Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

hpsc

National Guidelines for the Prevention and Control of Gonorrhoea and for minimising the impact of Antimicrobial Resistance in *Neisseria Gonorrhoea*

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The feedback received during the consultation exercise was very helpful and the sub-committee is most grateful to all those who took the time to read the draft document and to send their comments.

Recommendations

National multi-disciplinary forum

- There is a need for a national multi-disciplinary forum (microbiology, clinical, and public health) to advise on prevention, treatment, and control of gonorrhoea. The remit of the group should include monitoring the implementation of these guidelines and updating them, as required, in line with international evidence.

Surveillance and epidemiology of gonorrhoea and AMR in gonorrhoea

- Funding is required at local and reference laboratory level and at the Health Protection Surveillance Centre for gonorrhoea antimicrobial resistance surveillance (cephalosporin, azithromycin and other emerging), so that a representative national sample of isolates can be submitted for antimicrobial resistance testing, epidemiological data can be collected, and this information can be reviewed, analysed and regularly reported on, nationally and internationally.
- Provision of information to the Medical Officer of Health (MOH) on mode of transmission for all cases of gonorrhoea needs to be improved (http://www.hpsc.ie/).

Prevention of gonorrhoea

- Sexual health promotion:
  - Include a combination of approaches in programmes for sexually transmitted infection (STI) reduction (prevention, health promotion and individual well-being).
  - Sexual health promotion campaigns targeting various groups need to be aligned and coordinated within a nationally framed programme for maximum effect.
  - Ensure STI reduction programmes are ongoing and long-term.
  - Consideration needs to be given to a standardised policy in prisons to give prisoners access to free condoms, sexual health information and appropriate STI testing.
- Promotion of condoms:
  - Large-scale free distribution of condoms.
  - Free condom education and distribution scheme for young people, up to 25 years old. At present, there is a national condom distribution service through which services can access condoms (see http://www.crisispregnancy.ie/support-for-services/national-condom-distribution-service/ for further information).
  - Remove VAT on condoms.
- Sexual health messages:
  - Design mass media campaigns for target populations to promote positive sexual health behaviour change. These require political commitment.
  - Use social media, particularly with an interactive element, to positively change sexual health behaviour.
  - Provide health and education professionals with the knowledge and skills to deliver opportunistic sexual health messages.
  - Important sexual health messages need to be positively framed and to remain personal, pertinent and readily available.
  - Sexual health messages can include:
    - Always using a condom, correctly and consistently, particularly when having sex with new or casual sexual partners;
    - Avoiding overlapping sexual relationships and reducing the number of sexual partners;
    - Having regular sexual health tests, and treatment, if necessary.
  - Sexual health messages need to be targeted at specific groups to take account of different types of sexual relationships and behaviours.

Clinical management of gonorrhoea and partner notifications

- All cases of gonorrhoea should be managed by suitably qualified clinicians according to current national guidelines.
- Should a clinician diagnosing a case of gonorrhoea not have the required resources to comply with national guidelines the clinician should refer the case to a specialised STI service that is resourced to provide the required services, including partner notification.
- A process for quality assurance of STI services should be established.
- Resources should be in place to ensure that there is clinical capacity for timely STI testing for those who need it.
- In primary care, testing is advised for those who are symptomatic, those at high risk e.g. men who have sex with men, sex workers, sexual contact abroad, those who change partners frequently and contacts of cases.
- It is recommended that, if indicated and where feasible, culture specimens are taken **prior** to treatment.
- Patient follow-up after treatment with the recommended therapeutic regimen is essential to confirm resolution of symptoms, to exclude the possibility of reinfection and to pursue partner notification.
- Test of Cure is recommended for all cases of gonorrhoea to identify cases of treatment failure:
  - If asymptomatic, a nucleic acid amplification test (NAAT) should be taken two weeks after completion of therapy, followed by culture if NAAT is positive.
  - If symptomatic, test of cure with culture method should be performed at least 72 hours (between three to seven days) after completion of therapy. Additional testing with NAAT for increased sensitivity can be considered one week after culture if it is negative.
- Enhanced epidemiological surveillance of cases of high-level azithromycin resistant cases of gonorrhea should be undertaken.
- Partner notification should be undertaken in all cases of gonococcal infection.
- Appropriate training should be provided for those carrying out partner notification.
- New approaches to partner notification, including web-based partner notification should be assessed.

Laboratory diagnosis of gonorrhoea (*Neisseria gonorrhoeae*)

- A reference laboratory service for *N. gonorrhoeae* should be established in Ireland.
- Laboratory capacity for STI testing should be established in a way that provides timely and accessible STI testing for patients and health care providers.
- NAATs accredited to ISO 15189 standard should be the standard of care in the laboratory detection of *Neisseria gonorrhoeae*.
- Where possible, positive predictive value of test results should be critically appraised.
- Supplementary testing with a second gene target is recommended in most clinical settings (following consideration of the sample types as well as disease prevalence in the population being investigated).
- Microscopy, if available, is recommended to facilitate immediate diagnosis of gonorrhoea in symptomatic men.
- Culture is still an essential laboratory investigation as isolates are required for antimicrobial susceptibility testing and molecular typing. Results can inform individual case management as well as public health policies and strategies for control of gonorrhoea.
- Consideration should be given to the development of a laboratory policy of selective culture, such as culturing of specimens from high risk patients (e.g. attendees of STI clinics) and/or culturing of specimens taken from optimal sites (e.g. endocervical swabs in females and urethral swabs in males).
- Laboratories should be adequately resourced to perform the recommended tests such as NAATs, culture and

antimicrobial susceptibility testing. A survey of Irish laboratories' capacity and resources to provide the expected diagnostic standard of care for gonorrhoea should be carried out. A mapping exercise and needs assessment of STI diagnostics is one of the priority actions currently being undertaken by the HSE Sexual Health and Crisis Pregnancy Programme, through implementation of the Sexual Health Strategy.

- Test of Cure is recommended for all cases of gonorrhoea to identify cases of treatment failure.

Public Health response to suspected cephalosporin resistant *Neisseria gonorrhoeae*

- Where *N. gonorrhoeae* cephalosporin treatment failure is suspected by a clinician they should inform the local MOH promptly.
- In the event of suspected or confirmed *N. gonorrhoeae* cephalosporin treatment failure the MOH should convene an incident control team.
- Where a probable or confirmed case of cephalosporin resistant *N. gonorrhoeae* is identified further laboratory evaluation (culture and susceptibility testing and molecular typing) should be performed at a gonococcal reference laboratory.
- Enhanced surveillance information needs to be collected from all probable or confirmed cases of cephalosporin resistant *N. gonorrhoeae*.
- If the proportion of resistant strains obtained from tested samples is at a level of 5% or more, or when an unexpected increase below 5% is observed in key populations, a multi-disciplinary group (ideally the forum referred to above) should take steps to review and modify guidelines for STI treatment and management, while at the same time enhancing gonococcal surveillance.

1. Terms of reference, introduction and background

> *"The emergence, in N. gonorrhoeae, of decreased susceptibility and resistance to the 'last line' cephalosporins,...is cause for concern. Gonorrhoea has the potential to become untreatable in the current reality of limited treatment options.... The loss of effective and readily available treatment options will lead to significant increases in morbidity and mortality, as the future could resemble the pre-antibiotic era when there was a risk of death from common infections...."* [1, p4].

In response to the increasing concern nationally and internationally about the development of cephalosporin resistant (Ceph-R) *N. gonorrhoeae* and to World Health Organization (WHO) and European Centre for Disease Prevention and Control (ECDC) action plans, the antimicrobial resistance in *Neisseria gonorrhoeae* subcommittee of the Scientific Advisory Committee of the Health Protection Surveillance Centre was convened. The sub-committee first met in May 2014.

The terms of reference of the sub-committee are as follows:

To provide national guidelines for minimising the impact of antimicrobial resistance (AMR) in N. gonorrhoeae, including prevention, surveillance, clinical management, laboratory diagnosis and public health response.

The sub-committee agreed that it would use the terms of reference for the group to frame these guidelines and that the main sources for the development of the guidelines would be the following documents:

1. Global action plan to control the spread and impact of antimicrobial resistance in *Neisseria gonorrhoeae*. [1].
2. Response plan to control and manage the threat of multidrug-resistant gonorrhoea in Europe [2].
3. Gonococcal Resistance to Antimicrobials Surveillance Programme (GRASP) Action Plan for England and Wales: Informing the Public Health Response [3].
4. Cephalosporin-resistant *Neisseria gonorrhoeae* Public Health Response Plan [4].

The Antimicrobial Resistance in *Neisseria gonorrhoeae* Sub-Committee of the Scientific Advisory Committee of the Health Protection Surveillance Centre met on six occasions, between 01/05/2014 and 25/08/2016. There was a four week consultation period in 2016. The organisations consulted with are outlined in Appendix 1.

These guidelines must be implemented in the context of the National Sexual Health Strategy [5], and in the context of broader national and regional strategies for sexual transmitted infection (STI) prevention and control. The guidelines should be reviewed and updated in five years, or earlier pending changes in surveillance data.

1.1 Responses to emergence of AMR in gonorrhoea

In 2014 WHO published its first global report on surveillance of antimicrobial resistance [6]. In this, *N. gonorrhoeae* was listed as one of nine bacteria of international concern.

> *"It is anticipated to be only a matter of time before gonococci with full resistance to the third generation extended spectrum cephalosporins emerge and spread internationally"* [6, p29].

A "Global action plan to control the spread and impact of antimicrobial resistance in *Neisseria gonorrhoeae*" was published in 2012 [1]. This plan advocates the establishment of national STI guideline working groups and development, publication and dissemination of a national mitigation plan. Also in 2012, ECDC published its "Response plan to control and manage the threat of multidrug-resistant gonorrhoea in Europe" [2]. The plan details the response at European level and is designed as a guide for Member States when planning national interventions.

These plans have been developed in response to reports internationally of decreasing susceptibility to cephalosporins (especially oral cefixime) manifesting as clinical treatment failure. Clinical treatment failure with cefixime has been reported from Japan [7], Norway [8] and the United Kingdom (UK) [9]. In 2011, the first detected case of high-level resistance to injectable ceftriaxone, which also led to clinical treatment failure, was published [10].

In Ireland, in 2013, the first (three) cases of in-vitro cefotaxime resistance were reported [11]. One case had reduced susceptibility to ceftriaxone. All three cases were resistant to azithromycin and ciprofloxacin. Additionally, in 2015 Lynagh *et al.* reported two cases of gonorrhoea with a *N. gonorrhoeae* strain with high level azithromycin resistance (HL-AziR) (MIC >256mg/L) in Ireland [12]. There have been further cases reported in Ireland, and there is an ongoing outbreak of HL-AziR gonorrhoea in England [13, 14]. This first emerged in Leeds and the north of England in late 2014 [13]. It has since spread to the West Midlands and south of England, with 34 cases reported by April 2016 [14]. Initial cases were heterosexuals, but the later report suggested that there was evidence of HL-AziR spreading among men who have sex with men (MSM) by 2016. Therefore, the committee decided to also include epidemiological data on, and a protocol for surveillance of, HL-AziR in this report.

The WHO document "Global action plan to control the spread and impact of antimicrobial resistance in *Neisseria gonorrhoeae*" [1] recommends that to make a sustained difference in the continuing problem of multidrug-resistant *N. gonorrhoeae* infection, the following two overlapping goals must be met:

- broad-based control of drug resistance (prevention of the emergence of AMR in gonorrhoea).
- prevention of gonorrhoea;

Both should be approached in the wider context of global control of AMR.

1.2 Prevention of the emergence of AMR in gonorrhoea

Research in other jurisdictions indicates that indiscriminate antibiotic prescribing may be a problem [15]. Clinicians have a crucial role in preventing the spread of antimicrobial resistance through appropriate clinical management, partner notification services, and reporting cases of treatment failure [2].

In relation to use of antibiotics and appropriate management of cases of gonorrhoea WHO suggests the following strategies to reduce the emergence of AMR in *N. gonorrhoeae* [1].

- Early detection and diagnosis of gonococcal infections with appropriate treatment of cases and their partners;
- Advocacy for increased awareness on correct use of antibiotics among healthcare providers and among patients, particularly in key populations including MSM and sex workers;
- Appropriate selection of antibiotics for first-line treatment of gonorrhoea. Important considerations include:
  - high efficacy;
  - low cost;
  - acceptable toxicity;
  - microbial resistance that is unlikely to develop or can be delayed;
  - single dosage;
  - oral administration;
  - safety for use in women during pregnancy and lactation;
- Effective drug regulations and prescription policies;
- Research into and implementation of, as appropriate, alternative effective treatment antibiotic regimens for gonococcal infections.

The Irish College of General Practitioners (ICGP) has an e-learning module for GPs on STIs [16] which provides guidelines for clinicians working in primary care. This is an important resource for those working in primary care.

1.3 Gonorrhoea

Gonorrhoea is a STI caused by a Gram-negative bacterium *Neisseria gonorrhoeae.* It predominantly involves the mucosal surfaces of urethra, endocervix, rectum, pharynx and conjunctiva. There is a significant burden of gonococcal disease globally, with higher rates of infection in less developed countries in sub-Saharan Africa, Southeast Asia, Latin America and the Caribbean than in developed countries [17]. This public health problem is further compounded by the emergence and spread of antimicrobial resistance in *N. gonorrhoeae,* including third generation cephalosporin resistance [18].

In 2014, a total of 1,320 cases of gonorrhoea were reported in Ireland, giving a notification rate of 28.8/100,000 population. In the UK, a population-based study revealed prevalence rates amongst those aged 20 to 24 years to be 0.1% and 0.2% for men and women, respectively [19]. Gonorrhoea is also concentrated in certain core risk groups, such as MSM and young heterosexuals [20] and has been associated with deprivation and lower socioeconomic status [17, 21, 22]. In London in 2013, 65% of gonorrhoea cases were diagnosed in MSM, who constituted less than 2% of the London adult population. From 2010 to 2013, the number of gonorrhoea diagnoses in MSM increased three fold (rise of 222%) [22].

While more than 80% of genital site infections in men are symptomatic, up to 50% of women with endocervical infections can be asymptomatic [23]. Undetected or inadequately treated gonorrhoea can lead to complications such as prostatitis or epididymitis in men as well as salpingitis, pelvic inflammatory disease (PID), tubal infertility, or ectopic pregnancy in women. Gonorrhoea can also facilitate the transmission of HIV infection. Rates of human immunodeficiency virus (HIV) transmission in patients with gonorrhoea may be up to five times higher than in those without gonorrhoea [17].

2. Surveillance and epidemiology of gonorrhoea and AMR in gonorrhoea

Surveillance of AMR in *N. gonorrhoeae* is crucial for monitoring local, national and international trends in antimicrobial resistance. It can inform and shape public health policy for the control of gonococcal infections and containment of antimicrobial resistance.

The WHO Action Plan states that strengthened surveillance systems are needed in order to notify and investigate drug-resistant *N. gonorrhoeae* in a timely manner [1]. STI surveillance, including gonococcal antimicrobial susceptibility surveillance, conducted in a systematic and regular manner, enables the early detection of resistant microorganisms and monitors their spread among people and geographic areas. Drug-resistant infections can be verified and notified early and allow correct decisions to be taken about treatment of individual patients, as well as informing national and international treatment guidelines.

Current surveillance activities for gonorrhoea and for surveillance of AMR in *N. gonorrhoeae* in Ireland are described below. The epidemiology of AMR in *N. gonorrhoeae* in Ireland is described, as well as an analysis of current surveillance strengths and limitations, and recommendations for improvement.

2.1 Gonorrhoea notification

Gonorrhoea is a notifiable disease in Ireland under the Infectious Disease Regulations [24]; laboratory directors and clinicians are required to notify any cases detected to the local Medical Officer of Health (local Director of Public Health or Consultant in Public Health Medicine, MOH), who in turn notifies the Health Protection Surveillance Centre (HPSC). There is an agreed case definition for gonorrhoea [25] (Appendix 2). Up to 2013, the information available nationally was limited; aggregate information by gender, area and age group on a quarterly basis only.

National case based reporting of gonorrhoea commenced in January 2013; data from all laboratories and STI clinics on gonorrhoea is held in the national computerised infectious disease surveillance system, CIDR. National data on laboratory diagnosed cases of gonorrhoea is now comprehensive, since its inclusion in CIDR [26]. In addition, since 2014, for cases notified by laboratories, mode of transmission information and county of residence (if not provided by the laboratory) has been routinely requested from STI clinicians. This latter information is less comprehensive at present.

