7 (6.7%)	22 (21.0%)	4 (3.8%)	36 (34.3%)
Discharge and or dysuria	514	24 (4.7%)	125 (24.3%)	34 (6.6%)	268 (52.1%)
Not reported	55	4 (7.3%)	9 (16.4%)	2 (3.6%)	20 (36.4%)
<b>Previously diagnosed with gonorrhoea</b>					
No	484	33 (6.8%)	111 (22.9%)	27 (5.6%)	223 (46.1%)
Yes	101	2 (2.0%)	25 (24.8%)	10 (9.9%)	50 (49.5%)
Not reported	89	0 (0.0%)	20 (22.5%)	3 (3.4%)	51 (57.3%)
<b>Total sexual partners (past 3 months)</b>					

Antimicrobial resistance in *Neisseria gonorrhoeae* in England and Wales

	<b>Total heterosexual men and women</b>	<b>Azithromycin</b>	<b>Ciprofloxacin</b>	<b>Penicillin</b>	<b>Tetracycline</b>
None to one	336	20 (6.0%)	66 (19.6%)	15 (4.5%)	142 (42.3%)
2 to 5	224	9 (4.0%)	46 (20.5%)	8 (3.6%)	105 (46.9%)
6 to 10	15	2 (13.3%)	6 (40.0%)	1 (6.7%)	10 (66.7%)
11 or more	4	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (25.0%)
Not reported	95	4 (4.2%)	38 (40.0%)	16 (16.8%)	66 (69.5%)
<b>Sex abroad (past 3 months)</b>					
Yes	562	31 (5.5%)	110 (19.6%)	23 (4.1%)	247 (44.0%)
No	17	0 (0.0%)	8 (47.1%)	1 (5.9%)	11 (64.7%)
Not reported	95	4 (4.2%)	38 (40.0%)	16 (16.8%)	66 (69.5%)

Notes: No isolates were resistant to ceftriaxone or spectinomycin in the 2020 sentinel surveillance collection.

Data not included for cefixime due to small numbers (n=3).

Percentages are row %

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