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Protecting and improving the nation's health

Surveillance of antimicrobial resistance in *Neisseria gonorrhoeae* in England and Wales

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

Data to May 2018

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1. Key points

The effectiveness of first-line treatment for gonorrhoea continues to be threatened by antimicrobial resistance.

Between 2016 and 2017, there was a reduction in susceptibility to the current first-line therapy, ceftriaxone: the modal minimum inhibitory concentration (MIC) increased from 0.008 mg/L in 2016 to 0.015 mg/L in 2017.

In 2018, one case of extensively drug resistant *Neisseria gonorrhoeae* was identified: this infection was acquired in South East Asia.

Gonococcal isolates collected through PHE's sentinel surveillance system showed between 2016 and 2017:

- an increase in azithromycin resistance from 4.7% to 9.2%
- an increase in resistance to ciprofloxacin from 33.7% to 36.4%
- an increase in the cefixime modal MIC from 0.015 mg/L to 0.03 mg/L
- a decline in penicillin resistance from 13.9% to 10.8%

2. Key recommendations

All primary diagnostic laboratories should test gonococcal isolates for susceptibility to first-line antimicrobials (ceftriaxone and azithromycin) and refer suspected ceftriaxone-resistant and/or high-level azithromycin-resistant isolates to PHE's national reference laboratory for confirmation and follow-up.

Practitioners should ensure that all patients with gonorrhoea are treated and managed according to [national guidelines](#), and should be alert to changes to the antimicrobials recommended for first-line use.

Sexual health services should report possible cases of treatment failure to PHE via the [HIV and sexually-transmitted infection \(STI\) web-portal](#)

Consistent and correct use of condoms can significantly reduce risk of STIs – the availability of condoms should be promoted through media campaigns as well as through local services including condom distribution schemes.

Regular testing for HIV and STIs is essential for good sexual health:

- anyone under 25 who is sexually active should be screened for chlamydia annually and on change of sexual partner
- men who have sex with men (MSM) should test annually for HIV and STIs and every 3 months if having condomless sex with new or casual partners
- black ethnic minority women and men should have an STI screen, including an HIV test, annually if having condomless sex with new or casual partners
- open-access to services that provide rapid treatment and partner notification can reduce the risk of STI complications and infection spread

3. Introduction

Gonorrhoea is the second most common bacterial sexually-transmitted infection (STI) in the UK and, if untreated, can lead to complications such as chronic pelvic pain, pelvic inflammatory disease, ectopic pregnancy and infertility in women. Gonorrhoea is concentrated among specific population groups, especially young adults, people of black Caribbean ethnicity and gay, bisexual and other men who have sex with men (MSM). In 2017, 44,676 diagnoses of gonorrhoea were reported in England, a 22% increase relative to the previous year¹. New treatment guidelines for gonorrhoea in the UK are currently under consultation (see the British Association for Sexual Health and HIV (BASHH) guidelines [webpage](#)), and recommend 1 g ceftriaxone monotherapy, instead of the current dual therapy of ceftriaxone (500 mg IM) in combination with azithromycin (1 g oral).

On-going monitoring of antimicrobial resistance (AMR) is vital to ensure that first-line treatment for gonorrhoea remains effective, as patterns of resistance can change rapidly. Ineffective treatment facilitates onward transmission and development of adverse sequelae.

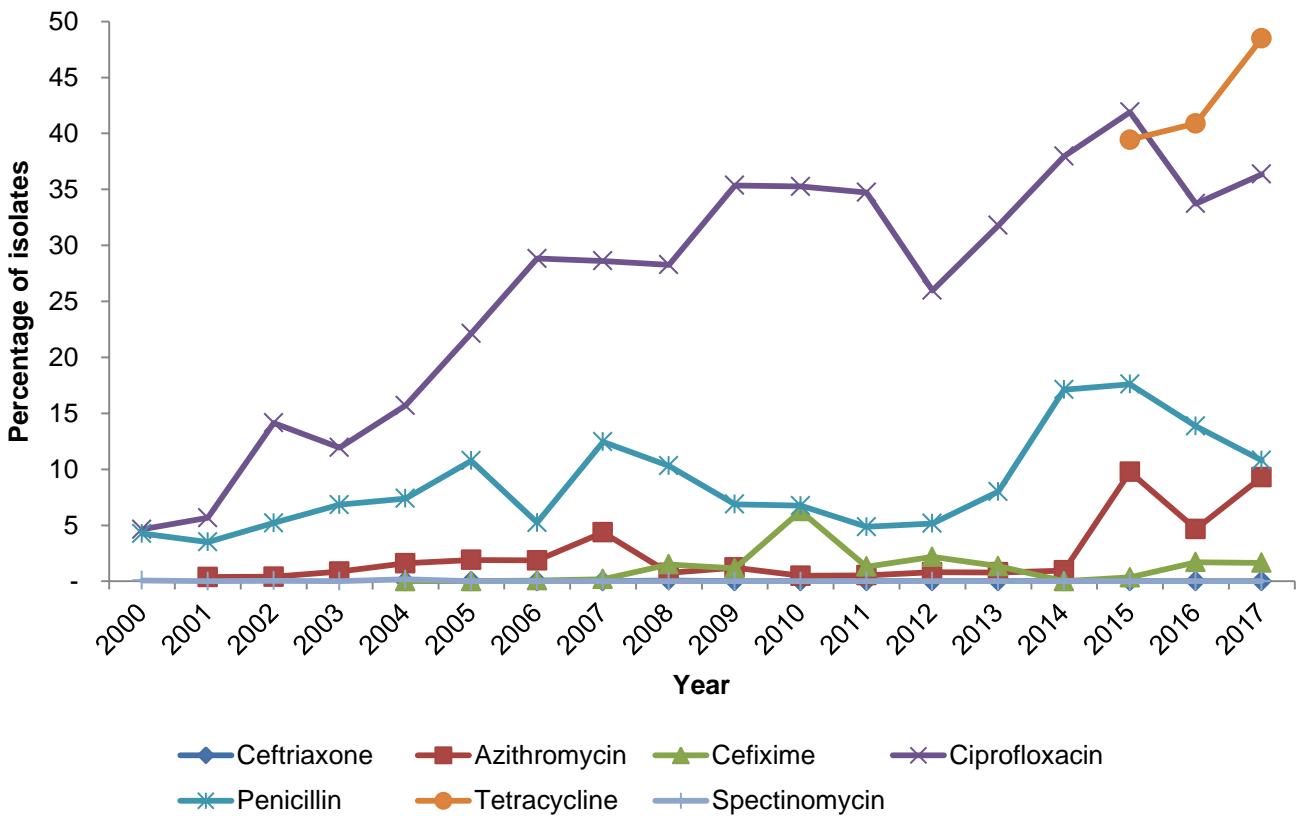
This report presents trends in gonococcal susceptibility to current and previously recommended antimicrobials used for treatment of gonorrhoea, and explores the recent epidemiology of gonococcal AMR in England and Wales.