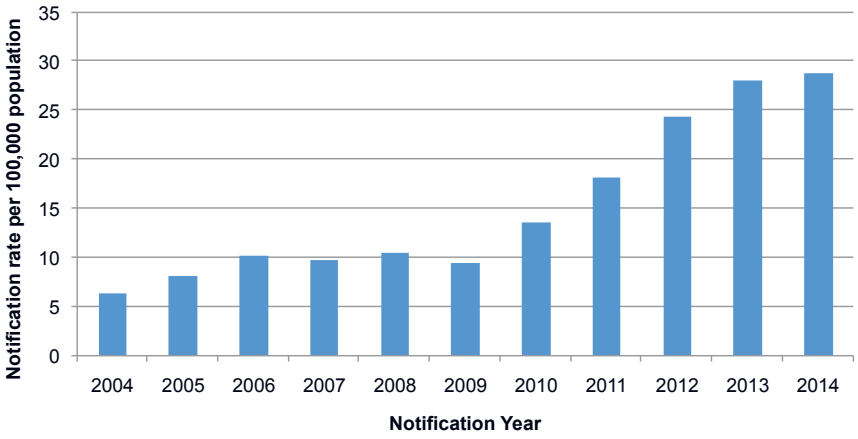
2.2 Epidemiology of gonorrhoea

Gonorrhoea is the second most common notifiable bacterial STI in Ireland, mainly affecting young people (aged 15-24 years) and MSM. The number of notifications of gonorrhoea has been rising in the past few years, but stabilised somewhat in 2014[1]. In 2014, a total of 1,320 cases of gonorrhoea were reported in Ireland, giving a notification rate of 28.8 per 100,000 population. Figure 1 shows the trend in gonorrhoea notifications from 2004 to 2014. The overall trend has increased by 200% between 2009 and 2014. The increase may be due to a number of factors, such as more sensitive diagnostic tests i.e. the nucleic acid amplification test (NAAT), increased testing of extragenital sites in MSM, increase in routine STI screening and ongoing high-levels of unsafe sexual behaviour. This increasing trend in gonorrhoea has been seen in other countries also. Latest figures for the UK show that between 2013 and 2014, there was a 19% increase in cases of gonorrhoea; 52% occurred in MSM, and 55% of cases occurred in young people aged 15-24 years [27]. In Europe, the number of cases of gonorrhoea increased by 58% between 2008 and 2012, with most countries reporting increasing trends. Rates in the European Union (EU) and European Economic Area (EEA; this incorporates the EU as well as Iceland, Liechtenstein and Norway) have increased since 2008, among both males and females; however there has been a more pronounced rise in rates among men [28].

1 Notifications of gonorrhoea in males increased in 2016. See www.hpsc.ie for latest data

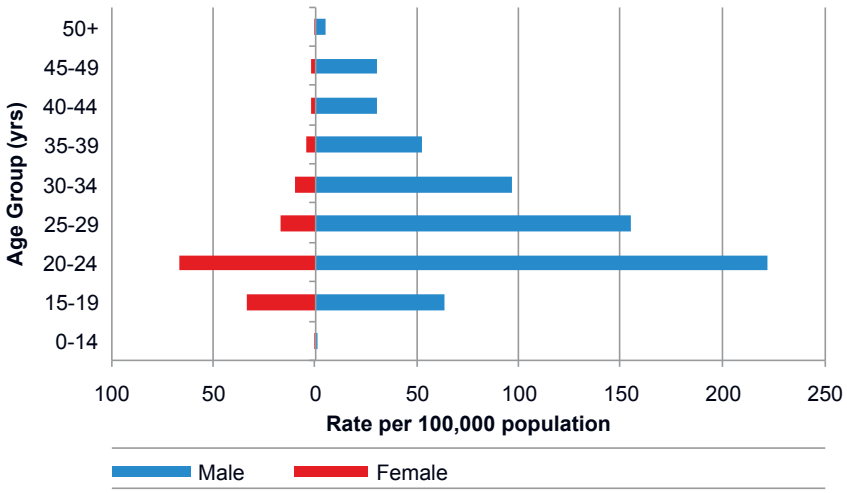
An upsurge in gonorrhoea occurred in the Health Service Executive (HSE) East region (Dublin, Kildare and Wicklow) in late 2012/2013, and a retrospective enhanced surveillance review of cases in the first quarter of 2013 was undertaken [20]. Over half of the cases were in MSM and 44% in heterosexuals (28% males and 16% females). The proportion of cases in MSM increased with increasing age, peaking in the 35-39 year age group, with 95% of the cases in this age group being MSM. Forty two percent (n=53) of MSM cases were born outside Ireland. Only 35% of the MSM cases were symptomatic. Thirteen per cent of cases were HIV positive. Fifteen per cent of cases had had an STI in the previous 12 months. Nearly two thirds of cases had pharyngeal infection (61%). One third of cases had infection at two or more sites. Cases in heterosexuals were significantly younger than MSM. Almost two thirds of the cases (62%) in those less than 25 years of age were heterosexual and approximately two thirds of cases were symptomatic.

Figure 1 Notification rates per 100,000 for gonorrhoea in Ireland 2004 - 2014



In all, a third (32%) of gonorrhoea cases notified in 2014 were among those aged between 20 and 24 years old and 71% were aged between 20 and 35 years old. The highest rate among males was in the 20-24 year old age group followed by the 25-29 year old group. The highest rate among females was also in the 20-24 year age group followed by the 15-19 year old age group (Figure 2). Mode of transmission was available for 419 (32%) of gonorrhoea notifications in 2014. Of the 419 cases, mode of transmission was reported as MSM for 71% of cases (n=297) and heterosexual for 29% (78 male and 44 female). This information on mode of transmission needs to be strengthened so that the effect of prevention and control interventions targeted to those groups most at risk can be evaluated.

Figure 2 Notification rates per 100,000 for gonorrhea cases notified in Ireland in 2014 by age group and gender



2.3 Surveillance of AMR in *N. gonorrhoeae*: Euro-GASP

Although there is currently no dedicated funding allocated for AMR surveillance, at either laboratory or HPSC level, Ireland participates in the European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP) [29]. This programme was established in 2009 by ECDC as a surveillance system across the countries of the EEA to monitor *N. gonorrhoeae* AMR in the EU/EAA.

The objectives of Euro-GASP are to:

- Develop and implement surveillance of gonococcal antimicrobial susceptibility to a range of therapeutically relevant antimicrobials in a timely manner to allow accurate information on trends in gonococcal AMR across Europe;
- Link susceptibility data with epidemiological information to inform prevention interventions;
- Ensure quality and comparability across countries, laboratories and samples through an external quality assurance (EQA) scheme for AMR testing;
- Provide training in gonococcal culture and antimicrobial susceptibility testing.

There are 21 countries participating in the network. Sentinel laboratories are chosen by individual member states based on local epidemiological patterns as well as convenience. Participating laboratories aim to test a minimum of 100 isolates per year. Isolates are selected from among consecutive patients during April/May and October/November each year. Testing was undertaken biannually until 2014 when it moved to annual testing. Laboratories can participate through decentralised testing, via supplying their own susceptibility test results, rather than submitting the samples for testing in the international reference laboratory hub. Laboratories are required to perform consistently well on EQA prior to moving from centralised to decentralised testing.

Euro-GASP detected the rapid spread of isolates with decreased susceptibility to cefixime in 2010 and 2011 across Europe [29]. Euro-GASP has also undertaken molecular epidemiological typing on a subset of the isolates within Euro-GASP using *Neisseria gonorrhoeae* multi-antigen sequence typing (NG-MAST) [30]. They found associations between antimicrobial resistance and molecular type.

Molecular typing work has been carried out in Ireland. Lynagh *et al.* published detailed characterisation of the first two high-level azithromycin resistant *Neisseria gonorrhoeae* cases in Ireland in 2015 [12]. They reviewed all available urethral isolates of *N. gonorrhoeae* (n=300) collected at St James's Hospital, Dublin from 2008-2014 and detected high-level resistance in two isolates. An association between antimicrobial resistance and molecular type in these two isolates was identified.

2.4 Report on Euro-GASP Ireland, 2010-2014

2.4.1 Isolate collection

2.4.1.1 Source of isolates

The Irish isolates for Euro-GASP come from a major STI clinic (87% of cases) and from GPs (12% of cases) who submit them to one laboratory in the HSE-Eastern region (St James's Hospital). The laboratory liaises with the STI clinic to get the epidemiological data for their cases which is then linked locally to the isolate data using the patient's medical record number (subsequently replaced with unique patient identifier for Euro-GASP in advance of submitting to HPSC who sends it to ECDC).

2.4.1.2 Sampling

The isolates are generally sampled consecutively but any isolates where one of the following phenotypic resistances has been detected are also included:

- β-Lactamase-positive
- Penicillin-Resistant
- Penicillin-Intermediate PLUS Ciprofloxacin-Resistant
- Ceftriaxone zone diameter ≤40mm

2.4.2 Antimicrobial susceptibility testing

Between 2010 and 2012, the laboratory in Ireland participated in centralised testing, i.e. they were asked to submit 110 isolates per year (55 isolates for each 3-month time period monitored: April-June and October-December) with the aim of retrieving and testing 100 isolates. Centralised testing was performed by Public Health England (Colindale).

In 2013, decentralised testing, in which the laboratory performed its own susceptibility testing, was first introduced for all Irish isolates reported to Euro-GASP.

In 2014, the collection period was changed from twice yearly as described above to just one continuous period, starting in August, until the 100 isolates were collected.

The following antimicrobials were tested:

- azithromycin
- ciprofloxacin
- spectinomycin
- cefixime
- ceftriaxone
- penicillinase production

All results were interpreted using European Committee on Antimicrobial Susceptibility Testing (EUCAST) breakpoints with the exception of azithromycin and ciprofloxacin which use more clinically relevant breakpoints as recommended by Euro-GASP (Table 1).

2.4.3 Limitations

The data presented here originate from one laboratory only and so the findings need to be interpreted with caution.

In general, the isolates were selected consecutively over the required study period; however, "non-consecutive" isolates with specific resistance profiles as described above were also included in the study sample. Thus the proportions of isolates with resistance to particular antibiotics may be over-estimated. The sample selected is not necessarily representative of the population from which it is taken (i.e. there are selection biases) and is not representative of the Irish population.

Table 1 Minimal Inhibitory Concentration breakpoints for specific antimicrobials tested

Antimicrobial	Guideline	MIC breakpoint (mg/L)		
		R ≥	I	S ≤
Azithromycin	Euro-GASP	1		0.5
Cefixime*	EUCAST	0.25		0.125
Ceftriaxone*	EUCAST	0.25		0.125
Ciprofloxacin	Euro-GASP	1	0.12-0.5†	0.06
Spectinomycin	EUCAST	128		64

* Decreased susceptibility reported as Intemediate (I) by Euro-GASP (in TESSy)
† Resistant according to EUCAST but recorded as I by Euro-GASP

2.4.4 Results

2.4.4.1 Number of isolates tested

In 2014, 1,320 notifications of gonorrhoea were made in Ireland via CIDR. In the same year 101 isolates were reported to Euro-GASP. This represents 8% of the total (Table 2) and is in accordance with the Euro-GASP aims of testing at least 5% of all cases reported nationally. Between 2010 and 2014, 7-9% of all cases have consistently been tested. However, the isolates tested are from just one laboratory and therefore the results are not geographically representative of national data.

Table 2 Number of *N. gonorrhoeae* isolates tested, number of gonorrhoea cases notified nationally and percentage of isolates tested nationally, 2010-2014

Year	Number of isolates tested	Number of cases notified	% isolates tested
2010	54	625	9%
2011	64	834	8%
2012	80	1108	7%
2013	103	1293*	8%
2014	101	1336*,†	8%

* Cases first notified via the Computerised Infectious Diseases Reporting (CIDR) system
† Provisional data

2.2.4.2 Patient demographics

The majority of gonococcal isolates (cases) were collected from samples from males (Table 3; 370 of 402; 92%).

The age range for all patients was from 16 to 63 years with a median of 27 years. For males (n=370) the age range was from 16 to 63 years with a median of 27 years. For females (n=32), the age range was from 18 to 63 years with a median of 22 years.

Table 3 Patient age distribution, 2010-2014

	2010-2014						
	Number	**Range**	**IQR**	**Mean**	**Median**	**Mode**	**<25 years**
All patients	402	16-63	23-34	28	27	23	143 (35.6%)
Gender							
Female	32 (8.0%)	18-63	20-26	25	22	19	21 (66%)
Male	370 (92.0%)	16-63	23-34	29	27	23	122 (33.0%)
Mode of transmission							
Heterosexual (female and male)	92 (22.9%)	16-63	21-28	26	24	21	47 (51%)
Female heterosexual	*28 (7.0%)*	*18-63*	*20-26*	*25*	*22*	*23*	*19 (68%)*
Male heterosexual	*64 (15.9%)*	*16-57*	*21-29*	*26*	*25*	*19*	*28 (44%)*
Men who have sex with men	255 (63.4%)	18-51	24-34	29	28	23	77 (30.2%)
Unknown	55 (13.7%)	18-63	23-37	31	28	20	19 (35%)

2.4.4.3 Mode of transmission

Between 2010 and 2014, the majority of cases (63.4%) were MSM with heterosexual transmission accounting for 22.9%. The mode of transmission for 13.7% of cases was unknown (Table 4).

2.4.4.4 Site of infection

Genital isolates accounted for the majority of cases (55.7%), followed by anorectal (22.4%) and pharyngeal (21.9%) isolates (Table 4).

2.4.4.5 Previously diagnosed cases

Between 2010 and 2012, 6-8% of cases had a previous diagnosis of gonorrhoea. This increased to 18% in 2013 and 22% in 2014 (Table 4).

2.4.4.6 Concurrent STIs

Between 2011 and 2014, the proportion of cases with a concurrent chlamydia infection increased from 8% to 19% (Table 4).

Table 4 Overall patient characteristics, 2010-2014

	2010	2011	2012	2013	2014	2010-2014
Total number of isolates	54	64	80	103	101	402
Gender						
Female	2 (4%)	6 (9%)	10 (12.5%)	10 (10%)	4 (4%)	32 (8.0%)
Male	52 (96%)	58 (91%)	70 (87.5%)	93 (90%)	97 (96%)	370 (92.0%)
Age (years)						
<25	13 (24%)	27 (42%)	41 (51%)	32 (31%)	28 (28%)	141 (35.1%)
>=25	41 (76%)	37 (58%)	39 (49%)	71 (69%)	73 (72%)	261 (64.9%)
Median	33	26.5	24	27	26	27
Mode of transmission						
Heterosexual (female and male)	12 (22%)	12 (19%)	24 (30%)	21 (20%)	23 (23%)	92 (22.9%)
Female heterosexual	2 (4%)	4 (6%)	10 (13%)	8 (8%)	4 (4%)	28 (7.0%)
Male heterosexual	10 (19%)	8 (13%)	14 (18%)	13 (13%)	19 (19%)	64 (15.9%)
Men who have sex with men	27 (50%)	42 (66%)	47 (59%)	68 (66%)	71 (70%)	255 (63.4%)
Unknown	15 (28%)	10 (16%)	9 (11%)	14 (14%)	7 (7%)	55 (13.7%)
Site of infection						
Anorectal	5 (9%)	20 (31%)	16 (20%)	23 (22%)	26 (26%)	90 (22.4%)
Genital	43 (80%)	33 (52%)	51 (64%)	47 (46%)	50 (50%)	224 (55.7%)
Pharyngeal	6 (11%)	11 (17%)	13 (16%)	33 (32%)	25 (25%)	88 (21.9%)
Previously diagnosed						
Yes	4 (7%)	5 (8%)	5 (6%)	18 (18%)	22 (22%)	54 (13.4%)
No	50 (93%)	58 (91%)	72 (90%)	84 (82%)	73 (72%)	337 (83.8%)
Unknown	0 (0%)	1 (2%)	3 (4%)	1 (1%)	6 (6%)	5 (1.7%)
Concurrent STIs						
Concurrent chlamydia	14 (26%)	5 (8%)	9 (11%)	13 (13%)*	19 (19%)*	41 (13.6%)†
Concurrent other STIs (not HIV)	4 (7%)	6 (9%)	0 (0%)	1 (1%)*	4 (4%)*	11 (3.7%)†
No concurrent STI	35 (65%)	31 (48%)	68 (85%)	89 (86%)	73 (72%)	223 (74.1%)
Unknown	1 (2%)	22 (34%)	3 (4%)	1 (1%)	6 (6%)	27 (9.0%)
HIV status						
Positive	0 (0%)	5 (8%)	7 (9%)	4 (4%)	11 (11%)	27 (6.7%)
Negative	0 (0%)	18 (28%)	68 (85%)	98 (95%)	82 (81%)	266 (61.2%)
Unknown	54 (100%)	41 (64%)	5 (6%)	1 (1%)	8 (8%)	109 (27.1%)

* includes one case with both concurrent chlamydia and syphilis;
† includes 2 cases with both concurrent chlamydia and syphilis

2.4.4.7 HIV status

In 2014, 11% of cases were HIV-positive (Table 4). This represents an increase from 4% in 2013. There were five gonorrhoea cases reported, all MSM, where the patient was HIV-positive and also had concurrent chlamydia infection.

2.4.4.8 Probable country of infection

Between 2012 and 2014, the probable country of infection was provided for the majority of cases (178 of 284, or 63%). Most of these (169, or 95%) were probably infected in Ireland. The nine cases probably infected outside of Ireland originated in six countries: the UK (n=3), Thailand (n=2) and one case each from the Netherlands, Pakistan, Poland and Romania. The mode of transmission was heterosexual for four cases and MSM for four cases.