Data presented in this report was retrieved from multiple sources. The Gonococcal Resistance to Antimicrobial Surveillance Programme (GRASP) includes a suite of initiatives to detect and monitor AMR in *Neisseria gonorrhoeae* and to record potential treatment failures. Data from the national sentinel surveillance system were supplemented by data from the Second Generation Surveillance System (SGSS) (see Appendix) and from PHE's national reference laboratory. All PHE results were interpreted using EUCAST breakpoints (see [Appendix 6.1.2](#))².

4. Antimicrobial resistance

N. gonorrhoeae has developed resistance to all classes of antimicrobials recommended to treat the infection. Figure 1 and Table 1 show trends in the prevalence of resistance in gonococcal isolates collected through the GRASP sentinel surveillance system.

Figure 1. Percentage of gonococcal isolates resistant to selected antimicrobials: England and Wales, 2000 to 2017*



* Note: due to changes in the DST medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2017 collections were not directly comparable with those from previous years; trends from 2000 to 2014 compared to 2015 to 2017 must be interpreted with caution, particularly for azithromycin and tetracycline (data for tetracycline is only included from 2015 onwards due to this issue)³.

Table 1. Percentage of gonococcal isolates in the GRASP sentinel surveillance system that were resistant to selected antimicrobials: England and Wales, 2012 to 2017*

Antimicrobial (MIC** threshold for resistance, mg/L)	Number resistant (%)					
	2012	2013	2014	2015***	2016*	2017*
	N=1,374	N=1,636	N=1,565	N=1,699	N=1,284	N=1,268
Ceftriaxone (>0.125)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Azithromycin (>0.5)	11 (0.8)	13 (0.8)	15 (1.0)	166 (9.8)	60 (4.7)	117 (9.2)
Cefixime (>0.125)	30 (2.2)	22 (1.3)	0 (0.0)	6 (0.4)	22 (1.7)	21 (1.7)
Ciprofloxacin (>0.06)	357 (26.0)	520 (31.8)	594 (38.0)	712 (41.9)	433 (33.7)	461 (36.4)
Penicillin (>1.0)	71 (5.2)	131 (8.0)	268 (17.1)	299 (17.6)	178 (13.9)	137 (10.8)
Tetracycline (>1.0)	1,064 (77.4)	1,309 (80.0)	1,297 (82.9)	670 (39.4)	525 (40.9)	615 (48.5)
Spectinomycin (>64)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

* The numbers of isolates included in the sample may differ from previous reports as, in this report, only data for isolates matched to GRASP clinics is presented

** MIC = minimum inhibitory concentration

*** Due to changes in the DST medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2017 collection were not directly comparable with those from previous years; similarly trends from 2000 to 2014 compared to 2015 to 2017 must be interpreted with caution, particularly for azithromycin³.

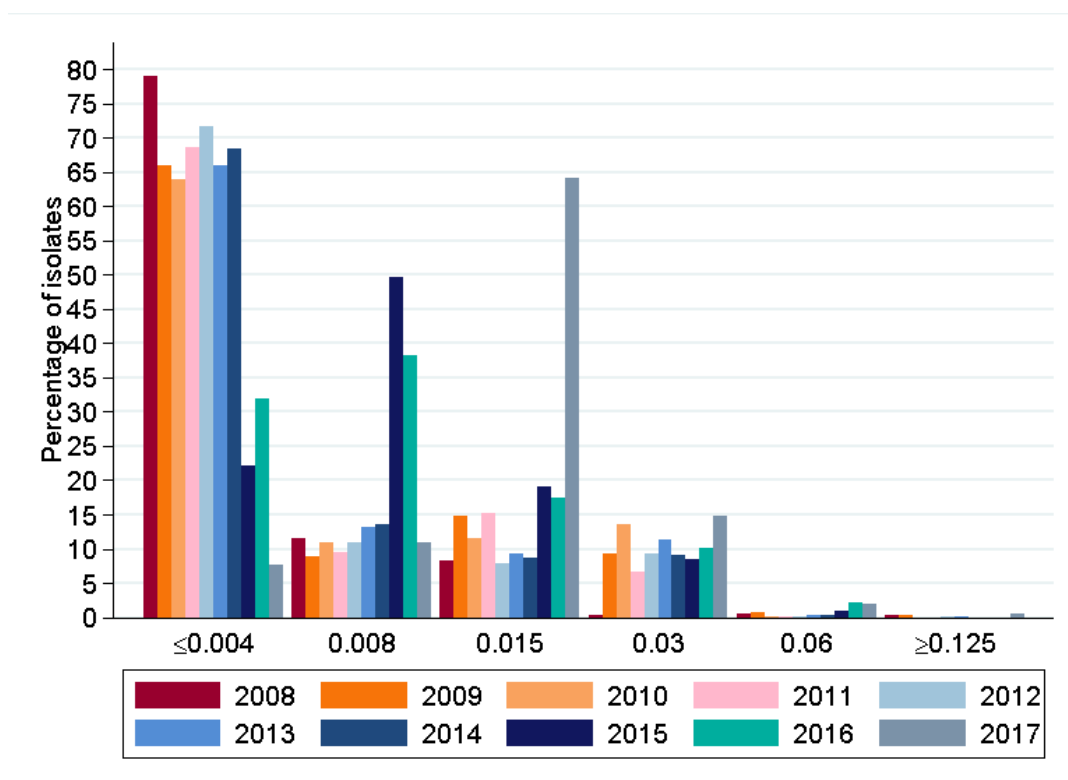
4.1 Ceftriaxone

In 2017, 1,268 gonococcal isolates were collected through PHE's sentinel surveillance system; none were resistant to ceftriaxone but, for 7, the minimum inhibitory concentration (MIC) was at the breakpoint (0.125 mg/L): all were from men (Figure 2 and Figure 3). The number of isolates at this MIC has increased since 2016, when no MIC greater than 0.06 mg/L was seen for any isolate. The modal MIC also increased from 0.008 mg/L in 2016 to 0.015 mg/L in 2017 across all patient gender and sexual orientation subgroups (Figure 3). Although geometric mean ceftriaxone MICs for control strains in 2017 were slightly higher than in 2016, the shift was insufficient to account for this shift in modal MIC.

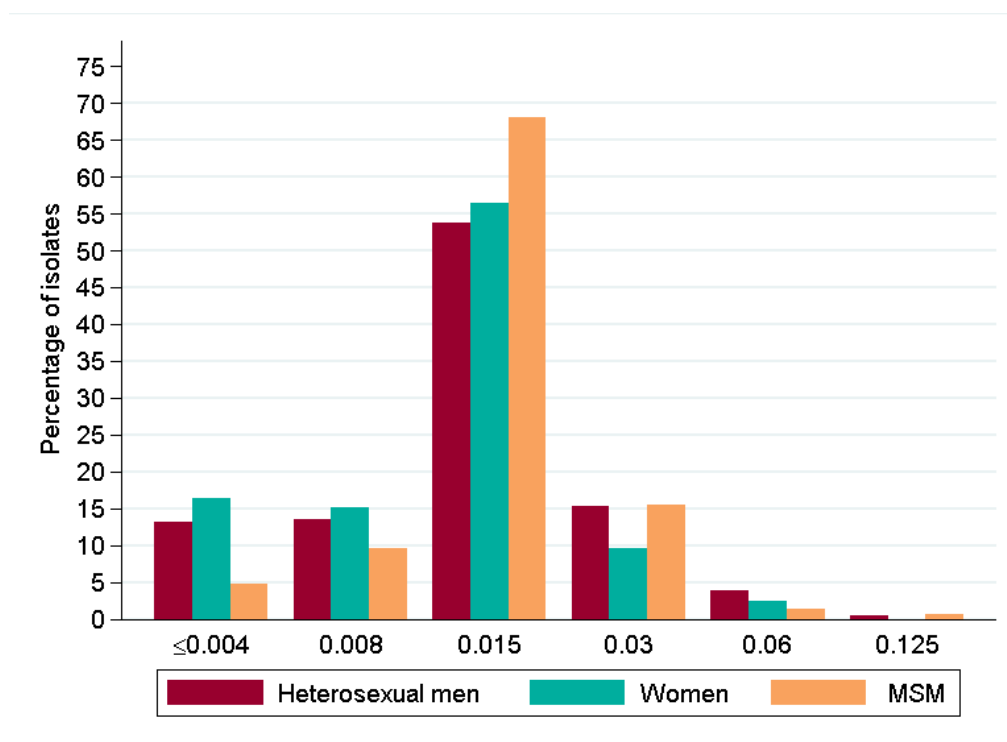
The percentage of isolates that were tested for ceftriaxone antimicrobial susceptibility (or cefuroxime as a proxy, see Appendix) in primary diagnostic laboratories has increased yearly from 91.2% in 2015 to 97.2% in 2018 (Table 2).

In 2018, one case of ceftriaxone resistance was identified by the national reference laboratory (Table 2). This case was extensively-drug-resistant *N. gonorrhoeae* (XDR-Ng) and has been published separately^{4,5}. The ceftriaxone MIC for the isolate was 0.5 mg/L and the azithromycin MIC, >256 mg/L (high-level azithromycin resistant, HLAziR). On wider antimicrobial susceptibility testing, the strain was resistant to cefixime, ciprofloxacin and tetracycline, and susceptible to spectinomycin. The case reported one regular female partner in the UK and a female sexual contact in south east Asia in the month prior to symptom onset. The investigation co-ordinated by PHE concluded that there had been no spread of the strain within the UK.

Figure 2. Distribution of ceftriaxone MICs (mg/L) for gonococcal isolates within the sentinel surveillance system: England and Wales, 2008 to 2017*



*Note: due to changes in the DST medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2017 collection were not directly comparable with those from previous years; trends from 2000 to 2014 compared to 2015 to 2017 must be interpreted with caution³.

Figure 3. Distribution of ceftriaxone MICs (mg/L) for gonococcal isolates by gender and sexual orientation in the GRASP sentinel surveillance: England and Wales, 2017**Table 2. Ceftriaxone susceptibility testing and referral: data from primary diagnostic laboratories and the national reference laboratory (January 2015 to May 2018)**

	2015	2016	2017	2018*
Primary diagnostic laboratories (SGSS**)				
Total isolates reported to SGSS	19,369	17,868	20,062	9,570
Total isolates tested for ceftriaxone susceptibility	17,666	17,098	19,306	9,298
Percentage of isolates tested for ceftriaxone susceptibility	91.2	95.7	96.2	97.2
Total isolates reported ceftriaxone resistant in SGSS	89	48	48	29
National reference laboratory				
Total isolates tested for ceftriaxone susceptibility	259	299	480	468
Total isolates confirmed as ceftriaxone resistant	2	0	0	1
SGSS & National reference laboratory matched data				
Total isolates reported as ceftriaxone resistant in SGSS and referred to national reference laboratory***	21	15	13	7
Total isolates reported as ceftriaxone resistant in SGSS and confirmed resistant by the national reference laboratory	1	0	0	0

* Data for 2018 cover January to May

** SGSS – Second Generation Surveillance System

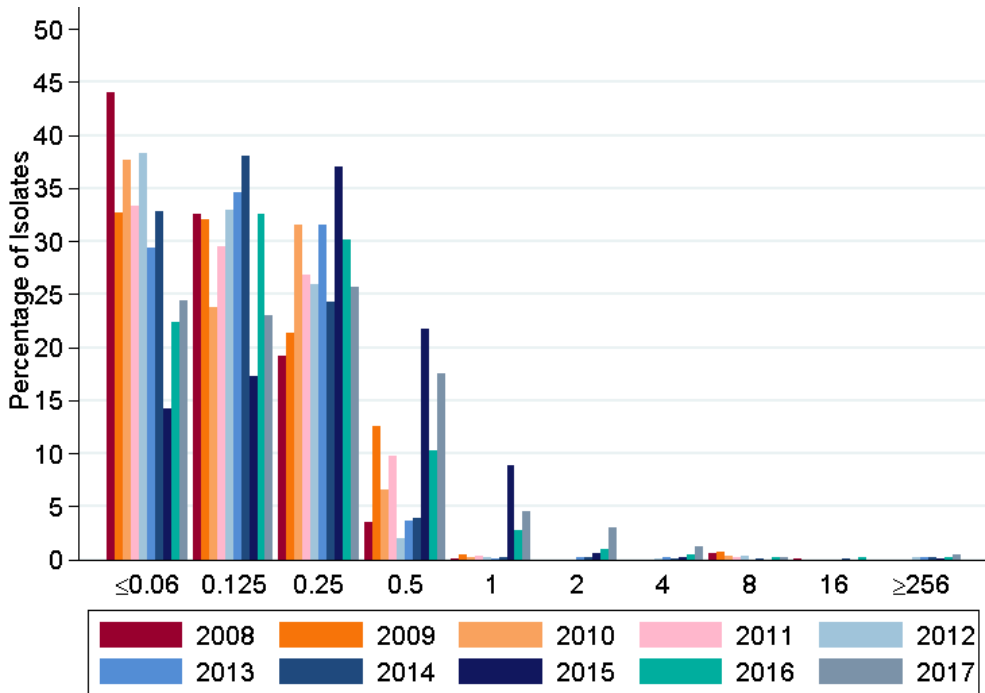
*** Not all isolates reported to the national reference laboratory can be matched to records in SGSS and not all isolates reported as resistant are referred to the national reference laboratory (although we request that all are).

4.2 Azithromycin

Between 2016 and 2017, among gonococcal isolates in the sentinel surveillance sample, the prevalence of azithromycin resistance increased from 4.7% to 9.2%, a similar level to the prevalence in 2015 (Figure 1). The modal MIC has also increased by one dilution to 0.25 mg/L, corresponding to that also seen in 2015 (Figure 4). Geometric mean MICs of azithromycin for control strains were near identical in 2016 and 2017, suggesting that this shift was real and not due to technical variation. Isolates from MSM were less susceptible to azithromycin than those from women or heterosexual men (Figure 5). The ceftriaxone MICs for isolates that were resistant to azithromycin ranged from 0.008 to 0.06 mg/L (ceftriaxone resistance threshold >0.125 mg/L): 42% of isolates with a ceftriaxone MIC of 0.06 mg/L were resistant to azithromycin (azithromycin resistance threshold >0.5 mg/L) (Figure 6).