2.4.4.9 Country of birth

Between 2011 and 2014, the country of birth was provided for the majority of cases (254 of 348, or 73%). Most of these (162, or 64%) were born in Ireland. Of the 92 cases born outside Ireland, 29 countries were represented, including Brazil (n=26), Poland (n=12), UK (n=8) and Venezuela (n=6). The majority of cases born outside of Ireland were MSM (n=80, or 87%).

In 2014, the country of birth was provided for 92% (93 of 101) of cases. The majority were born in Ireland (n=56), but 37 cases from patients born in 17 other countries (including 11 from Brazil and five each from the UK and Venezuela) were reported. The majority of cases born outside of Ireland were MSM (n=31, or 84%).

2.4.4.10 Antimicrobial resistance patterns

A summary of the numbers of isolates tested and their susceptibility to key antibiotics is provided in Table 5 and Figure 3.

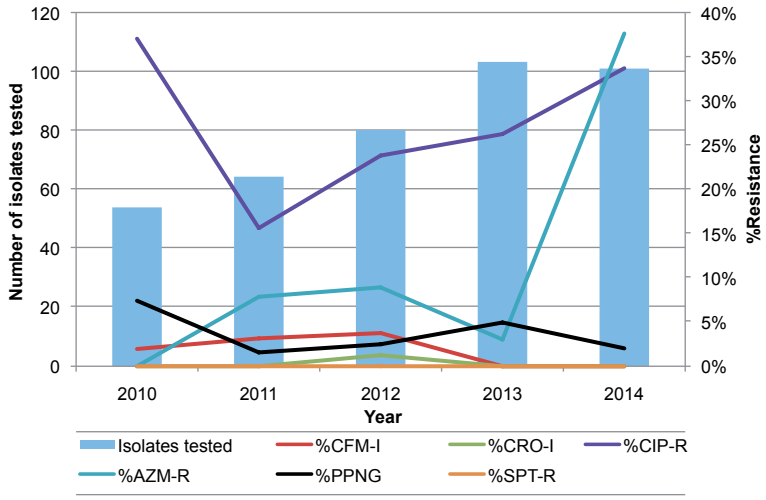
A more detailed discussion of resistance of *N. gonorrhoeae* to individual antibiotics from 2010-2014, and providing the European context is provided in Appendix 3.

Table 5 Antimicrobial susceptibility to key antibiotics (numbers and proportions that are resistant or have decreased susceptibility, i.e. with intermediate levels of resistance), 2010-2014

		Number antibiotic-resistant / proportion antibiotic-resistant											
Time period	**Isolates tested**	**CFM-I**	**%CFM-I**	**CRO-I**	**%CRO-I**	**CIP-R**	**%CIP-R**	**AZM-R**	**%AZM-R**	**PPNG**	**%PPNG**	**SPT-R**	**%SPT-R**
2010	54	1	2%	0	0%	20	37%	0	0%	4	7%	0	0%
2011	64	2	3%	0	0%	10	16%	5	8%	1	2%	0	0%
2012	80	3	4%	1	1%	19	24%	7	9%	2	3%	0	0%
2013	103	0	0%	0	0%	27	26%	3	3%	5	5%	0	0%
2014	101	0	0%	0	0%	34	34%	38	38%	2	2%	0	0%
2010-2014	**402**	**6**	**1.5%**	**1**	**0.2%**	**110**	**27.4%**	**53**	**13.2%**	**14**	**3.5%**	**0**	**0.0%**

CFM-I, cefixime-intermediate; CRO-I, ceftriaxone-intermediate; CIP-R, ciprofloxacin-resistant; AZM-R, azithromycin-resistant; PPNG, penicillinase-producing *N. gonorrhoeae*; SPT-R, spectimomycin-resistant

Figure 3 Numbers of *N. gonorrhoeae* isolates tested and proportions of isolates with resistance or decreased susceptibility (i.e. with intermediate levels of resistance) to key antibiotics, 2010-2014



CFM-I, cefixime-intermediate; CRO-I, ceftriaxone-intermediate; CIP-R, ciprofloxacin-resistant; AZM-R, azithromycin-resistant; PPNG, penicillinase-producing *N. gonorrhoeae*; SPT-R, spectimomycin-resistant

In summary, resistance levels in Ireland are low compared with the Euro-GASP data (see limitations highlighted earlier):

- No reduced susceptibility (or intermediate resistance) to cefixime and ceftriaxone reported for past two years (2013 and 2014);
- No resistance to spectinomycin reported since surveillance began in 2010;
- Increase in azithromycin resistance reported in 2014, but the majority of isolates (37 of 38) were at the resistance breakpoint (Minimum Inhibitory Concentration, MIC = 1 mg/L) and no treatment failures were reported from these cases;
- Increase in previously diagnosed cases in 2013 and 2014 compared with the period 2010-2012;
- Increase in cases with a concurrent STI in 2014;
- Increase in HIV-positive status in 2014 including five cases where the patient had a concurrent chlamydia infection.

2.5 High level azithromycin resistant (HL-AziR) gonorrhoea in Ireland (2011-2016)

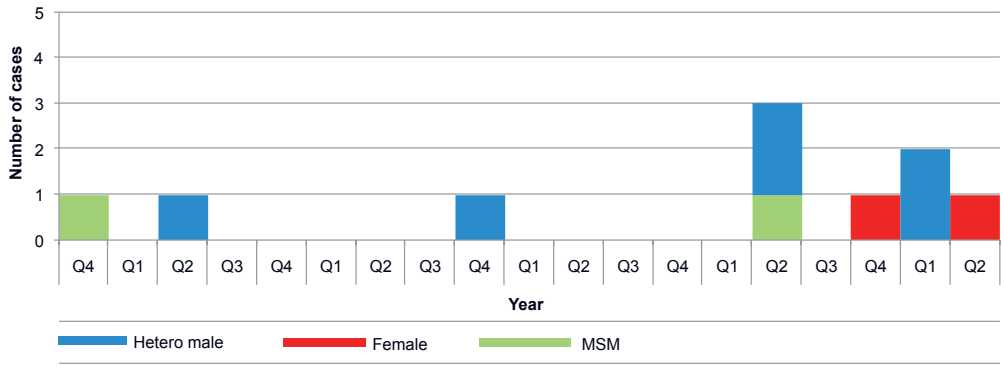
In Ireland, a total of 10 cases of high-level azithromycin resistant (HL-AziR) gonorrhoea have been reported since 2011, with three cases reported in the first half of 2016 (Figure 4). Surveillance forms were distributed to clinicians for six cases notified within the past year, to date, 66% of which have been completed. Data on the others have been collated from EURO GASP upload data (n=4) and initial notification data provided to Departments of Public Health (n=2). HPSC has convened a group to monitor and make recommendations in relation to the surveillance of HL-AziR gonorrhoea in Ireland with representation from clinical microbiology, laboratory, public health, and HPSC. As of September 2016, enhanced epidemiological surveillance forms and mechanisms to gather and collate information to monitor HL-AziR gonorrhoea are in development.

In summary:

- There were two cases in females and eight in males. The median age is 20 years (range 18 to 35 years). Sexual orientation is reported as MSM for two of the male cases (20%), heterosexual for seven cases (70%) and is missing for one case.
- Nine of the cases were reported from the GUIDE clinic and one from the Midwest via Public Health England.
- Site of infection was reported as urethra for four cases (40%), pharynx for three (30%) and rectum for one. Site of infection is missing for two others.
- Of the six cases for whom surveillance forms have been requested:
  - County of residence is available for four cases, three of whom live in Dublin, the fourth in Kildare.
  - Four cases were reported as symptomatic, one asymptomatic and unknown for one.
  - Two cases have been successfully treated and have had a negative test of cure. Two cases were treated but have not had a negative test of cure. These data are missing for the other two cases.
  - A total of six partners have been reported for four cases. Only one contact has been contacted, treated and has had a negative test of cure.

During the period 2010-2015, details of six isolates with HL-AziR have been reported to EURO GASP. One isolate was reported each year for the period 2011-2013 and three in 2015. None was reported in 2014.

Figure 4 Epidemiological curve of HL-AziR gonorrhoea in Ireland by sexual orientation, 2011-2016



Recommendations

- Funding is required at local and reference laboratory level and at HPSC for gonorrhoea AMR surveillance (cephalosporin, azithromycin and other emerging), so that a representative national sample of isolates can be submitted for AMR testing, epidemiological data can be collected, and this information can be reviewed, analysed and regularly reported on, nationally and internationally.

- Provision of information to the MOH on mode of transmission for all cases of gonorrhoea needs to be improved (http://www.hpsc.ie/).

3. Prevention of gonorrhoea

This section explores prevention strategies to reduce transmission of gonorrhoea so that the subsequent chance of AMR transmission will be reduced. A meta-analysis of sexual health interventions found that change in knowledge, attitudes and behaviours can happen if they include a combination of approaches that are appropriately placed within the overall context of prevention, health promotion and individual well-being [31] (Appendix 4).

The arguments are presented below for free-access to condoms and to STI-testing as proven interventions to prevent transmission of gonorrhoea and are recommended. However, knowledge of STIs and condom use skills alone is not enough to equip people with the means to reduce STI risk. For example, interventions need to place greater emphasis on: entering and maintaining healthy relationships and behaviours; awareness of risks attached to different forms of concurrency and how concurrency arises; skills to redress power imbalances and building self-esteem [32]. Consideration needs also to be given to the influence of alcohol and drugs on sexual behaviours.

Alongside clinical responses, promoting safer sexual and health-care-seeking behaviour among individuals is vital. Thus, population level awareness-raising, as well as high risk-group-tailored interventions, is suggested. Gonorrhoea is transmitted through unprotected vaginal, oral or anal intercourse or genital contact with an infected sexual partner. Therefore, safer sex programmes that promote condom use and regular STI testing are crucial. Gonorrhoea with short-lived, high transmission probability means that it is, generally, not the number of acts of unprotected sexual intercourse but the number of sexual partners that is most relevant from a public health perspective [33].

3.1 Condom use

For those engaging in any form of sexual behaviour, coital intercourse, anal or oral sex, the use of male condoms remains a critical component of safer sexual practice. Condoms are the most commonly used safer sex mechanism among adolescents [34, 35, 36]. Young people tend to have concurrency of partners with short time frames between relationships and so gonorrhoea may be more of a risk.

A recent study of first time patients in Cork found that a major risk factor of STIs among 13-19 year old males was only sometimes or never using condoms [37]. Male condoms are relatively easily accessible and available to everyone; there is no need for a prescription [38].

VAT on condoms makes Irish-bought condoms the most expensive in Europe. The Irish Study of Sexual Health and Relationships found cost was one of the reasons given for not using condoms, alongside lack of education and awareness of the risks [39]. As part of an ongoing commitment to improving young adults' sexual health in the UK, Public Health England and Brook (the largest young people's sexual health charity in the UK) support condom-card schemes. Condom-card schemes, such as C-Card, are schemes which provide free condoms to young people who are registered with them and have received education on their use. They aim to ensure easy access to sexual health advice and free condoms for young people and could be replicated in Ireland.

One of the most difficult tasks for educators is facilitating the personalisation of risk into daily encounters, especially within the context of steady relationships [40]. People's sense of invulnerability and belief in their own ability to successfully assess risks becomes validated when they participate in risky sexual practices and appear to survive unscathed. This is exacerbated by the fact that gonorrhoea may be asymptomatic.

A Cochrane systematic review found behavioural interventions for young women which aim to promote sexual behaviours protective of STI transmission can be effective, primarily at encouraging condom use [41].

Intentions to use condoms with casual sexual partners can be increased through developing skills around how to initiate condom use [42]. In addition, targeted interventions for high risk individuals will be more effective once the variables related to their inaccurate risk perceptions are understood. "*Feelings of love may override an objective evaluation of risk*" [43]. Perceived risk may decrease over the duration of a relationship even if the risk behaviour, i.e. unsafe sex, continues.

3.2 Regular STI tests

The value of regular STI testing for the sexually active population and especially for high risk groups is clear. Evidence from elsewhere indicates that by encouraging STI testing, safer sexual practices are likely to ensue. For example, in the UK, following the 2014 National Chlamydia Screening Programme, a web survey found that many respondents reported that testing had an impact on their knowledge and/or their sexual risk behaviour:

- 66% more likely to test again in future;
- 62% more likely to use condoms with new partner;
- 59% know how to avoid chlamydia in future;
- 30% more likely to have fewer sexual partners [44].

3.3 Changing condom-use and STI testing behaviour

Evidence suggests that the following characteristics are key elements for success in changing or establishing behaviours like condom use and STI testing:

- Using theoretical models in developing interventions, for example, social cognitive frameworks such as the health belief model and the theory of reasoned action [43].
- Using multiple levels of awareness raising and information sharing, for example:
  - Relationship and Sexuality Education (RSE) programmes in schools and other centres of learning;
  - Media campaigns (social media e.g. Twitter and posters with high visibility);
  - Health care settings with posters and health care professional input;
  - Clear political leadership as, for example, the introduction of the Irish Sexual Health Strategy;
  - Increased and advertised sexual health resources;
  - Clear Department of Justice policy on safer sex in prisons (e.g. in the UK, The Howard League of Penal Reform, 2015 [45]).
- Providing targeted and tailored information, in terms of sex, age, culture, sexual identity and orientation. For example, the Gay Health Network's 'Luv Bugs' project targeting MSM to raise awareness about increasing gonorrhoea infections, testing and prevention. A similar campaign is needed in Irish prisons for more than just 'pre-release courses'.
- Using needs assessments and formative research. Formative research can "guide development and evaluation of interventions to enhance sexual health communication within partnerships and within social networks, as a potential harm reduction strategy to foster healthier partnerships" [46].
- Providing basic accurate information through clear, unambiguous messages, for example, through RSE education in schools or the Irish OMG campaign 2013-2014 (Appendix 5).
- Using behavioural skills training, including self-efficacy, so that individuals feel confident to:
  - buy condoms,
  - ask that condoms be used,
  - put them on effectively, and to
  - go for STI screening.
- Joining up services with community provisions, e.g. situate sexual health services in accessible community settings.
- Addressing peer norms and social pressures, for example, work with voluntary and support agencies (NGOs) for high risk groups, as well as the educators of young people, to challenge heteronormative and sexualised notions about relationships.

Long-term follow-up is needed as most changes in health behaviour need constant reinforcement [47].

Social marketing is a useful tool for sexual health promotion e.g. increasing condom use. Social marketing seeks to develop and integrate marketing concepts with other approaches to influence behaviors that benefit individuals and communities for the greater social good [48].

3.4 Media campaigns

In order to effect risky sexual behaviour change, awareness of AMR in gonorrhoea needs to increase; the media can increase awareness quickly and effectively [49]. When public discussion is likely to facilitate the educational process, media messages can be emotional and thought provoking; they can be targeted at many different levels, stimulating discussion and so expand the impact of a message. When the behavioural goals are relatively easy to understand i.e. condom use and regular STI testing, mass media campaigns have been effective when supported by political commitment, policies and educational interventions (e.g. Swiss campaigns). Until recently such awareness-raising interventions have been expensive. New media channels such as Twitter, Snapchat, Facebook, Instagram and blogging, create possibilities for the widest possible exposure in the delivery of health-related information with relatively little cost.

Social media provides a relatively inexpensive way to directly access individuals in non-intrusive ways, as well as the technical ability to provide tailored information. Swanton *et al.*'s (2015) meta-analysis found that new media interventions can lead to significant increases in positive sexual health behaviours in non-clinical populations [50]. Interactivity of the intervention, target population and study design influenced the efficacy of interventions on condom use, whereas intervention duration influenced sexually transmitted infection testing. Interventions aimed at improving condom use were more successful when an interactive component was used. Further research was suggested to explore how best to reach specific high risk populations [50].

Effective media campaigns are usually one element of broader sexual health promotion programmes with mutually reinforcing components:

- Mobilising and supporting local agencies and professionals who have direct access to individuals within the target population;
- Bringing together partnerships of public, voluntary and private sector bodies and professional organisations;
- Informing and educating the public, but also setting the agenda for public debate about the topic, thereby modifying opinion surrounding it;
- Encouraging local and national policy changes so as to create a supportive environment within which people are more able to change their behaviour.

Public health campaigns need to be aligned, with increased involvement of NGOs, with government and health organisations.

3.5 Reframing the sexual health messages

Prevention messages need to be targeted at every sexually active man and woman, and those who are not yet sexually active. With an increased awareness of risks, individuals may postpone sexual intercourse and/or be better able to resist peer pressure to engage in activities with which they are not comfortable. This includes the identified high risk population groups (MSM, prisoners, young people and sex workers) to reduce their risk of getting and transmitting gonorrhoea.

The way sexual health knowledge and information is framed in its delivery could be altered to make it personal rather than general; otherwise the information will be stored in the reservoir of objective knowledge that has little or nothing to do with the individual [43, 51]. Important sexual health messages need to remain personal, pertinent and readily available if or when sexually charged situations arise.

In medical literature the effect is well documented; showing that positive framing in terms of survival rates lead to "*risk-averse*" choices while negative framing in terms of mortality rates increase *"risk tolerant"* decision-making [52]. Such framing effects appear to be similar to the negative effects of fear in health promotion media messages [53]. The limited effect of public sexual health campaigns has been blamed on the emphasis on the negative consequences of sexual activity; reframing messages with an emphasis on the pleasure in using condoms (both male and female) alongside safer sex messages, is more effective for consistent condom use [54].