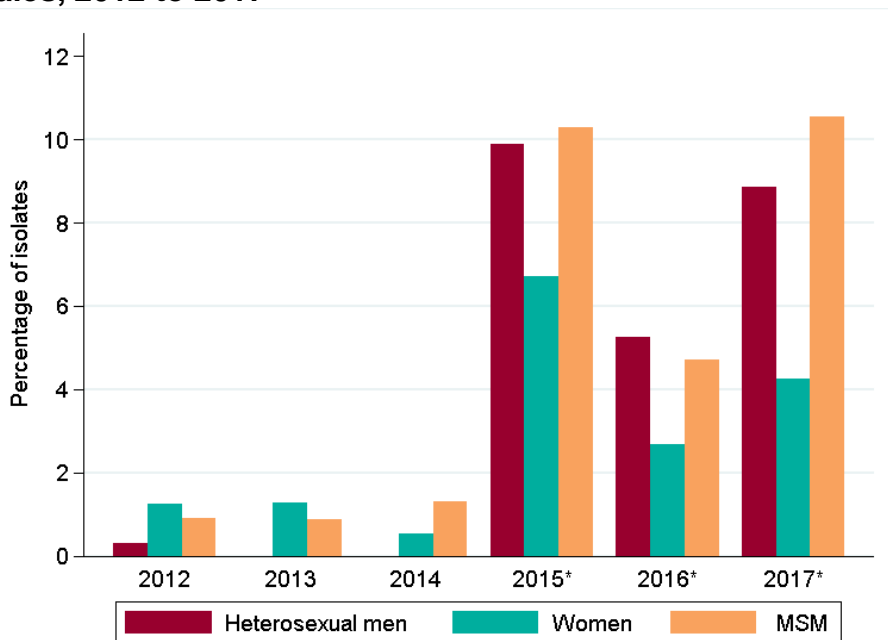
The percentage of isolates that were tested for azithromycin antimicrobial susceptibility in primary diagnostic laboratories has increased yearly from 88.2% in 2015 to 98.4% in 2018 (Table 3). Among isolates referred by primary diagnostic laboratories to the national reference laboratory between January 2015 and May 2018, there were 637 with azithromycin resistance confirmed. Of these 130 exhibited high-level resistance (HLAziR; MIC \geq 256 mg/L). Further epidemiological analyses of 118 of these cases have been previously reported⁶. Cases emerged among heterosexuals in Leeds but spread across England and into sexual networks of MSM as the outbreak progressed. Studies using whole genome sequencing indicated sustained transmission of *N. gonorrhoeae* with the HLAziR phenotype on a national scale^{7,8}.

Figure 4. Distribution of azithromycin MICs (mg/L) for gonococcal isolates within the sentinel surveillance system: England and Wales, 2008 to 2017*



* Note: due to changes in the DST medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2017 collection were not directly comparable with those from previous years; trends from 2000 to 2014 compared to 2015 to 2017 must be interpreted with caution, particularly for azithromycin³.

Figure 5. Percentage of azithromycin-resistant gonococcal isolates (MIC >0.5 mg/L) by gender and sexual orientation within the sentinel surveillance system: England and Wales, 2012 to 2017*



*Note: due to changes in the DST medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015-2017 collection were not directly comparable with those from previous years; trends from 2000 to 2014 compared to 2015-2017 must be interpreted with caution, particularly for azithromycin³.

Figure 6. Percentage of gonococcal isolates resistant to azithromycin (MIC >0.5 mg/L) in relation to ceftriaxone MICs (mg/L) in GRASP sentinel surveillance: England and Wales, 2017

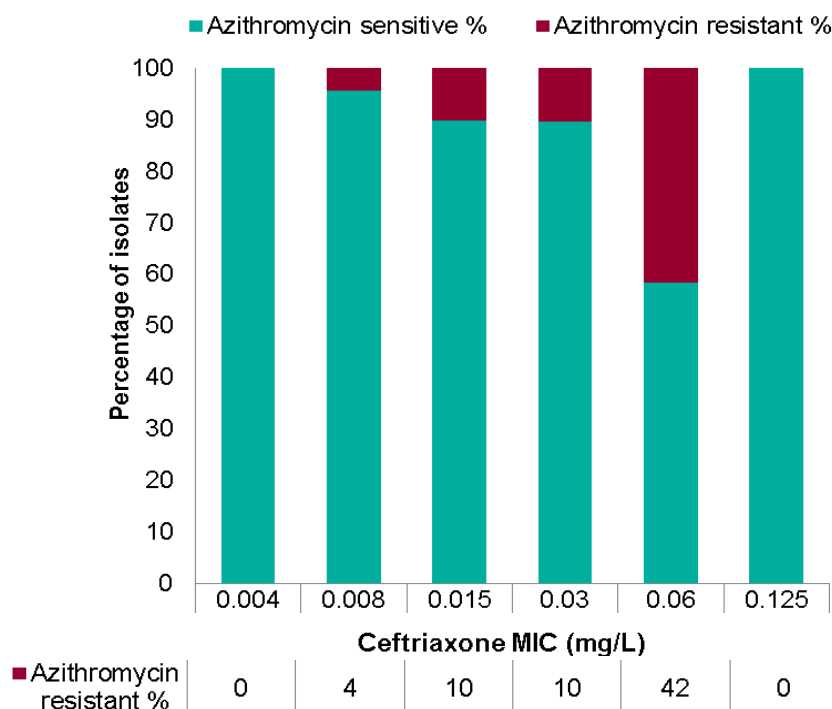


Table 3. Azithromycin susceptibility testing and referral in SGSS: January 2015 to May 2017

	2015	2016	2017	2018*
Primary diagnostic laboratories (SGSS**)				
Total isolates reported to SGSS	19,369	17,868	20,062	9,570
Total isolates tested for azithromycin susceptibility	17,076	17,321	19,671	9,416
Percentage of isolates tested for azithromycin susceptibility	88.2	96.9	98.1	98.4
Total isolates reported azithromycin resistant in SGSS	282	313	514	414
National reference laboratory				
Total isolates tested for azithromycin susceptibility	259	299	478	469
Total isolates confirmed as azithromycin resistant (MIC >0.5 mg/L)	68	96	228	245
Total isolates confirmed as high level azithromycin resistant (MIC ≥256 mg/L)	34	28	38	30
SGSS & National reference laboratory matched data				
Total isolates reported as azithromycin resistant in SGSS and referred to national reference laboratory***	75	136	230	244
Total isolates reported as azithromycin resistant in SGSS and confirmed resistant by the national reference laboratory	65	98	199	179