In addition, if interventions target specific groups in order to take into account the types of relationships (steady or casual) and the meaning of the relationships and sex itself they will be more effective. Below are two examples of slogans with this in mind:

"I care about you therefore I will use a condom",
or, for casual sex
"Feel good about condoms, carry them with you and use them: you are worth it." [55].

3.6 At risk population groups

MSM and young heterosexual men and women were two population groups identified by the Gonorrhoea Control Group (investigating an upsurge of gonorrhoea cases in the East and South-East of Ireland in 2011-2012) as requiring special consideration [20]. The HSE Gay Men's Health Service and various non-government organisations, as well as the HSE funded Man-to-Man project, all run sexual health promotion campaigns. These need to be aligned and coordinated.

There is currently no evidence around "prison sex" in Irish prisons but the authors advocate additional support for prisoners, as a highly vulnerable population. This includes a need for access to free condoms, sexual health information and appropriate STI testing.

3.7 Informing professionals involved in sexual health services

The HSE course 'Foundations in Sexual Health Promotion' was developed by HSE South in Cork and is now being rolled out in Kilkenny, Carlow and Galway. Once evaluation is completed (by Trinity College, Dublin) it is possible that this course, delivered over five months, could be the basis for health and education professionals to gain better understanding and skills to deliver opportunistic sexual health messages; including the importance of safer sex and regular STI testing to their clients throughout the life course i.e. young and old.

Recommendations

- Sexual health promotion:
  - Include a combination of approaches in programmes for STI reduction (prevention, health promotion and individual well-being).
  - Sexual health promotion campaigns targeting various groups need to be aligned and coordinated within a nationally framed programme for maximum effect.
  - Ensure STI reduction programmes are ongoing and long-term.
  - Consideration needs to be given to a standardised policy in prisons to give prisoners access to free condoms, sexual health information and appropriate STI testing.
- Promotion of condoms:
  - Large-scale free distribution of condoms.
  - Free condom education and distribution scheme for young people, up to 25 years old e.g. a condom card scheme in Ireland. At present, there is a national condom distribution service through which services can access condoms. See http://www.crisispregnancy.ie/support-for-services/national-condom-distribution-service/ for further information.
  - Remove VAT on condoms.
- Sexual health messages:
  - Design mass media campaigns for target populations to promote positive sexual health behaviour change. These require political commitment.
  - Use social media, particularly with an interactive element, to positively change sexual health behaviour.
  - Provide health and education professionals with the knowledge and skills to deliver opportunistic sexual health messages.
  - Important sexual health messages need to be positively framed and to remain personal, pertinent and readily available.
  - STI messages can include:
    - Always using a condom, correctly and consistently, particularly when having sex with new or casual sexual partners.
    - Avoiding overlapping sexual relationships and reducing the number of sexual partners.
    - Have regular sexual health testing; by normalising testing and making it more widely available, those with STIs can be promptly treated so reducing the pool of infection.
    - Where to access services and supports.
  - Sexual health messages need to be targeted at specific groups to take account of different types of sexual relationships and behaviours.

4. Clinical management of gonorrhoea and partner notifications

The symptoms, complications, investigations, treatment and partner notification advice for cases of gonorrhoea in men and women and of gonococcal conjunctivitis in neonates is outlined in Table 6. In primary care, testing is advised for those who are symptomatic, contacts of cases and those at high risk (e.g. MSM, sex workers, sexual contact abroad or sex with someone from abroad, those who change partners frequently). It is recommended that, in all cases for whom treatment is being prescribed, specimens for culture are taken prior to treatment. The management of gonococcal conjunctivitis in adults and in neonates is outlined in more detail in Appendix 6.

4.1 Uncomplicated anogenital and pharyngeal gonorrhoea

Single-dose therapy is the recommended treatment for gonococcal infections, to ensure compliance. Treatment of uncomplicated anogenital and pharyngeal gonorrhoea in adults including in those with cephalosporin allergy is outlined in Table 7.

Patient follow-up after treatment with the recommended therapeutic regimen is also recommended as it is essential to confirm resolution of symptoms, to exclude the possibility of reinfection and to pursue partner notification (PN) (see Section 4.3). Test of Cure (ToC) is the retesting for gonorrhoea from the site of initial infection to determine whether the patient has been cured following treatment. All patients should have a ToC taken from the site of initial gonococcus positive after completion of antibiotics.

If asymptomatic, NAAT should be taken two weeks after completion of therapy, followed by culture if NAAT is positive.

For those with persistent symptoms or signs, testing using culture should be performed at least 72 hours after therapy. Additional testing with NAAT for increased sensitivity can be considered one week after ToC, if culture is negative.

Table 6 Symptoms, complications, investigations, treatment and partner notification advice for cases of gonorrhoea

	Symptoms	Specimen collection	Complications	Partner notification	Treatment	Further investigation
Men	***Urethral infection***		Epididymo-orchitis (uncommon) Prostatitis (uncommon) Disseminated gonococcal infection (uncommon)	Symptomatic urethral infection: all partners in past two weeks or last partner, if longer Infections at other sites: all partners in past three months Asymptomatic infections: all partners in past three months	Uncomplicated anogenital/ pharyngeal infection in adults*: Indications: 1. Empirical treatment of those with symptoms/signs highly suggestive of gonococcal infection (have tests at same time) 2. Positive diagnostic test 3. Recent sexual partner with confirmed infection (individual assessment) Ceftriaxone 500mg IM, single dose PLUS Azithromycin 1g orally, single dose * See Appendix 6 for treatment of adult gonococcal conjunctivitis See Table 7 for alternative regimens	Where feasible take culture and NAAT from all patients presenting with symptoms/ signs of gonorrhea before treating empirically Where feasible, culture all NAAT positive cases before treatment All treated cases should have a test of cure (ToC). If asymptomatic, NAAT from site initial positive result two weeks after treatment. If symptoms or signs persisting, culture, at least 72 hours after completion of treatment. Supplementary NAAT for increased sensitivity can be considered after one week if culture is negative. Full STI screen including hepatitis B (and A and C where indicated), syphilis and HIV Vaccination of MSM against hepatitis A and B
	Urethral discharge and/or dysuria, starting within 2-5 days of exposure	First pass urine preferred sample for NAAT Urethral swab for microscopy and culture where feasible				
	Rectal and pharyngeal infection					
	Often asymptomatic	Rectal and pharyngeal swabs for NAAT as determined by sexual history/ symptoms Where symptomatic or a contact take culture at same time				
	Conjunctival infection					
	Red eye, swelling and exudate	Swab from lower eyelid after removal of excess exudates for NAAT and culture (where feasible)				
Women	***Endocervical infection***		Pelvic inflammatory disease (PID) (may occur in 10-20% of women with endocervical gonorrhoea and may be asymptomatic) PID may lead to infertility, ectopic pregnancy and chronic pelvic pain Disseminated gonococcal infection (uncommon)	All partners in past three months		
	Often asymptomatic (up to 50%), may present as abnormal vaginal discharge Rarely, intermenstrual bleeding or postcoital bleeding	Vulvovaginal (self taken or provider taken) for NAAT; endocervical swab for NAAT Endocervical swab for culture Urine **NOT** optimal specimen type for women				
	Rectal and pharyngeal infection					
	Often asymptomatic	Rectal and pharyngeal swabs for NAAT as determined by sexual history/ symptoms Where symptomatic or a contact take culture at same time				
	Conjunctival infection (as per men above)					
Neonates	Conjunctival infection with red eye, swelling and exudate	Swab lower eyelid after removal of excess exudate	Rupture of the globe and blindness (uncommon) Disseminated gonococcal infection (uncommon)	Test mother for chlamydia and gonorrhoea	See Appendix 6	

Table 7 Treatment of uncomplicated anogenital and pharyngeal gonorrhoea in adults, including those with cephalosporin allergy

Uncomplicated anogenital and pharyngeal gonorrhoea in adults **(1st line for cervical, pharyngeal, rectal and urethral gonorrhoea)**	**Uncomplicated anogenital gonorrhoea in adults with cephalosporin allergy*** **OR** **Previous immediate and/or severe hypersensitivity to penicillin or other ß-lactam***	**Pharyngeal gonorrhoea† in adults with cephalosporin allergy*** **OR** **Previous immediate and/or severe hypersensitivity to penicillin or other ß-lactam***
Ceftriaxone 500mg IM stat **and** Azithromycin 1g PO stat	Ciprofloxican 500mg PO stat (when known to be sensitive to quinolones) **OR** Spectinomycin 2g deep IM stat **OR** Azithromycin 2g PO stat (when known to be susceptible to azithromycin).	Ciprofloxacin 500mg PO stat‡ (when known to be sensitive to quinolones) **OR** Azithromycin 2g PO stat (when known to be susceptible to azithromycin)

*This should be administered in a specialist setting and, if not feasible, only following specialist advice, especially where the sensitivity of the isolate is not known and a symptomatic person is being treated empirically.

† Single dose treatment with Spectinomycin has poor efficacy in treatment of gonococcal infection of the pharynx

‡ In practice additional doses of Ciprofloxacin are generally given in this situation because of poor penetration of Ciprofloxacin into the pharynx

4.2 Cephalosporin treatment failure

Cases who present with:

- persistent genital discharge following treatment with a recommended cephalosporin regimen OR
- who are asymptomatic with a positive test-of-cure (Gram stain, culture or NAATs) following treatment with a recommended cephalosporin regimen

AND

- have had sexual contact since treatment outruled.

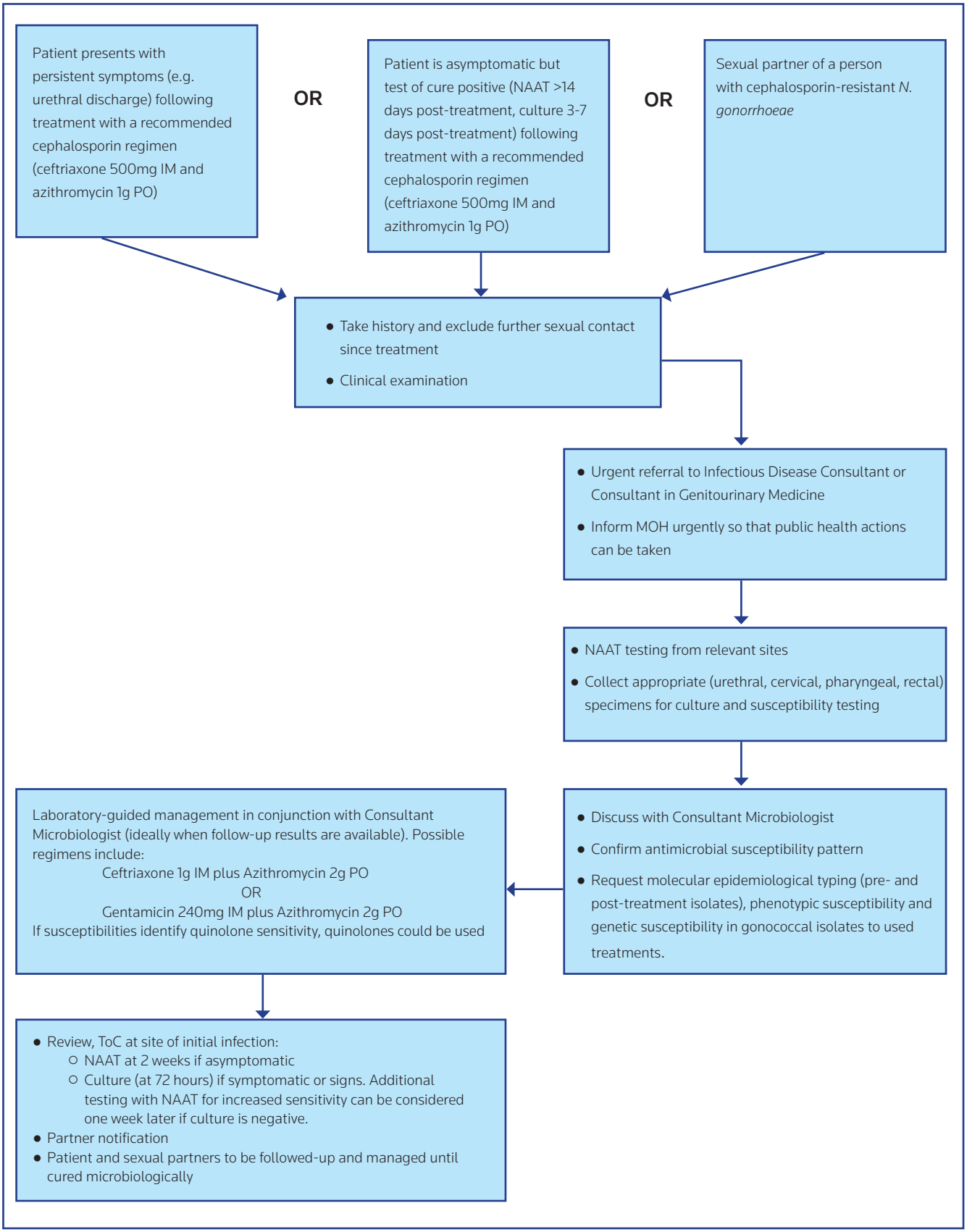
should be referred urgently to an Infectious Diseases Consultant or Consultant in Genitourinary Medicine for management (Figure 5). The case should also be notified by phone to the MOH. Liaise with Consultant Microbiologist about specimens required for further appropriate analysis. Further treatment options will be guided by available susceptibility data on the isolate. Possible treatment regimens include higher dose ceftriaxone, e.g. 1g IM and azithromycin 2g PO, or gentamicin 240mg IM and azithromycin 2g PO. Quinolones, e.g. ciprofloxacin 500 mg PO may be appropriate, depending on sensitivity testing results.

For cases of treatment failure, effective partner notification, treatment and ToC for all identified partners are key priorities. All sexual partners of those with cephalosporin treatment failure should be referred to an Infectious Disease Consultant or Consultant in Genitourinary Medicine.

4.3 HL-AziR gonorrhoea cases

At present, the management of known HL-AziR cases and their sexual contacts is not different from the management of uncomplicated cases. HL-AziR gonorrhoea will be subject to enhanced epidemiological surveillance. As of September 2016, enhanced epidemiological surveillance forms and mechanisms to gather and collate information to monitor HL-AziR gonorrhoea cases are in development. Cases of known HL-AziR gonorrhoea where cephalosporin treatment is not possible (either because of unavailability of resources to administer IM ceftriaxone or because of patient allergy to ceftriaxone) should be referred to an Infectious Diseases Consultant or a Consultant in Genitourinary Medicine.

Figure 5 Flowchart for the management of cephalosporin treatment failure for urogenital and pharyngeal infections in symptomatic and asymptomatic patients.



4.4 Partner Notification (PN)

PN, previously known as contact tracing, plays an integral role in the reduction of transmission of gonorrhoea and prevention of reinfection [56]. PN facilitates provision of health care to sexual contacts who may be at risk from an index case and can provide valuable information in understanding the disease transmission patterns in a community and in identifying sexual networks.

PN should be undertaken in all partners with gonococcal infection. International guidelines recommend the following [57]:

- Male patients with symptomatic urethral infection should notify all sexual partners within the preceding two weeks or their last partner, if longer.
- Those with asymptomatic urethral infection or infections at other sites and females should notify all partners from within the preceding three months.

Sexual partners should be offered NAAT testing. An individual assessment may be made as to whether immediate (epidemiological) treatment should be offered or to await NAAT results. Assessment should include standard of English, level of understanding and likelihood of compliance with abstinence, retesting and return for treatment. If the last contact was less than 14 days the NAAT should be repeated 14 days after exposure [56].

PN should be undertaken, ideally, by health advisors with specific expertise. It may be patient or provider delivered. Patients often prefer to notify partners themselves [58, 59] while provider delivery has resource implications. The index case is reviewed by the health advisor and contacts are identified. A record of contacts and outcomes should be maintained. In some cases, contacts will be untraceable and this should be recorded. Follow-up is by telephone. An individual assessment should be made in each case where partners have not been notified as to what further action, if any, is required. Increasing numbers of gonorrhoea cases are managed in primary care or other non-specialist settings which may not have access to health advisors. The role of alternative PN methods such as electronic notification using secure and confidential systems need to be assessed, in conjunction with the provision of community based health advisors. Such electronic systems currently require further evaluation and validation [60].

Recommendations

- All cases of gonorrhoea should be managed by suitably qualified clinicians according to current national guidelines.
- Where a clinician diagnosing a case of gonorrhoea does not have the required resources to manage the case appropriately the clinician should refer the case to a specialised STI service that is resourced to provide the required services, including partner notification.
- A process for quality assurance of STI services should be established.
- Resources should be in place to ensure that there is clinical capacity for timely STI testing for those who need it.
- In primary care, testing is advised for those who are symptomatic, those at high risk e.g. MSM, sex workers, sexual contact abroad, those who change partners frequently and contacts of cases.
- It is recommended that, when indicated and where feasible, culture is taken prior to treatment.
- Patient follow-up after treatment with the recommended therapeutic regimen is essential to confirm resolution of symptoms, to exclude the possibility of reinfection and to pursue partner notification.
- ToC at the site of initial infection is recommended for all cases of gonorrhoea to identify cases of treatment failure:
  - If asymptomatic, NAAT should be taken two weeks after completion of therapy, followed by culture if NAAT is positive.
  - If symptomatic or signs, ToC with culture method should be performed at least 72 hours (between three to seven days) after completion of therapy. Additional testing with NAAT for increased sensitivity can be considered one week after culture if it is negative.
- Enhanced epidemiological surveillance of cases of high-level azithromycin resistant cases of gonorrhoea should be undertaken.
- PN should be undertaken in all cases of gonococcal infection.
- Appropriate training should be provided for those carrying out PN.
- New approaches to PN, including web-based PN should be assessed.

5. Laboratory diagnosis of gonorrhoea (*Neisseria gonorrhoeae*)

The main benefits of gonorrhoea testing are the timely diagnosis and appropriate treatment of a sexually transmitted infection in individuals, as well as the disruption of the chain of transmission within the population through case and partner management.

The major risk associated with gonorrhoea testing is the increased likelihood of false positive test results arising from low positive predictive value (PPV) of test results in low-prevalence populations as well as potential cross-reactions in the tests with non-gonococcal commensal *Neisseria* species. Misdiagnoses may lead to direct harm and distress to the individuals resulting from unnecessary treatment as well as inappropriate diagnoses and partner notification. At a population level, they can lead to unnecessary use of antimicrobial agents, selective pressure for antimicrobial resistance development, and avoidable financial costs.

The implementation of assays using NAATs for the detection of *Neisseria gonorrhoeae* is increasingly widespread among laboratories. While testing for gonorrhoea is clearly indicated within specialist clinical settings targeting higher risk populations or where clinically indicated, there is little evidence to support widespread opportunistic screening for gonorrhoea in community-based settings [61]. However, the increasing use of dual NAATs will result in the significant proportion of testing occurring where the prevalence of gonorrhoea is likely to be low. For gonorrhoea, localised interventions targeting high risk groups are more likely to be cost-effective than unselected screening in community-based settings [22].

The evolving development of antimicrobial resistance in *N. gonorrhoeae* is now increasingly recognised as an emerging public health threat globally. The Centers for Disease Control and Prevention (CDC) identified drug-resistant *N. gonorrhoeae* as one of the top three antibiotic resistance threats in the United States for 2013 [62]. The emergence of multidrug resistance in *N. gonorrhoeae* also underpins the importance of the continuation of culture services in microbiology laboratories for the purpose of antimicrobial resistance surveillance, which can inform future treatment strategies.

This chapter aims to inform decisions pertaining to the detection of gonorrhoea, and to recommend best practice for testing and the expected standard of care.

5.1 Laboratory diagnosis

5.1.1 Nucleic Acid Amplification Tests (NAATs)

NAATs are now widely accepted as the standard of care for gonorrhoea testing [23, 63, 64]. They are more sensitive and have less stringent transport requirements than culture, and they allow the testing of both invasively and non-invasively taken samples [65, 66]. Many commercially available NAATs offer dual testing for *Chlamydia trachomatis* and *N. gonorrhoeae* [66, 67, 68]. A suggested algorithm for NAAT testing in gonorrhoea cases is outlined in Figure 6.

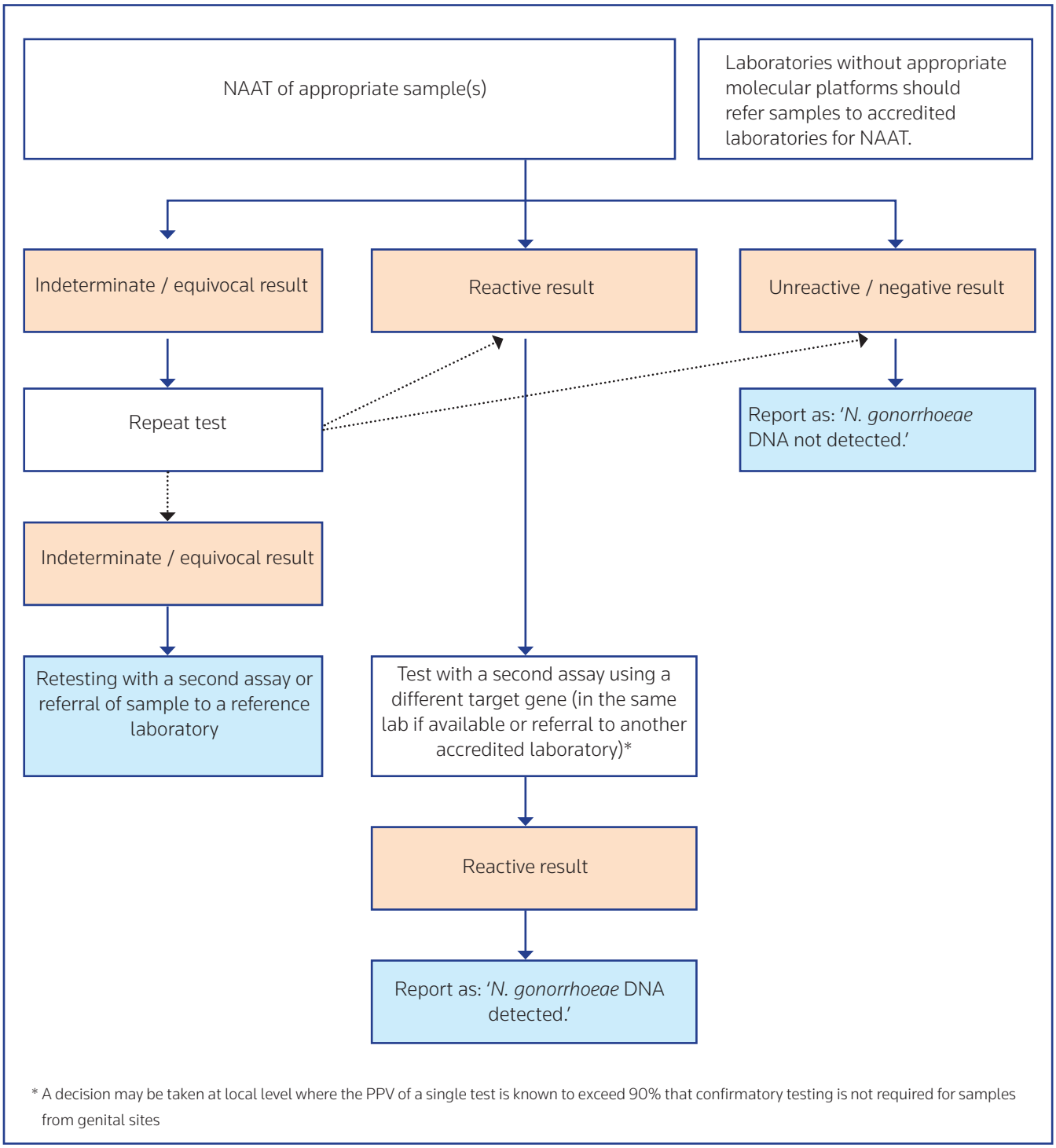
5.1.1.1 Sample types for genital sites

Equivalent NAAT sensitivity for *N. gonorrhoeae* detection has been reported in urine and urethral swab specimens in men [66, 67]. For NAAT testing, first pass urine is the specimen of choice in men as it can be non-invasively sampled [57, 63]. Manufacturers' recommendations on sampling and transport conditions should be strictly adhered to. In women, urine is an inferior sample type to cervical swab in the detection of gonorrhoea [66, 68]. Acceptable samples in women for NAAT testing for *N. gonorrhoeae* include clinician-taken endocervical swabs and self-taken vulvovaginal swabs. 90 to 95% of gonorrhoea cases in women have been diagnosed using either sample types [69]. Users should follow manufacturers' instructions closely.

5.1.1.2 Positive predictive value (PPV) and dual testing for genital samples

PPV is the percentage likelihood that a positive result is a true positive, and is influenced by the specificity and sensitivity of the test, as well as the prevalence of the infection in the population. The PPV for *N. gonorrhoeae* NAAT in the primary care setting is likely to be lower than that in the sexual health clinic setting as the prevalence of gonorrhoea in the general population is likely to be lower than that in the population attending a sexual health clinic (Table 8).

Figure 6 Algorithm for gonorrhoea testing of specimens from genital and extra-genital sites by NAAT



* A decision may be taken at local level where the PPV of a single test is known to exceed 90% that confirmatory testing is not required for samples from genital sites

Table 8 PPV of single NAAT test with sensitivity of 99% and specificity of 99% for different population prevalence of gonorrhoea

Prevalence	PPV
10%	92%
1%	50%

The formula for calculation of PPV is the following (PHE(c), 2014):

$$PPV = \frac{(\text{sensitivity} \times \text{prevalence})}{(\text{sensitivity} \times \text{prevalence}) + ((1 - \text{specificity}) \times (1 - \text{prevalence}))}$$

In view of the potential for false-positive results and possible consequences, it is recommended that in populations and specimen types where the calculated PPV of the NAAT is below 90%, a second NAAT (with a different target and with little or no cross-reactivity with other *Neisseria* species) should be used for the confirmation of the initial positive result [23, 63, 64]. In many cases, even in settings where the prevalence of gonorrhoea exceeds 1%, it will still be necessary to use a second gene target to achieve an acceptable PPV. In such settings, results should only be reported following confirmation by supplementary testing [23, 63, 64].

For settings and specimen types where the locally-calculated PPV of the NAAT exceeds 90%, supplementary testing may not be required [64]. Should supplementary testing be deemed necessary in such settings, local agreement should be reached with stakeholders on the reporting of preliminary results by the laboratory [64].

5.1.1.3 Extragenital samples

At present no commercial NAATs that are CE-marked for use with extragenital samples such as throat/pharyngeal swabs, rectal swabs, or eye swabs are available. However, NAATs have a superior sensitivity to culture for the detection of *N. gonorrhoeae* in extragenital samples [65, 70]. A local validation procedure should be carried out in the laboratory prior to the introduction of NAAT testing of extragenital samples. Due to the risk of false-positive results produced by cross-reactivity with commensal *Neisseria* species present in the throat or rectum, all positive NAAT results from extragenital samples should be confirmed by a second NAAT, targeting an alternative gene [57, 63, 71, 72].

5.1.1.4 Handling of samples

NAATs are highly sensitive in detecting even small amounts of nucleic acids in samples. Care should be taken by healthcare workers in the laboratory and clinic to prevent cross-contamination of samples. Laboratories and clinics should have decontamination protocols in place to minimise the risk of cross-contamination.

5.1.2 Culture and identification of Neisseria gonorrhoeae

Culture is a specific and inexpensive method for the isolation of *N. gonorrhoeae,* but can be technically and logistically demanding. It has lower test sensitivity when compared to NAATs, particularly at extragenital sites [65, 70]. Due to the high test sensitivity of NAATs, a negative NAAT result can reliably exclude gonorrhoea if an appropriate sample is taken at an appropriate time following sexual exposure. Consideration should be given for the development of a laboratory policy of selective culture, such as culturing of specimens from high risk patients (e.g. attendees of STI clinics) and/or culturing of specimens taken from optimal sites (e.g. endocervical swabs in females and urethral swabs in males). Adoption of such a policy may be cost-effective through reduction in culture workload while still obtaining isolates from the majority of gonorrhoea cases [63].

It is essential to obtain as many isolates from gonorrhoea episodes as possible for the purpose of antimicrobial susceptibility testing. Susceptibility test results can inform individual patient management, while resistance surveillance is crucial since evolving trends in resistance profiles can guide changes in the management of cases and public health policies. Isolates may also be utilised for molecular typing in outbreak investigations. Isolation rates of 70% and 40% for genital and rectal samples respectively may be achieved [63]. Where possible, samples from relevant sites should be taken for culture prior to the commencement of treatment in cases of suspected gonorrhoea and/or

with confirmed NAAT-positive results [23, 63, 64]. Samples should also be taken for cases of treatment failure (see Section 5.5). Even where culture yield is expected to be low, such as samples from pharyngeal infections, it should still be attempted as treatment failure has been more frequently reported in pharyngeal infections [73, 74].

For culture of *N. gonorrhoeae* from genital sites, endocervical swab remains the sample of choice in women, while urethral swab is the specimen of choice in men [23, 57]. As *N. gonorrhoeae* is a fastidious organism, direct plating after sampling should be considered. Rapid transport of samples/plates to the laboratory is also required to maximise the viability and recovery of the organism. Charcoal medium is the recommended specimen transport medium for swabs taken for culture. Selective culture media such as New York City agar are also recommended to minimise the level of contaminants on culture.

5.1.3 Microscopy

N. gonorrhoeae can be visualised microscopically in genital specimens using Gram stain. They appear as Gram-negative diplococci predominantly within polymorphonuclear leukocytes. Sensitivity of 90-95% has been reported for this method in symptomatic men with urethral discharge, and microscopy, if available, is recommended to facilitate immediate diagnosis in symptomatic men [23, 57, 75]. The test sensitivity of microscopy is lower for urethral swab in asymptomatic men (50-75%), endocervical smear in women (37-50%), and urethral swab in women (20%) [75, 76]. Microscopy is not recommended for pharyngeal specimens due to poor specificity and sensitivity [23].

5.2 Antimicrobial susceptibility testing

Various scientific organisations provide guidelines on susceptibility test methodologies and interpretive criteria for *N. gonorrhoeae*. The European Committee on Antimicrobial Susceptibility Testing (EUCAST), the Clinical and Laboratory Standards Institute (CLSI), and the British Society of Antimicrobial Chemotherapy (BSAC) have regular updates on their respective methodologies and interpretive breakpoints. For further technical details, please refer to the organisations' respective websites and relevant documents [77, 78, 79]. Many laboratories in Ireland are currently using EUCAST guidelines for antimicrobial susceptibility testing in *N. gonorrhoeae*. BSAC is also currently supporting the EUCAST method for antimicrobial susceptibility testing in preference to the current BSAC method. While CLSI and BSAC have interpretive criteria for disc diffusion as well as MIC methods, EUCAST has recommended that an MIC method be used for susceptibility testing in *N. gonorrhoeae* as disc diffusion interpretive criteria have not yet been defined by them [77]. Where a commercial MIC method is employed, such as the gradient MIC method (e.g. Etest, BioMerieux), EUCAST has recommended that users follow the manufacturer's instructions closely.

The numbers of antimicrobial agents with available interpretive criteria for *N. gonorrhoeae* vary according to the recommendations of the respective scientific bodies. However, interpretive criteria are available from the above committees for the following classes or agents: penicillin, cephalosporins (cefixime, cefotaxime, ceftriaxone), quinolones (ofloxacin, ciprofloxacin), tetracycline, and spectinomycin. EUCAST and BSAC also have interpretive criteria for azithromycin [77, 79].

Testing for beta-lactamase in *N. gonorrhoeae*, as recommended by EUCAST and BSAC, detects a commonly occurring mechanism of plasmid-mediated penicillin resistance. A positive beta-lactamase test result predicts resistance to penicillin, ampicillin, and amoxicillin. However the beta-lactamase test will not detect other mechanisms of penicillin resistance such as chromosomal mutations of genes encoding penicillin-binding proteins.

5.3 Molecular typing

Typing of *N. gonorrhoeae* isolates for epidemiological studies using traditional non-DNA-based methods have now largely been replaced by DNA-based methods such as *Neisseria gonorrhoeae* multi-antigen sequence typing (NG-MAST). Compared to traditional typing methods such as auxotyping and serotyping, DNA-based methods (especially sequence-based analysis) are more discriminatory and reproducible, and potentially more cost-effective [80]. Ireland currently does not have a designated reference laboratory for purposes such as the typing of *N. gonorrhoeae* isolates. St James's Hospital microbiology laboratory currently performs molecular typing such as NG-MAST and whole genome sequencing for research purposes. Irish laboratories and users requiring such typing services would usually have to send isolates/specimens to reference laboratories in neighbouring countries such as England and Scotland, or alternatively, can discuss with St James's Hospital microbiology laboratory. The National Sexual Health Strategy [5]

calls for the designation of a reference laboratory for STIs. Once this designation has been made, such work should be referred to the reference laboratory.

5.3.1 NG-MAST

NG-MAST is a sequence-based typing method that examines the variable segments of two highly polymorphic loci of the *N. gonorrhoeae* genome: porB (a 490-bp segment) and tbpB (a 390-bp segment) [81]. This typing method is relatively fast and easy to perform and is highly discriminatory and reproducible. A public database (http://www.ng-mast.net) is also available, and can be accessed for analysis of the results and for assignment of allele numbers and sequence types. It is a recommended typing method when analysing strains collected over relatively short periods (days to a few years), and hence is an ideal typing method for analysing isolates from settings such as outbreaks, core groups or sexual networks, examination of the transmission of individual strains, partner notification, investigations of suspected clusters, and characterisation of clones [80]. NG-MAST is performed in many laboratories offering reference services for *N. gonorrhoeae*.