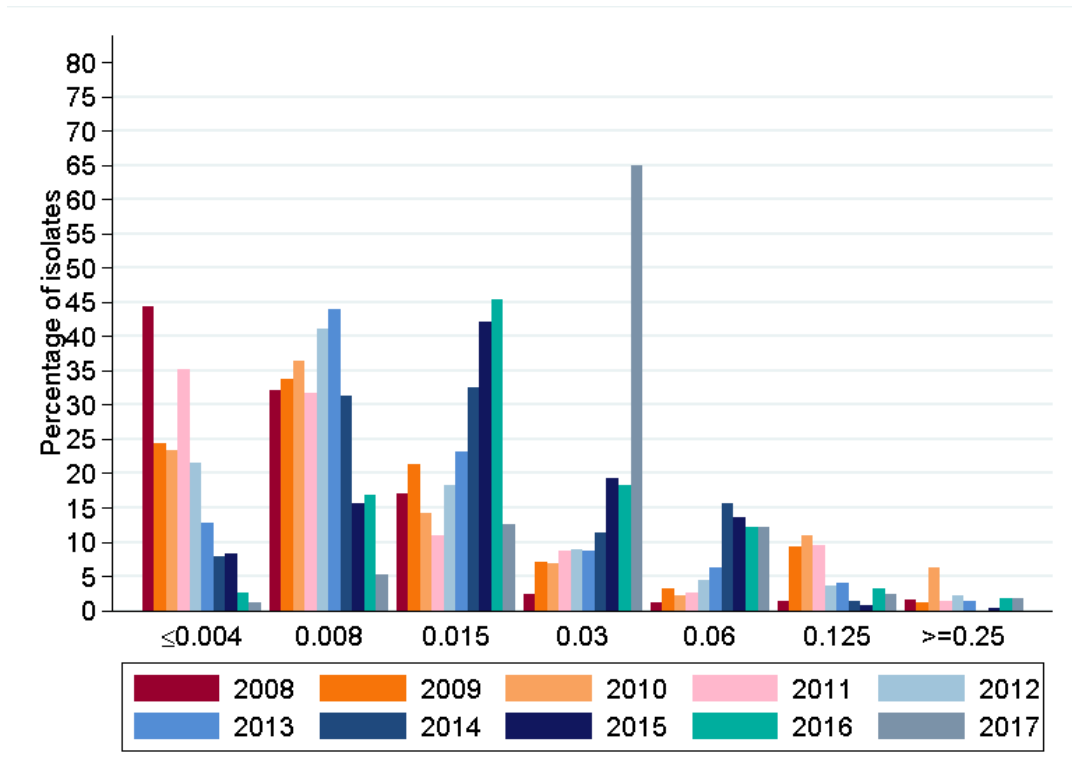
* Data for 2018 cover January to May, ** SGSS – Second Generation Surveillance System, *** Not all isolates reported to the national reference laboratory can be matched to records in SGSS and not all isolates reported as resistant are referred to the national reference laboratory (although we request that all are)

4.3 Susceptibility to other antimicrobials

4.3.1 Cefixime

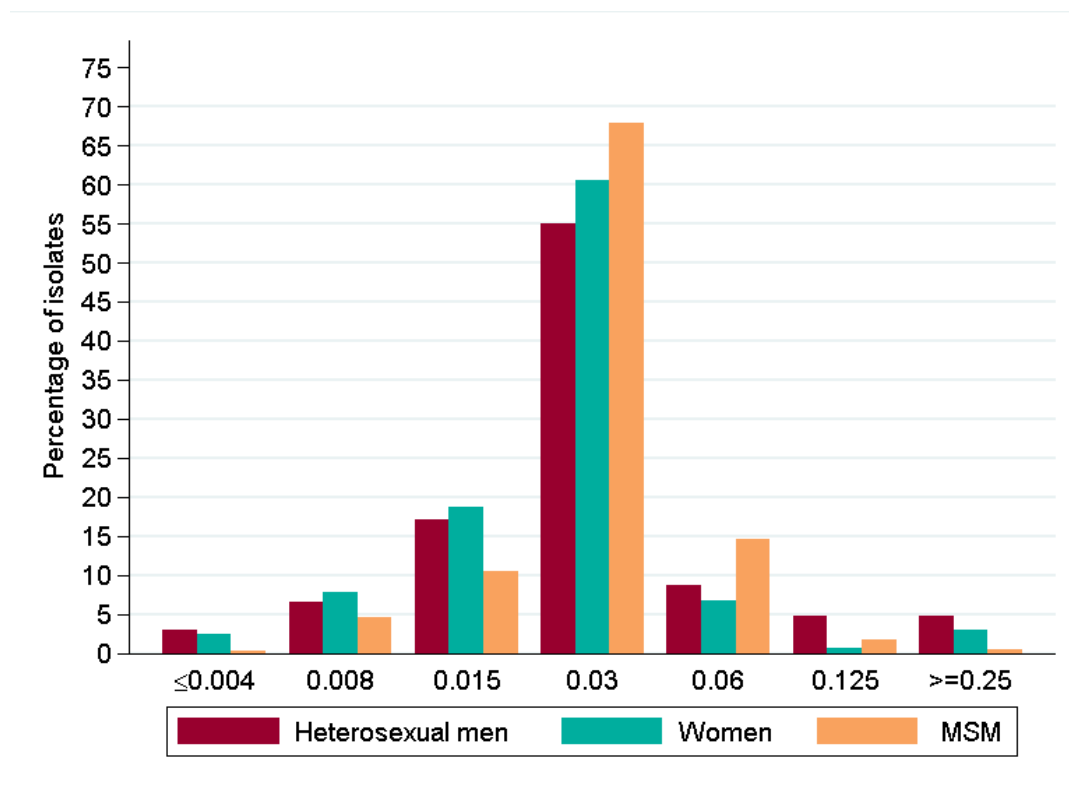
The percentage of gonococcal isolates resistant to cefixime remained at 1.7% in 2017, the same as found in 2016 (Table 1). However, the modal MIC increased from 0.015 mg/L in 2016 to 0.03 mg/L in 2017 (Figure 7). Although geometric mean cefixime MICs for control strains in 2017 were slightly higher than in 2016, the shift was insufficient to account for this shift in modal MIC. The modal MIC was the same across all sexual orientation and gender sub-groups but more isolates that were resistant to cefixime were from women or heterosexual men (16/20) than from MSM (4/20) (Figure 8).

Figure 7. Distribution of cefixime MICs (mg/L) for gonococcal isolates within the sentinel surveillance system: England and Wales, 2008 to 2017*



*Note: due to changes in the DST medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2017 collection were not directly comparable with those from previous years; trends from 2000 to 2014 compared to 2015 to 2017 must be interpreted with caution³.