5.4 Test following sexual exposure

Incubation period for gonorrhoea can range from 2 to 10 days, and testing by culture within 48 hours following sexual exposure may yield false-negative results [82]. In the UK, it had been recommended that to confidently exclude gonorrhoea in patients presenting early (within 3 days) following sexual contact, repeat testing 14 days after contact should be considered if effective therapy had not been given [57]. It is unclear if this recommendation was influenced by considerations pertaining to culture detection of *N. gonorrhoeae*. In the European guidelines, no recommendation was made with respect to the minimum incubation period necessary before testing can be performed as the data was lacking, although the authors noted that clinical experience suggested the possibility of positive NAAT results within 1 to 2 days of infection [23]. Furthermore, based on expert opinion, the Public Health Agency of Canada has recommended that NAAT may be performed at the time of presentation, without having to wait for at least 48 hours following sexual contact [82]. The committee recommends that, regardless of time since exposure, a NAAT test be performed at presentation. When tested at less than 48 hours since exposure and test negative, if high risk exposure and symptomatic repeat NAAT after a week, if high risk exposure and asymptomatic retest more than 48 hours after exposure.

5.5 Test of Cure (ToC)

ToC is recommended for all cases of gonorrhoea to identify cases of treatment failure. Testing is particularly important in pharyngeal infections, where effective eradication can be more difficult to achieve than in genital or anorectal infections [73, 74].

ToC can be performed by either culture or NAAT depending on clinical circumstances. UK and European guidelines have recommended that if symptoms or signs persist after therapy, ToC with culture method should be performed at least 72 hours (between three to seven days) after completion of therapy [23, 57]. Supplementary testing with a NAAT for increased sensitivity can be considered one week after the ToC if the culture is negative.

Asymptomatic patients should be tested with a NAAT two weeks after completion of therapy. In the event of a NAAT-positive ToC result, culture should be performed for the purpose of antimicrobial susceptibility testing and resistance surveillance [23, 63].

5.6 Notification of gonorrhoea cases for public health surveillance

Public health surveillance data are essential in monitoring trends in STI diagnoses, to determine specific groups at risk of infection and to take action where there is a need for additional control measures, such as in the case of an outbreak. The data can be used to inform public health response by improving the planning and management of services, developing and refining interventions, and monitoring the effectiveness of sexual health policies.

Gonorrhoea is a notifiable disease in Ireland, Appendix 2 [24]. Both laboratory and clinical notifications are required, and are made to the MOH. All notifications sent electronically should be encrypted. Laboratory notifications are made electronically via CIDR. For more information on infectious disease notification, please refer to the HPSC website at www.hpsc.ie.

HPSC currently defines a confirmed case of gonorrhoea as any person who meets at least one of the following four laboratory criteria [25]:

- Isolation of *N. gonorrhoeae* from a clinical specimen;
- Detection of *N. gonorrhoeae* nucleic acid in a clinical specimen;
- Demonstration of *N. gonorrhoeae* by a non amplified nucleic acid probe test in a clinical specimen;
- Microscopic detection of intracellular gram negative diploccocci in a urethral male specimen.

Recommendations

- A reference laboratory service for *N. gonorrhoeae* should be established in Ireland.
- Laboratory capacity for STI testing should be established in a way that provides timely and accessible testing for patients and health care providers.
- NAATs accredited to ISO 15189 standard should be the standard of care in the laboratory detection of *Neisseria gonorrhoeae*.
- Where possible, PPV of test results should be critically appraised.
- Supplementary testing with a second gene target is recommended in most clinical settings (following consideration of the sample types as well as disease prevalence in the population being investigated).
- Microscopy, if available, is recommended to facilitate immediate diagnosis of gonorrhoea in symptomatic men.
- Culture is still an essential laboratory investigation as isolates are required for antimicrobial susceptibility testing and molecular typing. Results can inform individual case management as well as public health policies and strategies for control of gonorrhoea.
- Consideration should be given to the development of a laboratory policy of selective culture, such as culturing of specimens from high-risk patients (e.g. attendees of STI clinics) and/or culturing of specimens taken from optimal sites (e.g. endocervical swabs in females and urethral swabs in males).
- Laboratories should be adequately resourced to perform the recommended tests such as NAATs, culture and antimicrobial susceptibility testing. A survey of Irish laboratories' capacity and resources to provide the expected diagnostic standard of care for gonorrhoea should be carried out. A mapping exercise and needs assessment of STI diagnostics is one of the priority actions currently being undertaken by the HSE Sexual Health and Crisis Pregnancy Programme, through implementation of the Sexual Health Strategy.
- ToC is recommended for all cases of gonorrhoea, to identify cases of treatment failure.

6. Public health response to suspected cephalosporin resistant *Neisseria gonorrhoeae*

There is a need for a national multi-disciplinary forum (microbiology, clinicians, and public health medicine) to monitor the development of antimicrobial resistance in *N. gonorrhoeae* in Ireland and to advise on treatment, prevention and control. The remit of the group should include reviewing these guidelines on an ongoing basis and updating them as required, in line with international evidence. This group could also advise on prevention and control of other STIs. The group should have a remit for training. It should include at least the following:

- MOH (Director of Public Health or Consultant in Public Health Medicine)
- Consultant in Public Health Medicine and Consultant Microbiologist, Health Protection Surveillance Centre
- Consultant in Infectious Diseases/Genitourinary Medicine
- Consultant Microbiologist
- Health Advisor
- Health Promotion Officer
- Surveillance Scientist
- Laboratory Scientist

Cases of possible antibiotic treatment failure are of considerable importance and verification of such an event requires collaboration between clinical, laboratory and public health medical staff.

Clinicians should treat cases of *N. gonorrhoeae* infection as outlined in Section 4.1 of this document. The required follow-up after recommended treatment is also outlined: follow-up is necessary to confirm resolution of symptoms, to exclude the possibility of reinfection and to pursue partner notification.

6.1 Single case of suspected Ceph-R *N. gonorrhoeae*

If a patient presents with a persistent gonococcal infection following appropriate treatment it is essential that the possibility of reinfection or infection with other pathogens (e.g. chlamydia) is outruled and that appropriate (urethral, cervical or rectal) specimens are taken for microscopy, culture and susceptibility testing (Figure 7). NAATs and genotyping should also be performed. The laboratory should be informed that treatment failure is suspected and that cephalosporin resistance is a consideration. The case must be seen by an Infectious Disease Consultant/Consultant in Genitourinary Medicine. Where *N. gonorrhoeae* cephalosporin treatment failure is suspected by a clinician they should inform the local MOH promptly.

In the event of confirmed *N. gonorrhoeae* cephalosporin treatment failure the MOH should convene an incident control team. The role of this team will be to investigate the incident and to increase surveillance, prevention and control measures, as necessary.

Members of the team may include the following:

- MOH (Director of Public Health or Consultant in Public Health Medicine)
- Consultant in Public Health Medicine, Health Protection Surveillance Centre
- Consultant in Infectious Diseases/Genitourinary Medicine
- Director of STI clinic
- Consultant Microbiologist
- Surveillance Scientist
- Health Advisor

The ECDC Response Plan [2] has recommended a working definition of a confirmed treatment failure and a probable treatment failure (Table 9).

Where a probable or confirmed case of Ceph-R *N. gonorrhoeae* is identified, further laboratory evaluation (culture and susceptibility testing and molecular typing) should be performed at a gonococcal reference laboratory.

Clinical management of cephalosporin treatment failure is outlined in Section 4.2.

Figure 7 Flowchart for the Public Health management of a single case of suspected Ceph-R *Neisseria gonorrhoeae*

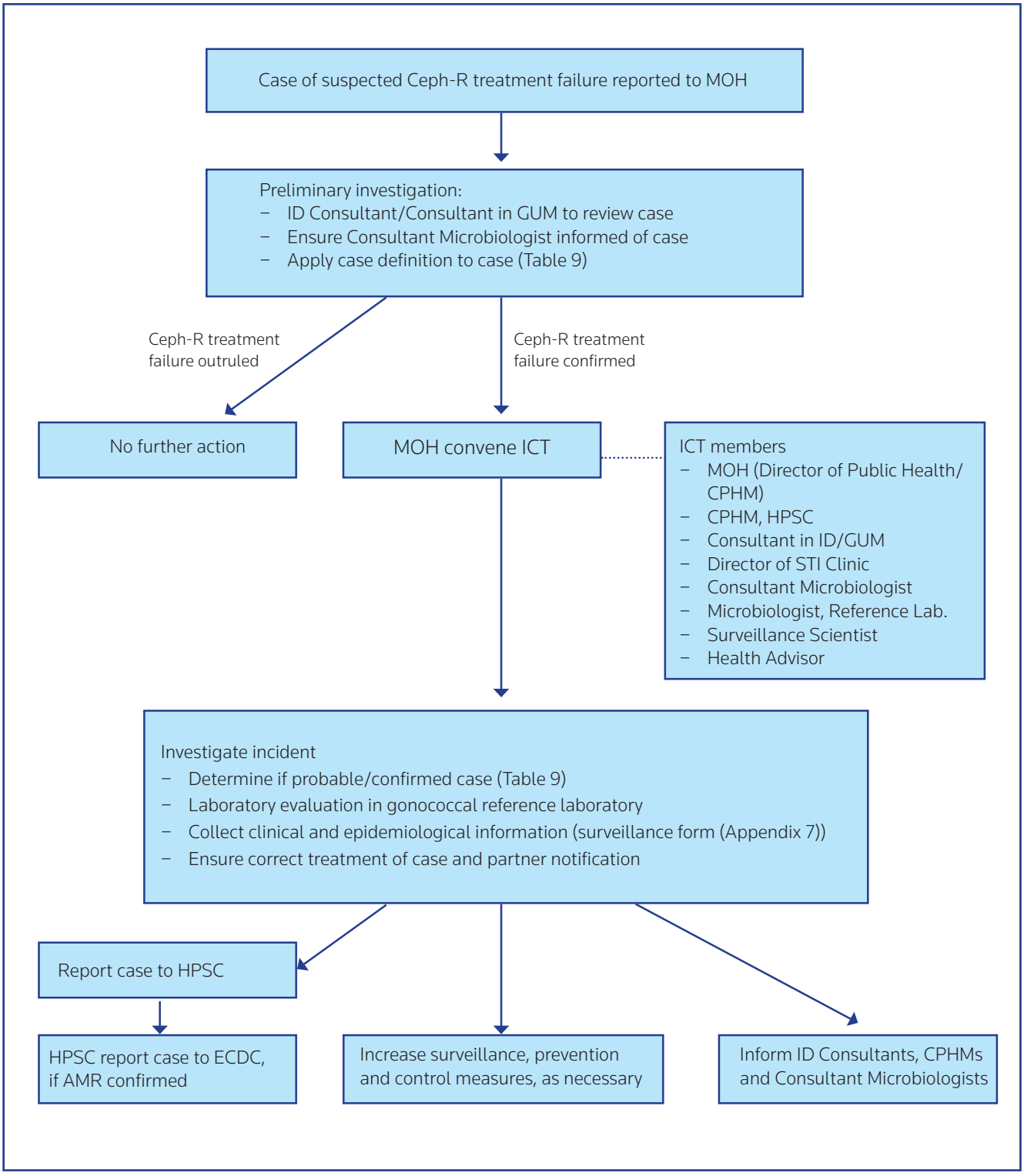


Table 9 Working case definition for probable and confirmed cephalosporin treatment failure: clinical and laboratory criteria [2]

Case definition for probable treatment failure	Case definition for confirmed treatment failure
A gonorrhoea patient who returns for ToC or who has persistent genital* symptoms after having received treatment for laboratory-confirmed gonorrhoea with a recommended cephalosporin regimen (ceftriaxone or cefixime in appropriate dose) AND remains positive for one of the following tests for *N. gonorrhoeae*: - Presence of intracellular Gram-negative diplococci on microscopy taken at least 72 hours after completion of treatment; OR - Isolation of *N. gonorrhoeae* by culture taken at least 72 hours after completion of treatment; OR - Positive nucleic acid amplification test (NAAT) taken two-to-three weeks after completion of treatment AND Denies sexual contact during the post-treatment follow-up period	A gonorrhoea patient who returns for ToC or who has persistent genital* symptoms after having received treatment for laboratory-confirmed gonorrhoea with a recommended cephalosporin regimen (ceftriaxone or cefixime in appropriate dose) AND remains positive for one of the following tests for *N. gonorrhoeae*: - Presence of intracellular Gram-negative diplococci on microscopy taken at least 72 hours after completion of treatment; OR - Isolation of *N. gonorrhoeae* by culture taken at least 72 hours after completion of treatment; OR - Positive nucleic acid amplification test (NAAT) taken two-to-three weeks after completion of treatment AND Denies sexual contact during the post-treatment follow-up period AND Decreased susceptibility to cephalosporin used for treatment†: - Cefixime: MIC>0.12 mg/L‡ - Ceftriaxone: MIC> 0.12 mg/L‡

*Gonorrhoea patient may have non-genital symptoms
†Ideally, the pre-and post-treatment isolates should be examined with an appropriate and highly discrimatory molecular epidemiological typing method to establish if isolates are indistinguishable
‡These thresholds are in accordance with EUCAST tentative breakpoints. Reporting of probable treatment failures where MICs are lower than the EUCAST breakpoints will be essential to evaluate if current breakpoints are clinically relevant.

The following clinical and epidemiological information should be collected from a case of Ceph-R *N. gonorrhoeae* and their sexual partners:

- Treatment taken and when,
- Anatomic site(s) of infection
- Demographic and behavioural risk factors:
  - Demographic characteristics
  - Sexual orientation and practices
  - Drug use
  - HIV status
- Source(s) of infection
  - Recent travel history of both the index patient and their sexual partner(s)
  - The place and type of sexual contact(s)
- Risk of secondary transmission
  - The place and number of recent sexual contacts

An enhanced surveillance form is available in Appendix 7 and on the HPSC website.

The case and enhanced surveillance information should be reported by the MOH to HPSC. If strains with unusually high MICs are confirmed by the reference laboratory an alert will be raised internationally (ECDC and WHO, as appropriate). In addition, an alert should be sent to STI and Infectious Disease clinicians, Consultants in Public Health Medicine and Clinical Microbiologists in Ireland to advise them of the finding and as an early warning of possible AMR in the community.

6.2 More than one case of Ceph-R *N. gonorrhoeae*

When cases of treatment failure occur with increasing frequency there is a need for further liaison between Public Health Medicine, clinicians and laboratories to determine the proportion of isolates that show resistance (Figure 8). WHO advises that, when the proportion of resistant strains obtained from tested samples is at a level of 5%[1] or more, or when an unexpected increase below 5% is observed in key populations with high rates of gonococcal infection (e.g. MSM or sex workers), steps should be taken to review and modify guidelines for STI treatment and management, while at the same time enhancing gonococcal surveillance [1]. This would be a role for the proposed national clinical forum on AMR in gonorrhoea.

If receiving repeated notifications of treatment failure then Departments of Public Health and/or HPSC need to initiate epidemiological assessments to measure the level of spread in affected locations. The following is proposed by WHO [1]:

- Epidemiological assessment to identify potential demographic and sexual-behavioural risk factors.
- Design and implementation of clinic-based activities to enhance case detection:
  - Targeted gonorrhoea screening and laboratory examination of samples,
  - Test-of-cure using culture for key populations at high risk of infection.
- Enhanced laboratory capacity to improve gonococcal culture and susceptibility testing.
- Enhanced local surveillance to monitor the occurrence and magnitude of Ceph-R *N. gonorrhoeae* and confirmed treatment failure cases in the affected areas. This includes conducting ad hoc rapid assessment studies (e.g. local GASP) using different sample-collection approaches, such as:
  - Prospective collection of gonococcal isolates,
  - Retrospective review of antimicrobial susceptibility test patterns of gonococcal isolates,
  - Laboratory evaluation of patients with repeat episodes of gonorrhoea within a short period
  - Communication strategies to increase awareness of local clinicians and laboratory staff about the presence of Ceph-R *N. gonorrhoeae* cases and/or confirmed cases of treatment failure.