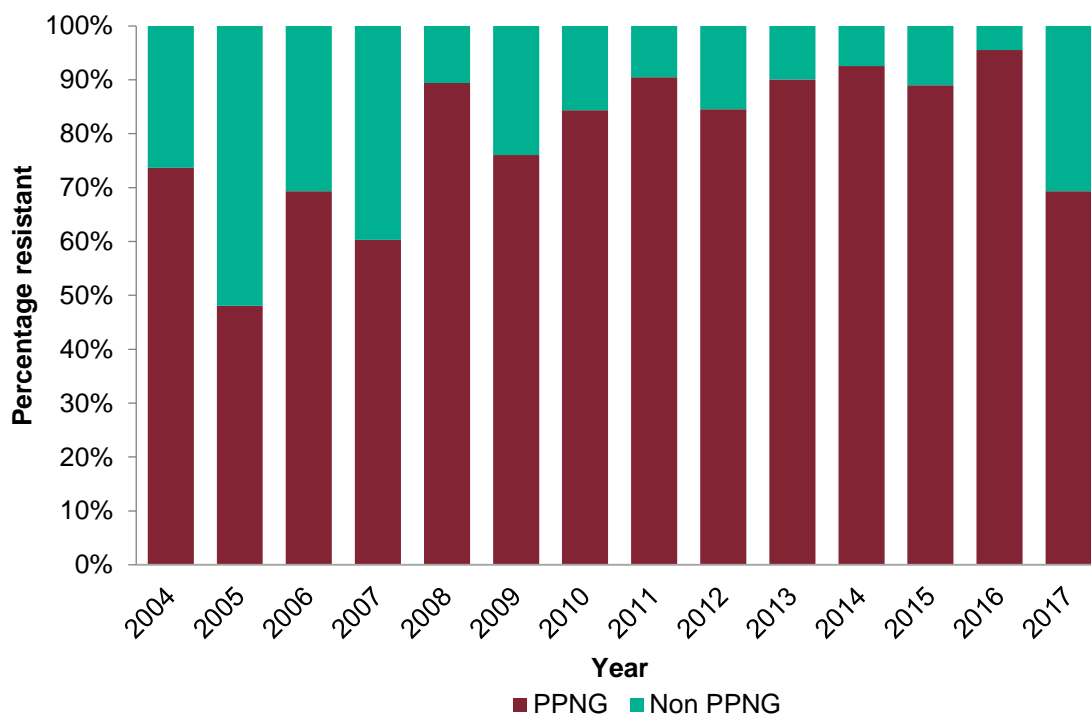
Figure 8. Distribution of cefixime MICs (mg/L) for gonococcal isolates by gender and sexual orientation within the sentinel surveillance system: England and Wales, 2017



4.3.2 Ciprofloxacin, penicillin and tetracycline

Resistance to each of ciprofloxacin, penicillin and tetracycline remained endemic in England and Wales, although the decline in the percentage of isolates resistant to penicillin since 2014 continued (2014: 17.1%, 2017: 10.8%) (Table 1). Among isolates found resistant to penicillin in 2017, 69% (95/137) were penicillinase-producing *N. gonorrhoeae* (PPNG), which have plasmid-mediated resistance (Figure 9). Among the isolates found resistant to tetracycline in 2017, 43.7% (268/613) had high-level tetracycline resistance (MIC >8 mg/L), which is plasmid mediated. No isolates were resistant to spectinomycin.

Figure 9. Percentage of penicillin-resistant isolates that were PPNG in the GRASP sentinel surveillance sample: England Wales, 2004 to 2017*



*Note: due to changes in the DST medium used to test antimicrobial susceptibility of sentinel surveillance system isolates, MICs for the 2015 to 2017 collection were not directly comparable with those from previous years; trends from 2000 to 2014 compared to 2015 to 2017 must be interpreted with caution³.

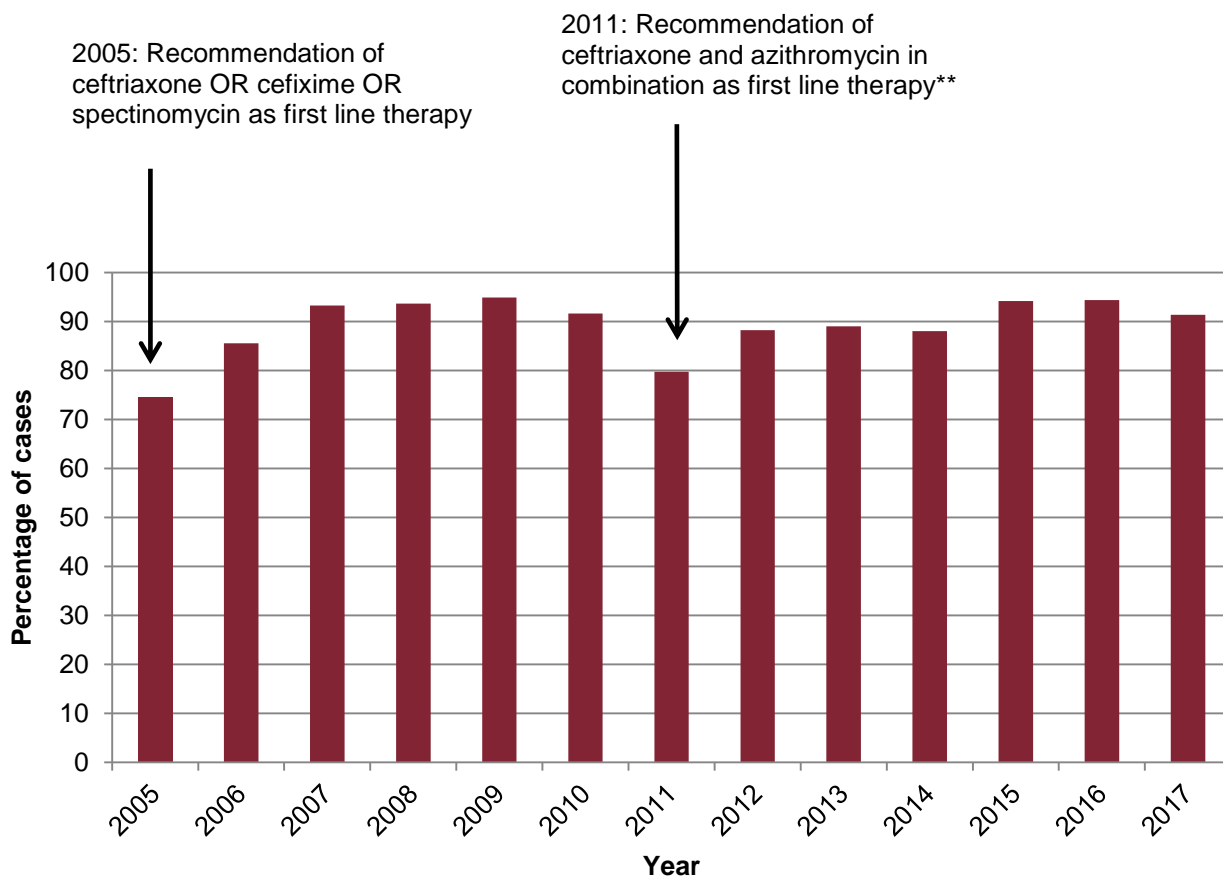
5. Prescribing practice

Antimicrobial prescription data was available for 92% of gonorrhoea diagnoses made in clinics in the sentinel surveillance sample in 2017 (3,002/3,270). Of these, 92% received ceftriaxone (500 mg IM) in combination with azithromycin (1 g oral) (as recommended by BASHH as first-line treatment in 2017) compared with 95% in 2016 (Figure 10). In 2017, 94% of heterosexual men and 90% of MSM received ceftriaxone (500 mg IM) in combination with azithromycin (1 g oral), compared with 93% of women.

Among patients prescribed other treatment (n=255):

- 22% (57/255) received combination therapy with azithromycin plus an antimicrobial other than ceftriaxone; the majority were treated with azithromycin and spectinomycin (75%; 43/57)
- 56% (143/255) were prescribed monotherapy, of whom 71% (101/143) received ceftriaxone, 17% (24/143) received azithromycin (2 g), and the remainder either spectinomycin, ciprofloxacin or ofloxacin
- 22% (55/255) received combination therapy with antimicrobials other than azithromycin, including 52 patients receiving ceftriaxone plus doxycycline

Figure 10. Antimicrobial prescribing practice: England and Wales, 2005 to 2017*



* Prior to 2016 the denominator includes only isolates within the sentinel surveillance system. In 2016, the denominator includes diagnoses made in GRASP clinics where prescription data was available.

** New treatment guidelines for gonorrhoea in the UK are currently under consultation (see the BASHH guidelines [webpage](#)), and recommend 1 g ceftriaxone monotherapy instead of ceftriaxone (500 mg IM) in combination with azithromycin (1 g oral).

6. Appendix

6.1 Methodology

6.1.1 Sentinel surveillance system

A total of 2,006 isolates of *N. gonorrhoeae* were sent to PHE from 24 participating English GUM clinics and 2 Welsh GUM clinics: 1,268 of these 2,006 were included in the 2017 GRASP analysis. Isolates not included in the analysis were either (i) not matched to clinical data/from a clinic in the sentinel surveillance system (285); (ii) duplicate isolates/isolates collected outside the collection period (1 July 2017 to 1 September 2017) (91); (iii) irretrievable, contaminated or did not grow on Diagnostic Sensitivity (DST) agar with lysed blood (362).

The complete GRASP methodology can be accessed [online](#).

6.1.2 Definitions of antimicrobial resistance

GRASP uses EUCAST breakpoints² to define susceptibility to a given antimicrobial.

Antimicrobial	MIC* threshold for resistance (mg/L)
Ceftriaxone	> 0.125
Azithromycin	> 0.5
High-level resistance to azithromycin**	>128
Cefixime	> 0.125
Ciprofloxacin	> 0.06
Penicillin	>1.0 and/or β -lactamase positive
Penicillinase producing <i>N. gonorrhoeae</i>	β -lactamase positive
Tetracycline	>1.0
Spectinomycin	>64

* MIC = minimum inhibitory concentration

** High-level azithromycin resistance is not defined by EUCAST but the definition in this table is recognised internationally

6.1.3 SGSS data extraction

Data on *N. gonorrhoeae* isolates tested for antimicrobial susceptibility in January 2017 to May 2018 were from SGSS. There are two sub-repositories within SGSS that hold data on antimicrobial susceptibility: the communicable disease reporting (CDR) repository and the antimicrobial resistance (AMR) repository. Data was extracted from both repositories and duplicate records were removed (ie 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 1 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 1 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 susceptible to cefuroxime it may be reported susceptible to ceftriaxone or cefixime. If, however, 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 was reported susceptible, the ceftriaxone or cefixime result was recorded as susceptible. Where the ceftriaxone or cefixime susceptibility results were missing and cefuroxime was reported resistant, 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 or azithromycin resistant by primary diagnostic laboratories were linked to the PHE national reference laboratory database based on available patient information. This was used to calculate the percentage of isolates successfully referred to and confirmed resistant (or not) by the PHE national reference laboratory.

Table 4. Characteristics of patients in the sentinel surveillance system, by gender and sexual orientation 2017

	Women	Het. men	MSM	Not reported	Total
Total (N)	165	229	839	35	1268
Total (%)	13.0	18.1	66.2	2.8	100.0
Patient residence	%				
London	37.0	40.6	73.7	65.7	62.7
Outside London	62.4	59.0	26.3	34.3	37.1
Not reported	0.6	0.4	0.0	0.0	0.0
Ethnicity					
White	48.5	37.1	69.0	25.7	59.4
Black Caribbean	7.9	14.0	2.3	0.0	0.0
Black African	3.0	11.4	2.7	5.7	4.4
Black Other	3.0	3.1	0.6	0.0	0.0
Asian (including Chinese)	3.6	7.0	4.8	8.6	5.1
Other Ethnic group	13.3	10.9	5.0	5.7	7.2
Mixed Ethnic group	16.4	15.3	12.8	51.4	14.7
Not reported	4.2	1.3	2.9	2.9	2.8
Age Group (years)					
13-19	23.0	7.9	2.3	8.6	6.2
20-24	32.7	28.4	14.5	2.9	19.1
25-34	33.9	39.7	44.2	17.1	41.3
35-44	4.2	10.9	22.8	14.3	18.0
≥45	1.8	10.0	11.6	5.7	9.9
Not reported	4.2	3.1	4.6	51.4	5.6
Symptoms					
Discharge and/or Dysuria	47.3	83.4	42.3	28.6	50.0
No Discharge and/or Dysuria	37.0	12.7	39.0	11.4	33.2
Not reported	15.8	3.9	18.7	60.0	16.8
Previously Diagnosed With Gonorrhoea					
Yes	5.5	9.2	17.6	11.4	14.4
No	89.7	87.3	77.4	37.1	79.7
Not reported	4.8	3.5	5.0	51.4	6.0
Concurrent STI**					
Syphilis	0.0	0.0	0.6	0.0	0.0
Chlamydia	34.5	23.6	18.1	11.4	21.1
Herpes	1.2	0.0	0.2	0.0	0.0
Warts	0.0	0.4	0.5	0.0	0.0
LGV	0.0	0.0	0.6	0.0	0.0
Hepatitis B	0.0	0.4	0.0	0.0	0.0
Hepatitis C	0.0	0.0	0.0	0.0	0.0
New HIV diagnoses	0.0	0.9	1.4	0.0	0.0
Site of Infection***					
Genital	59.4	78.2	12.0	11.4	30.1
Rectal	0.6	1.7	21.6	8.6	14.9
Throat	5.5	1.3	9.8	2.9	7.5
Other (not specified)	0.0	1.7	0.0	0.0	0.0
Multiple site of infection	27.9	13.5	51.0	22.9	40.5
Not reported	6.7	3.5	5.6	54.3	6.7
Test of cure					
Yes	61.1	49.8	67.1	28.6	62.1
No	18.2	26.2	15.3	8.6	17.4
Not reported	20.6	24.0	17.6	62.9	20.4
HIV Status					
Positive	3.0	2.6	25.1	20.0	18.1
Negative	84.2	85.2	68.4	28.6	72.4
Not reported/Unknown	12.7	12.2	6.4	51.4	9.5
Total Partners (past 3 months)					
0-1	41.2	33.6	15.3	11.4	21.8
2-5	24.2	36.7	22.2	5.7	24.6
6-10	1.2	1.7	3.1	5.7	2.7
11+	0.0	0.9	1.7	0.0	0.0
Not reported	33.3	27.1	57.8	77.1	49.6
Sex Abroad					
Yes	1.8	12.2	5.1	2.9	5.9
No	64.8	60.7	37.1	20.0	44.5
Not reported	33.3	27.1	57.8	77.1	49.6

** Numerator: patients in GRASP 2017 dataset with diagnosed concurrent STI, Denominator: all patients in GRASP 2017 dataset. Not all patients are tested for each STI.

*** Numerator: patients in GRASP 2017 dataset infected at site specified, Denominator: all patients in GRASP 2017 dataset. Not all patients are tested for gonorrhoea at each site. Data reported are for patients infected with at least the specified site, not exclusively this site.