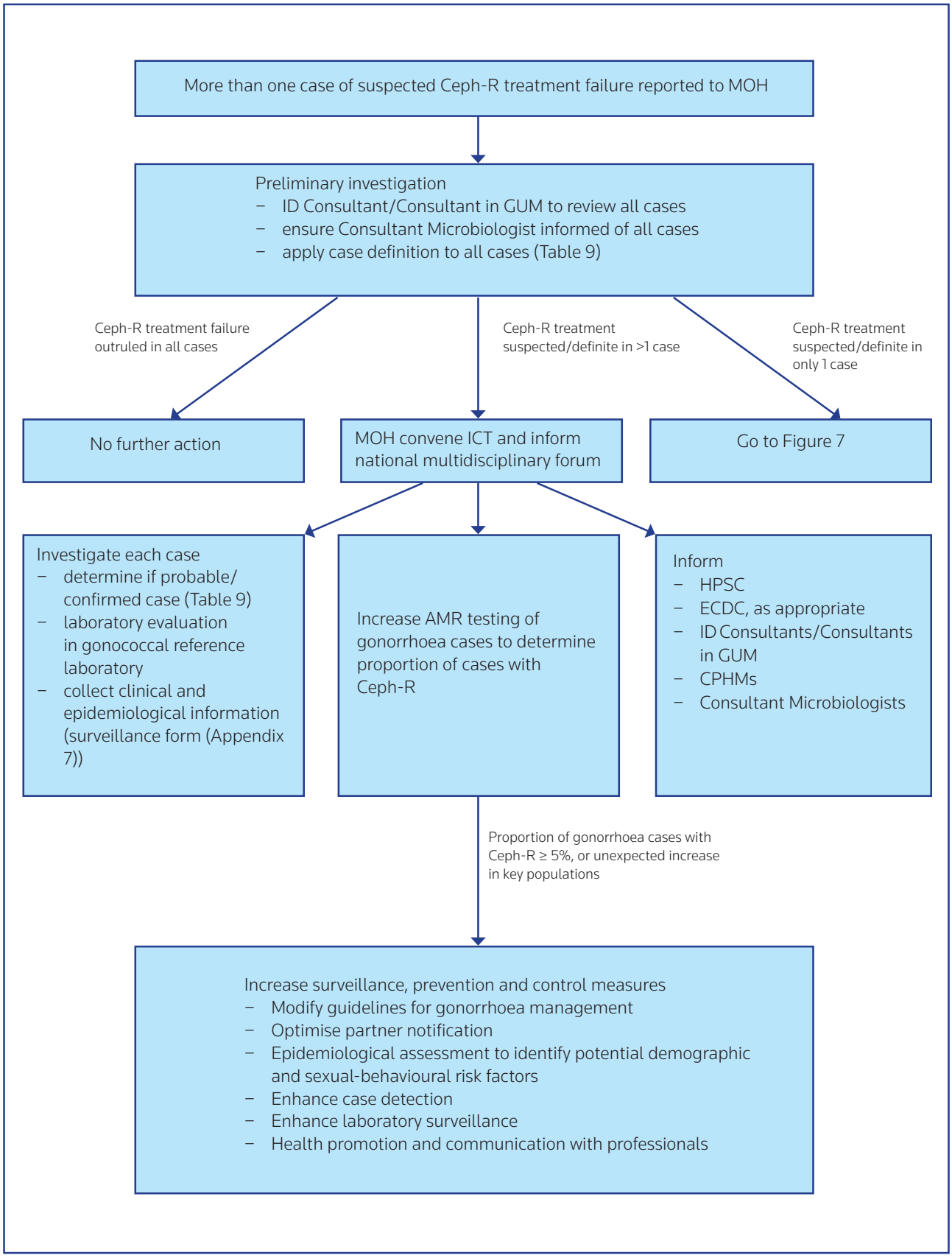
It is important to rapidly identify, screen and treat the sexual partners of patients with Ceph-R *N. gonorrhoeae* or confirmed treatment failure, and, ideally, to test any identified isolates for antimicrobial susceptibility.

1 It can be difficult to obtain a sample size large enough to confidently determine this rate. It may be necessary to determine the rate in approximately 100-200 samples initially and then, if 3-10% samples show resistance, to increase the sample size as necessary.

Recommendations

- A national multi-disciplinary forum (microbiology, clinicians, and public health) should be established to review national AMR data, to advise on changing patterns of resistance and to advise on treatment, prevention and control.
- Where *N. gonorrhoeae* cephalosporin treatment failure is suspected by a clinician they should inform the local MOH promptly.
- In the event of suspected or confirmed *N. gonorrhoeae* cephalosporin treatment failure the MOH should convene an incident control team.
- Where a probable or confirmed case of Ceph-R *N. gonorrhoeae* is identified, further laboratory evaluation (culture and susceptibility testing and molecular typing) should be performed at a gonococcal reference laboratory.
- Enhanced surveillance information needs to be collected from all probable or confirmed cases of Ceph-R *N. gonorrhoeae*.
- If the proportion of resistant strains obtained from tested samples is at a level of 5% or more, or, when an unexpected increase below 5% is observed in key populations, a multi-disciplinary group (ideally the forum referred to above) should take steps to review and modify guidelines for STI treatment and management, while at the same time enhancing gonococcal surveillance.

Figure 8 Flowchart for the Public Health management of more than one case of suspected Ceph-R *Neisseria gonorrhoeae*



References

1. World Health Organization. WHO, 2012. Global action plan to control the spread and impact of antimicrobial resistance in *Neisseria gonorrhoeae*. Geneva, WHO.
2. European Centre for Disease Prevention and Control. ECDC 2012. Response plan to control and manage the threat of multidrug-resistant gonorrhoea in Europe. Stockholm; ECDC.
3. Health Protection Agency. HPA 2013. Gonococcal Resistance to Antimicrobials Surveillance Programme (GRASP) Action Plan for England and Wales: Informing the Public Health Response. London, HPA.
4. Centers for Disease Control and Prevention. CDC 2012. Cephalosporin-Resistant *Neisseria gonorrhoeae* Public Health Response Plan. Atlanta, CDC.
5. Department of Health. National Health Strategy 2015-2020. Department of Health. Dublin, 2015.
6. World Health Organization. WHO, 2014. Antimicrobial Resistance: Global Report on Surveillance. Geneva, WHO.
7. Yokoi S, Deguchi T, Ozawa T, Yasuda M, *et al*. Threat to cefrixime treatment of gonorrhoea. Emer Infect Dis 2007;13:1275-1277
8. Unemo M, Golparian D, Syversen G, Vestrheim DF, Moi H. Two cases of verified clinical failures using internationally recommended first-line cefrixime for gonorrhoea treatment, Norway, 2010. Euro Surveill 2010;15(47):pii:19721
9. Ison CA, Hussey J, Sankar KN, Evans J, Alexander S. Gonorrhoea treatment failures to cefrixime and azithromycin in England, 2010 Euro Surveill 2011;16(43):pii:19833
10. Ohnishi M, Saika T, Hoshina S, Iwasaku K, Nakayama S, Watanabe H, Kitawaki J. Ceftriaxone-resistant *Neisseria gonorrhoeae*, Japan. Emer Infect Dis 2011(a);17(1):148-149
11. Moloney G, Coleman C, Carroll C, Cremin P, Ui Riain U, Cormican M, Flemming C. First report of ceftotaxime and azithromycin resistant *N. gonorrhoeae* in Ireland; multidrug resistant isolates from three linked patients. Presented at European Society of Clinical Microbiology and Infectious Diseases April, 2013. Abstract available at http://registration.akm.ch/einsicht.php?XNABSTRACT_ID=167283&XNSPRACHE_ID=2&XNKONGRESS_ID=180&XNMASKEN_ID=900 Accessed 01.07.15
12. Lynagh Y, Mac Aogáin M, Walsh A, Rogers TR, *et al*. Detailed characterization of the first high-level azithromycin-resistant *Neisseria gonorrhoeae* cases in Ireland. J. Antimicrob. Chemother. first published online April 22, 2015 doi:10.1093/jac/dkv106
13. Chisholm SA, Wilson J, Alexander S, Tripodo F, *et al*. An outbreak of high-level azithromycin resistant *Neisseria gonorrhoeae* in England. Sex Transm Infect 2016;92:365-367.
14. Public Health England. Outbreak of high level azithromycin resistant gonorrhoea in England. *Health Protection Report* 2016;10(15).
15. Vellinga A. The very first requirement of treatment is that it should do no harm, so why are antibiotics still overprescribed?. Int J Cinl Pract 2014;68:152-154
16. E learning module on diagnosis and management of sexually transmitted infections (STIs) in primary care Irish College of General Practitioners. Available at http://www.icgp.ie/go/courses/e_learning/76949ECF-DCF8-8365-775F7C7C7F233B1E.html. Accessed 01.07.15
17. Tapsall JW. Antibiotic resistance in *Neisseria gonorrhoeae*. Clin Infect Dis 2005;41 (Suppl 4): S263-8.
18. Ohnishi M, Golaprian D, Shimuta K, Saika T, *et al*. Is *Neisseria gonorrhoeae* initiating a future era of untreatable gonorrhoea? Detailed characterisation of the first strain with high-level resistance to ceftriaxone. Antimicrob Agents Chemother, 2011(b);55(7):2538-2545
19. Sonnenberg P, Clifton S, Beddows S, *et al*. Prevalence, risk factors, and uptake of interventions for sexually transmitted infections in Britain: findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal). Lancet 2013;382:1795-806.
20. Fitzgerald M, Igoe D, Cooney F *et al*., Control group use surveillance findings to target response to gonorrhoea increase. Epi-Insight 2013;14(10)
21. Public Health England. Sexually transmitted infections and Chlamydia screening in England, 2012. *Health Protection Report* 2013;7(23).
22. Public Health England. PHE 2014(b). HIV and STIs in men who have sex with men in London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/357451/2014_09_17_STIs_HIV_in_MSM_in_London_v1_0.pdf.
23. Bignell C, Unemo M; European STI Guidelines Editorial Board. 2012 European guideline on the diagnosis and treatment of gonorrhoea in adults. Int J STD AIDS 2013;24(2):85-92.
24. Infectious Disease Regulations, S.I. No. 390 of 1981. 1981
25. Health Protection Surveillance Centre. HPSC, 2013 Case definitions of notifiable diseases. Version 1.2, 2012. http://www.hpsc.ie/NotifiableDiseases/CaseDefinitions/File,823,en.pdf. Accessed 01.07.15
26. Health Protection Surveillance Centre. HPSC, 2014 Gonorrhoea in Ireland 2013. available online http://www.hpsc.ie/A-Z/HIVSTIs/SexuallyTransmittedInfections/Gonorrhoea/SurveillanceReports/, Accessed 01.07.15.
27. Public Health England. Sexually transmitted infections and Chlamydia screening in England, 2014. *Health Protection Report* 2015;9(22).
28. European Centre for Disease Prevention and Control. ECDC, 2015. Annual epidemiological report 2014 – sexually transmitted infections, including HIV and blood-borne viruses. Stockholm; ECDC.
29. Spiteri G, Cole M, Unemo M, *et al*. The European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP) – a sentinel approach in the European Union (EU)/European Economic Area (EEA). Sex Transm Infect 2013;89:iv16-iv18.
30. Chisholm SA, Unemo M, Quaye N, *et al*. Molecular epidemiological typing within the European Gonococcal Antimicrobial Resistance Surveillance Programme reveals predominance of a multidrug resistant clone. Euro Surveill 2013;18(3):pii=20358.
31. Becasen JS, Ford J, Hogben M. Sexual Health Interventions: A Meta-Analysis. J Sex Res 2014 (epub) J Sex Res 2015;52(4):433-43
32. Gerressu M, Elam G, Shain R, Bonel C, *et al*. Sexually transmitted infection risk exposure among black and minority ethnic youth in northwest London: findings from a study translating a sexually transmitted infection risk-reduction intervention to the UK setting. Sex Transm Infect 2009;85(4):283-289.

33. Aral S. Sexual risk behaviour and infection: epidemiological considerations. Sex Transm Infect 2004:80(suppl_2):ii8-12.
34. Godeau E, Nic Gabhainn S, Vignes C, Ross J, *et al*. Contraceptive use by 15-year-old students at their last sexual intercourse: Results from 24 countries. Arch Pediatr Adolesc Med 2008;162(1):66-73.
35. Parkes A, Wight D, Henderson M, Hart G. Explaining associations between adolescent substance use and condom use. J Adolesc Health 2007;40(2):180.e1-180.e18.
36. Wellings K, Cleland J. Surveys on sexual health: recent developments and future directions. Sex Transm Infect 2001;77(4):238-241.
37. Davoren MP. Hayes K. Horgan M, Shiely F. Sexually transmitted infection incidence among adolescents in Ireland. Fam Plann Reprod Health Care 2014;40(4):276-282.
38. Committee on Adolescence. Contraception and adolescents. Pediatrics 2007;120(5):1135- 1148.
39. Layte R, McGee H, Quail A, Rundl, K, *et al*. The Irish Study of Sexual Health and Relationships. Crisis Pregnancy Agency and the Department of Health and Children. 2006 Dublin.
40. O'Sullivan LF, Hoffman S, Harrison A, Dolezal C. Men, multiple sexual partners, and young adults' sexual relationships: Understanding the role of gender in the study of risk. Urban Health 2006;83(4):695-708.
41. Shepherd JP, Frampton GK, Harris P. Interventions for encouraging sexual behaviours intended to prevent cervical cancer. Cochrane Database of Syst Rev 2011;13(4):CD001035.
42. Newby KV, French DP, Brown KE, & Wallace LM. Beliefs underlying chlamydia risk appraisals: the relationship with young adults' intentions to use condoms. J Risk Res 2013;16(7):843-860.
43. Kershaw TS, Ethier K A, Niccolai LM, Lewis JB, Ickovics JT. Misperceived risk among female adolescents: social and psychological factors associated with sexual risk accuracy. Health Psychol. 2003;22(5):523-532
44. Public Health England, Components of Chlamydia screening and the impact of screening on behaviour. 2014 National Chlamydia Screening Programme web survey report. PHE 2014(a).
Available at http://www.chlamydiascreening.nhs.uk/ps/resources/web-survey/2014%20NCSP%20web%20survey%20report.pdf. Accessed 01.07.15
45. The Howard League for Penal Reform. Commission on Sex in Prison briefing papers 1-4 http://www.howardleague.org/behind-closed-bars/ Accessed 01.07.2015
46. Stoner BP, Whittington WLH, Aral SO, Hughes JP, *et al*. Avoiding risky sex partners: perception of partners' risks v partners' self reported risks. Sex Transm Infect 2003;79(3):197-201.
47. French J. Components of successful media campaigns. 2004 HDA Briefing Paper. London: Health Development Agency, in press (available from jeff.french@hda-online.org.uk).
48. International Social Marketing Association, European Social Marketing Association & Australian Association of Social Marketing. Consensus Definition of Social Marketing 2013.
49. Wakefield MA, Loken B, Hornik RC. Use of mass media campaigns to change health behaviour. The Lancet 2010;376(9748):1261-1271.
50. Swanton R, Allom V, Mullan B. A meta-analysis of the effect of new-media interventions on sexual-health behaviours. Sex Transm Infect 2015;91(1):14-20.
51. Slovic P. Do adolescent smokers know the risks? Duke Law Journal 1998;47:1133-1141.
52. Chapman GB, Elstein AS. Cognitive processes and biases in medical decision making. In Decision making in health care: Theory, psychology, and applications, (ed: Chapman & Sonnerberg) 2000 Chapter 7 pp: 183-210.
53. Sixsmith J. An evaluation of mass media interventions to promote health. Unpublished Doctoral Thesis. 2006 National University of Ireland, Galway.
54. Philpott A, Knerr W, Maher D. Promoting protection and pleasure: amplifying the effectiveness of barriers against sexually transmitted infections and pregnancy. Lancet 2006;368(9551):2028-2031.
55. Gebhardt WA, Kuyper L, Greunsven G. Need for intimacy in relationships and motives for sex as determinants of adolescent condom use. J Adolesc Health 2003;33(3):154-164.
56. Du P, Coles B, Gerber T, McNutt LA. Effects of partner notification on reducing gonorrhoea incidence rate. Sex Transm Dis 2007;34(4):189 – 194
57. Bignell C, Fitzgerald M. Guideline Development Group; British Association for Sexual Health and HIV UK. UK national guideline for the management of gonorrhoea in adults, 2011. Int J STD AIDS 2011;22(10):541-7.
58. Taylor D. Outcomes related to STI partner notification. National Collaborating Centre for Infectious Diseases, 2013.
https://cdn.metricmarketing.ca/www.nccid.ca/files/Evidence_Reviews/Partner_Notification/NCCID_PartnerNotify_Taylor_04.pdf Accessed 01.07.15.
59. Rietmeijer CA, Westergaard B, Mickiewicz TA, *et al*. Evaluation of an online partner notification program. Sex Transm Dis 2011;38:359-64
60. Gilbert M, Salway Hottes T. Alternative Strategies for Notification: a missing piece of the puzzle. Sex Transm Infect 2014;90(3):174 – 175
61. Fifer H, Ison CA. Nucleic acid amplification tests for the diagnosis of *Neisseria gonorrhoeae* in low-prevalence settings: a review of the evidence. Sex Transm Infect 2014;90(8):577-9.
62. Centers for Disease Control and Prevention. CDC 2014. Antibiotic resistance threats in the United States, 2013.
http://www.cdc.gov/drugresistance/pdf/ar-threats-2013-508.pdf.
63. Health Protection Scotland. HPS, 2012. Guidance on the use of molecular testing for *Neisseria gonorrhoeae* in diagnostic laboratories 2011.
http://www.documents.hps.scot.nhs.uk/labs/sbstirl/naats-guidance-2011.pdf.
64. Public Health England. PHE 2014(c). Guidance for the detection of gonorrhoea in England.
http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/405293/170215_Gonorrhoea_testing_guidance_REVISED__2_.pdf.
65. Harryman L, Scofield S, Macleod J, *et al*. Comparative performance of culture using swabs transported in Amies medium and the Aptima Combo 2 nucleic acid amplification test in detection of *Neisseria gonorrhoeae* from genital and extra-genital sites: a retrospective study. Sex Transm Infect 2012;88(1):27-31.