Table 5. Antimicrobial resistance by patient characteristic for MSM, sentinel surveillance system: 2017

No isolates were resistant to ceftriaxone or spectinomycin in the 2017 sentinel surveillance collection. Data not included for cefixime due to small numbers.

	Total	Azithromycin		Ciprofloxacin		Penicillin		Tetracycline	
Total	839	88		332		80		456	
Characteristics	Total	n	row %	n	row %	n	row %	n	row %
Age Group									
13-19	19	-	-	11	57.9	2	10.5	12	63.2
20-24	122	17	13.9	51	41.8	15	12.3	55	45.1
25-34	371	40	10.8	133	35.8	32	8.6	206	55.5
35-44	191	17	8.9	92	48.2	20	10.5	118	61.8
≥45	97	13	13.4	30	30.9	9	9.3	54	55.7
Not reported	39	1	2.6	15	38.5	2	5.1	11	28.2
Ethnicity									
White	579	56	9.7	240	41.5	63	10.9	321	55.4
Black Caribbean	19	4	21.1	3	15.8	1	5.3	12	63.2
Black African	23	4	17.4	6	26.1	1	4.3	14	60.9
Black Other	5	1	20.0	3	60.0	-	-	3	60.0
Asian (including Chinese)	40	6	15.0	14	35.0	3	7.5	25	62.5
Other Ethnic group	24	2	8.3	7	29.2	1	4.2	12	50.0
Mixed Ethnic group	42	7	16.7	18	42.9	2	4.8	26	61.9
Not reported	107	8	7.5	41	38.3	9	8.4	43	40.2
Total Partners (past 3 months)									
0-1	128	8	6.3	54	42.2	13	10.2	67	52.3
2-5	186	12	6.5	69	37.1	14	7.5	106	57.0
6-10	26	4	15.4	13	50.0	2	7.7	16	61.5
11+	14	2	14.3	6	42.9	2	14.3	7	50.0
Not reported	485	62	12.8	190	39.2	49	10.1	260	53.6
Travel-associated sexual partnership									
Yes	43	6	14.0	16	37.2	6	14.0	22	51.2
No	311	20	6.4	126	40.5	25	8.0	174	55.9
Not reported	485	62	12.8	190	39.2	49	10.1	260	53.6
Symptoms									
Discharge and/or Dysuria	355	38	10.7	152	42.8	31	8.7	199	56.1
No Discharge and/or Dysuria	327	36	11.0	128	39.1	36	11.0	179	54.7
Not reported	157	14	8.9	52	33.1	13	8.3	78	49.7
Previously Diagnosed With Gonorrhoea									
Yes	148	14	9.5	58	39.2	21	14.2	81	54.7
No	649	73	11.2	258	39.8	57	8.8	362	55.8
Not reported	42	1	2.4	16	38.1	2	4.8	13	31.0
HIV Status									
Positive	211	21	10.0	94	44.5	24	11.4	120	56.9
Negative	574	65	11.3	215	37.5	52	9.1	316	55.1
Not reported/Unknown	54	2	3.7	23	42.6	4	7.4	20	37.0
Patient residence									
London	618	73	11.8	246	39.8	67	10.8	354	57.3
Outside London	221	15	6.8	86	38.9	13	5.9	102	46.2
Not reported	-	-	-	-	-	-	-	-	-
*** Numerator: patients in GRASP 2016 dataset infected at site specified, Denominator: all patients in GRASP 2016 dataset. Not all patients are tested for gonorrhoea at each site. Data reported are for patients infected with at least the specified site, not exclusively this site									

Table 5. Antimicrobial resistance (MICs) by patient characteristic for women and heterosexual men, sentinel surveillance system: 2017

No isolates were resistant to ceftriaxone or spectinomycin in the 2017 sentinel surveillance collection. Data not included for cefixime due to small numbers.

	Total	Azithromycin		Ciprofloxacin		Penicillin		Tetracycline	
	394	27		116		54		140	
Characteristics	Total	n	row %	n	row %	n	row %	n	row %
Age Group									
13-19	56	3	5.4	13	23.2	4	7.1	17	30.4
20-24	119	5	4.2	23	19.3	12	10.1	37	31.1
25-34	147	12	8.2	55	37.4	22	15.0	58	39.5
35-44	32	3	9.4	11	34.4	9	28.1	16	50.0
≥45	26	3	11.5	11	42.3	6	23.1	10	38.5
Not reported	14	1	7.1	3	21.4	1	7.1	2	14.3
Ethnicity									
White	165	16	9.7	55	33.3	23	13.9	65	39.4
Black Caribbean	45	2	4.4	6	13.3	5	11.1	10	22.2
Black African	31	1	3.2	6	19.4	4	12.9	11	35.5
Black Other	12	1	8.3	3	25.0	1	8.3	4	33.3
Asian (including Chinese)	22	1	4.5	9	40.9	5	22.7	9	40.9
Other Ethnic group	10	0	0.0	3	30.0	3	30.0	4	40.0
Mixed Ethnic group	47	1	2.1	11	23.4	3	6.4	14	29.8
Not reported	62	5	8.1	23	37.1	10	16.1	23	37.1
Total Partners (past 3 months)									
0-1	145	11	7.6	41	28.3	21	14.5	54	37.2
2-5	124	4	3.2	39	31.5	18	14.5	47	37.9
6-10	6	1	16.7	3	50.0	2	33.3	3	50.0
11+	2	0	0.0	2	100.0	1	50.0	2	100.0
Not reported	117	11	9.4	31	26.5	12	10.3	34	29.1
Sex Abroad									
Yes	31	4	12.9	18	58.1	10	32.3	18	58.1
No	246	12	4.9	67	27.2	32	13.0	88	35.8
Not reported	117	11	9.4	31	26.5	12	10.3	34	29.1
Symptoms									
Discharge and/or Dysuria	90	4	4.4	21	23.3	8	8.9	24	26.7
No Discharge and/or Dysuria	269	21	7.8	89	33.1	41	15.2	109	40.5
Not reported	35	2	5.7	6	17.1	5	14.3	7	20.0
Previously Diagnosed With Gonorrhoea									
Yes	30	2	6.7	7	23.3	2	6.7	7	23.3
No	348	24	6.9	106	30.5	51	14.7	131	37.6
Not reported	16	1	6.3	3	18.8	1	6.3	2	12.5
HIV Status									
Positive	11	1	9.1	2	18.2	1	9.1	6	54.5
Negative	334	22	6.6	98	29.3	45	13.5	118	35.3
Not reported/Unknown	49	4	8.2	16	32.7	8	16.3	16	32.7
Patient residence									
London	2	0	0.0	1	50.0	0	0.0	1	50.0
Outside London	154	16	10.4	57	37.0	31	20.1	68	44.2
Not reported	238	11	4.6	58	24.4	23	9.7	71	29.8
*** Numerator: patients in GRASP 2016 dataset infected at site specified, Denominator: all patients in GRASP 2016 dataset. Not all patients are tested for gonorrhoea at each site. Data reported are for patients infected with at least the specified site, not exclusively this site.									

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