66. Van der Pol B, Ferrero DV, Buck-Barrington L, *et al*. Multicenter evaluation of the BDProbeTec ET System for detection of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in urine specimens, female endocervical swabs, and male urethral swabs. J Clin Microbiol 2001;39(3):1008-16.
67. Chernesky MA, Martin DH, Hook EW, *et al*. Ability of new APTIMA CT and APTIMA GC assays to detect *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in male urine and urethral swabs. J Clin Microbiol 2005;43(1):127-31.
68. Gaydos CA, Cartwright CP, Colaninno P, *et al*. Performance of the Abbott RealTime CT/NG for detection of *Chlamydia trachomatis* and *Neisseria gonorrhoeae*. J Clin Microbiol 2010;48(9):3236-43.
69. Schachter J, Chernesky MA, Willis DE, *et al*. Vaginal swabs are the specimens of choice when screening for *Chlamydia trachomatis* and *Neisseria gonorrhoeae*: results from a multicenter evaluation of the APTIMA assays for both infections. Sex Transm Dis 2005;32(12):725-8.
70. Schachter J, Moncada J, Liska S, Shayevich C, Klausner JD. Nucleic acid amplification tests in the diagnosis of chlamydial and gonococcal infections of the oropharynx and rectum in men who have sex with men. Sex Transm Dis 2008;35(7):637-42.
71. Palmer HM, Mallinson H, Wood RL, Herring AJ. Evaluation of the specificities of five DNA amplification methods for the detection of *Neisseria gonorrhoeae*. J Clin Microbiol 2003;41(2):835-7.
72. Tabrizi SN, Unemo M, Limnios AE, *et al*. Evaluation of six commercial nucleic acid amplification tests for detection of *Neisseria gonorrhoeae* and other *Neisseria* species. J Clin Microbiol 2011;49(10):3610-5.
73. Moran JS. Treating uncomplicated *Neisseria gonorrhoeae* infections: is the anatomic site of infection important? Sex Transm Dis 1995;22:39-47.
74. Ota KV, Fisman DN, Tamari IE, *et al*. Incidence and treatment outcomes of pharyngeal *Neisseria gonorrhoeae* and *Chlamydia trachomatis* infections in men who have sex with men: a 13-year retrospective cohort study. Clin Infect Dis 2009;48(9):1237-43.
75. Sherrard J, Barlow D. Gonorrhoea in men: clinical and diagnostic aspects. Genitourin Med 1996;72:422-6.
76. Barlow D, Phillips I. Gonorrhoea in women: diagnostic, clinical and laboratory aspects. Lancet 1978;1(8067):761-4.
77. European Committee on Antimicrobial Susceptibility Testing. EUCAST, 2014. Breakpoint tables for interpretation of MICs and zone diameters. Version 4.0, 2014. http://www.eucast.org.
78. Clinical and Laboratory Standards Institute CLSI, 2014. Performance standards for antimicrobial susceptibility testing; twenty-fourth informational supplement. M100-S24. January 2014.
79. British Society for Antimicrobial Chemotherapy . BASC 2014. BSAC methods for antimicrobial susceptibility testing. Version 13, January 2014. http://bsac.org.uk. Accessed 01.07.2015
80. Unemo M, Dillon JA. Review and international recommendation of methods for typing *Neisseria gonorrhoeae* isolates and their implications for improved knowledge of gonococcal epidemiology, treatment, and biology. Clin Microbiol Rev 2011;24(3):447-58.
81. Martin IM, Ison CA, Aanensen DM, Fenton KA, Spratt BG. Rapid sequence-based identification of gonococcal transmission clusters in a large metropolitan area. J Infect Dis 2004;189(8):1497-505.
82. Public Health Agency of Canada. PHAC, 2013. Canadian guidelines on sexually transmitted infections. Gonococcal Infections Chapter. July 2013. http://www.phac-aspc.gc.ca/std-mts/sti-its/cgsti-ldcits/section-5-6-eng.php

Glossary of Acronyms

AIDS	Acquired Immune Deficiency Syndrome
AMR	Antimicrobial resistance
BSAC	British Society of Antimicrobial Chemotherapy
CDC	Centers for Disease Control and Prevention
Ceph-R	Cephalosporin resistant
CIDR	Computerised Infectious Disease Reporting
CLSI	Clinical and Laboratory Standards Institute
CPHM	Consultant in Public Health Medicine
DPH	Director of Public Health
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
EQA	External quality assurance
EUCAST	European Committee on Antimicrobial Susceptibility Testing
Euro-GASP	European Gonococcal Antimicrobial Surveillance Programme
FPHM	Faculty of Public Health Medicine
GRASP	Gonococcal Resistance to Antimicrobials Surveillance Programme
GUM	Genitourinary medicine
HIV	Human immunodeficiency virus
HL-AziR	High level azithromycin resistant
HPS	Health Protection Scotland
HPSC	Heath Protection Surveillance Centre
HRB	Health Research Board
HSE	Health Service Executive
ICGP	Irish College of General Practitioners
ICT	Incident control team
ID	Infectious disease
IM	Intramuscular
IV	Intravenous
MIC	Minimum inhibitory concentration
MOH	Medical Officer of Health (Director of Public Health or Consultant in Public Health Medicine)
MSM	Men who have sex with men
NAAT	Nucleic acid amplification test
NG-MAST	*N. gonorrhoeae* multi-antigen sequence typing
NGO	Non-governmental organisation
PHAC	Public Health Agency of Canada
PID	Pelvic inflammatory disease
PN	Partner notification
PO	By mouth
PPV	Positive predictive value
PWID	People who inject drugs
RCPI	Royal College of Physicians of Ireland
RSE	Relationship and Sexuality Education
STI	Sexually transmitted infection
ToC	Test of cure
WHO	World Health Organization

Appendix 1
Organisations consulted during the consultation period

The consultation document was made available via the HPSC website www.hpsc.ie, highlighted in Epi Insight, and emailed directly to the following:

Chief Medical Scientists

Consultants in Genitourinary Medicine

Department of Health

Directors of HSE Sexual Health Clinics

Dr Fiona Lyons, HSE Clinical Lead for Sexual Health

Dr Kevin Kelleher, Assistant National Director Health & Wellbeing - Public Health Child Health, HSE

Dr Philip Crowley, National Director Quality and Patient Safety Division, HSE

Dr Stephanie O'Keeffe, Director of Health & Wellbeing, HSE

Faculty of Pathology, RCPI

Faculty of Public Health Medicine, RCPI

Gender Orientation Sexual Health and HIV, Limerick

Health Service Executive

HIV Ireland

HIV Services Ireland

HPSC Scientific Advisory Committee

HSE Health Promotion

HSE Nursing and Midwifery Services

HSE Sexual Health and Crisis Pregnancy Programme

Infection Prevention Society

Infectious Disease Society of Ireland

Irish College of General Practitioners

Infectious Diseases Consultants

Irish Patients Association

Irish Society of Clinical Microbiology

Medical Officers of Health

Royal College of Physicians of Ireland

Society of Sexually Transmitted Infections in Ireland

Specialists in Public Health Medicine

Surveillance Scientists Association of Ireland

The Sexual Health Centre, Cork

The Women's Health Project, Baggot St., Dublin

Appendix 2
Case Definition

Gonorrhoea (*Neisseria gonorrhoeae*)

Clinical criteria
Any person with at least one of the following eight:

- Urethritis
- Acute salpingitis
- Pelvic inflammatory disease
- Cervicitis
- Epididymitis
- Proctitis
- Pharyngitis
- Arthritis

OR

Any newborn child with conjunctivitis

Laboratory criteria
At least one of the following four:

- Isolation of *Neisseria gonorrhoeae* from a clinical specimen
- Detection of *Neissera gonorrhoeae* nucleic acid in a clinical specimen
- Demonstration of *Neissera gonorrhoeae* by a non amplified nucleic acid probe test in a clinical specimen
- Microscopic detection of intracellular Gram negative diplococci in a urethral male specimen

Epidemiological criteria
An epidemiological link by human to human transmission (sexual contact or vertical transmission)

Case classification

A. **Possible case**

NA

B. **Probable case**

Any person meeting the clinical criteria an with an epidemiological link

C. **Confirmed case**

Any person meeting the laboratory criteria

Appendix 3
Analysis of Irish Euro-GASP Isolates for Individual Antibiotics 2010-2014

Ceftriaxone and cefixime

In 2013 and 2014, no isolates with decreased susceptibility (MIC ≥0.25mg/L; also called intermediate-resistant) to either cefixime or ceftriaxone were reported from Ireland.

Between 2010 and 2012, six isolates were reported with decreased susceptibility to cefixime:

- one in 2010 (genital isolate; male; ≥25 years; mode of transmission unknown);
- two in 2011 (one genital and one anorectal isolate; both MSM; one <25 years and one ≥25 years);
- three in 2012 (all genital isolates; one female and two males; two heterosexual transmission and one unknown; two <25 years and one ≥25 years).

Only one isolate with decreased susceptibility to ceftriaxone has been reported from Ireland in the five years that surveillance has been undertaken: an anorectal isolate from an MSM <25 years in 2012 (this isolate was also ciprofloxacin-resistant but cefixime-susceptible).

European context: Decreased susceptibility to cefixime was first reported to Euro-GASP by France in 2010. In 2012 (this is the latest year for which European-level data from Euro-GASP are available), decreased susceptibility to cefixime was reported by 14 (of 20) Euro-GASP countries, with eight countries reporting >5% and one country (Spain) reporting >15%. Ireland reported 4% decreased susceptibility to cefixime in 2012.

In 2012, three isolates, from three different countries (Germany, Ireland and Slovenia), were reported with decreased susceptibility to ceftriaxone compared with 11 in 2011.

Ciprofloxacin

In 2014, 34% of isolates were ciprofloxacin-resistant, which represents an increase from 26% in 2013.

European context: Of the 20 countries reporting to Euro-GASP in 2012, Ireland had the lowest proportion of resistance to ciprofloxacin (22.5%) [mean 50%; median 56%; range 22.5% (Ireland) to 74% (Austria and Germany; excluding Cyprus with 100% but only three isolates tested)].

Azithromycin

In 2014, 38% of isolates were azithromycin-resistant, which represents a substantial increase on 2013 (3%) and earlier years. Of the 38 isolates reported as azithromycin-resistant, all but one had an MIC of 1 mg/L, which is within one doubling dilution of the susceptible breakpoint. No treatment failures were reported among these isolates.

One isolate with high-level resistance to azithromycin (MIC ≥256 mg/L) was reported in 2012 but this isolate remained susceptible to cefixime and ceftriaxone.

European context: Between 2009 and 2012, there was an overall decrease in azithromycin resistance levels across Europe. In 2012, resistance levels ranged from 0% (France and Hungary) to 15% (Slovenia). Ireland had 9% resistance (all Euro-GASP countries: mean 4.5%; median 2.4%).

Three isolates with high-level resistance to azithromycin (≥256 mg/L) were reported to Euro-GASP in 2012 (two in Sweden and one in Ireland).

Penicillin G

Penicillinase-producing *N. gonorrhoeae* (PPNG) (or high-level plasmid-mediated resistance to penicillin G) was detected in 2% of isolates in 2014. Between 2010 and 2014, the proportion of PPNG in Ireland has varied from 2% to 7%.

European context: In 2012, Ireland had one of the lowest proportions (3%) of PPNG among Euro-GASP countries [mean 13%; median 10.3%; range 0% (Latvia) to 32% (Austria)].

Spectinomycin

No resistance to spectinomycin has been detected in Ireland in 2014, similar to the situation for 2010 to 2013.
European context: No resistance to spectinomycin has been detected in Euro-GASP countries since surveillance began in 2009.

Multi-drug resistance

Considering only the antibiotics that are/were used for first-line treatment (cefixime, ceftriaxone, azithromycin and spectinomycin), one isolate was reported in 2012 with resistance/reduced susceptibility to two or more of these, i.e. were multi-drug resistant. This isolate was resistant to azithromycin and had reduced susceptibility to cefixime (and additionally was ciprofloxacin-resistant) and was from an MSM.

Appendix 4
Summary of Sexual Health Interventions to Change Knowledge, Attitudes and Behaviour (Becassen *et al*, 2014)

How to change 'risky' behaviours:

- Increase knowledge and awareness of risk – through information and awareness raising or increasing knowledge of services
- Change attitudes and motivations
- Increase physical or interpersonal skills – like using assertive skills to suggest that condoms be used
- Change beliefs and perceptions
- Influence social norms – change public perceptions/acceptance of particular behaviours
- Change structural factors and influence wider determinants of health
- Influence availability and accessibility of health services

Key elements of successful approaches for population groups:

- Increase people's ability to communicate effectively about sex
- Facilitate people to increase their condom use skills
- Personalise risk
- Achieve people's perception of risk avoidance as an accepted social norm, provide reinforcement and support for sustaining risk reduction
- At individual level interventions need context specific information and skills

Comprehensive and integrated approaches at community level:

- Focus on changing policy, social structures, norms and cultural practices that can surround individual risk behaviours
- Changing the support structures for unsafe behaviour can ensure that behaviour changes are maintained
- Participatory methodologies that empower individuals in the communities they are working with are the most effective
- The use of the media to shift social norms and address stigma and public misconceptions
- Sustained national prevention strategies - scaling up STI prevention programmes

Appendix 5
The OMG Campaign 2014-15

The OMG campaign, organised by the Gonorrhoea Outbreak Control Team in response to an upsurge in gonorrhoea cases in the East and South-East in 2014-15 was a project with Dublin AIDS Alliance, the HSE Crisis Pregnancy Programme, HSE Health Promotion and Improvement Department, SpunOut.ie and the Union of Students in Ireland. Primarily a social media campaign targeting young (heterosexual) men and women aged 25 years and younger, the main aim was to raise awareness about increased gonorrhoea infections in Ireland and to promote information about gonorrhoea symptoms, transmission, prevention and testing as well as promoting consistent condom use and regular STI testing. Following the campaign it was concluded:

- Using social media channels to target a young audience is a highly cost-effective approach.
- Engaging peers in the development of campaigns is vital to ensure engagement from the target audience.
- Partnerships and collaboration with the 'right' organisations is fundamental to the success of joint (and social media) campaigns.
- Existing STI prevention social media campaigns need to be resourced to build on the success of this campaign and develop a sustained national STI prevention campaign.
- Partnerships with youth organisations that have a high volume of website traffic, and can provide referral links to sexual health-related websites such as yoursexualhealth.ie is highly recommended.
- Partnerships with youth-related organisations that offer additional opportunities for engaging young people in sexual health promotion is recommended and should be resourced.
- Engaging with popular social networking sites relevant to the target audience is recommended for future campaigns of this nature.
- Further development of the design concept used for this campaign is recommended and should be resourced to expand on STI prevention messages.
- The inclusion of a budget for condom packs is recommended for any future sexual health campaigns.
- Provision of hard-copy resources, to complement online resources, is recommended to meet the needs of those who request them.
- Broader communications and collaboration was very beneficial to the development of the campaign, linking up-to-date data surveillance with key messages of the campaign, and collaborating with other relevant experts.

The OMG campaign messages were:

- Gonorrhoea transmission increasing
- Transmission by all types of sexual engagement
- It can be asymptomatic
- You can get tested and treated
- Get tested – it's free
- Use condoms for penetrative vaginal, anal and oral sex

Appendix 6
Gonococcal Conjunctivitis

Neonatal conjunctivitis (opthalmia neonatorium)

Neonatal conjunctivitis presents as acute conjunctivitis, with pink eye, exudate and swelling of the eye within 2-4 days of delivery. If undiagnosed it can lead to rupture of the globe and blindness. The lower eyelid should be swabbed after removal of excess exudate and specimens sent for microscopy, culture and susceptibility testing. Multiplex NAAT for *N. gonorrhoeae* & *C. trachomatis* can be requested but there is no data to validate the use of NAATs at this site. The baby's mother should be tested for gonorrhoea and chlamydia. The eye should be irrigated with sterile saline solution and treatment is with cefotaxime 100mg/kg IM single dose or ceftriaxone 25-50mgs/kg IM / IV (not to exceed 125mgs maximum dose). Ceftriaxone is contra-indicated in neonates <41 weeks gestation and use with caution in neonates >41 weeks gestation as ceftriaxone may displace bilirubin from albumin. The infant should be assessed for evidence of disseminated gonococcal infection, including septicaemia and meningitis.

Acute gonococcal conjunctivitis in adults

Acute gonococcal conjunctivitis in adults often occurs with genital gonorrhoea and autoinoculation is believed to be a significant route of infection. It causes a severe conjunctivitis with marked exudate, usually of short duration. The lower eyelid should be swabbed after removal of excess exudate and samples sent for microscopy, culture and susceptibility testing. Multiplex NAAT for *N. gonorrhoeae* & *C. trachomatis* can be requested but there is no data to validate the use of NAATs at this site. The eye should be irrigated with sterile saline solution and treatment is with ceftriaxone 500mgs IM daily for three days or alternatively ceftriaxone 1g IM single dose (if conjunctivitis) or 3-5 days (if keratitis). If there is a history of penicillin allergy or established ceftriaxone allergy, use spectinomycin 2g IM daily for three days.

Appendix 7
Surveillance form for Probable and Confirmed Cases of Gonorrhoea Treatment Failure

Feidhmeannacht na Seirbhise Sláinte
Health Service Executive

Antimicrobial Resistance Surveillance Form for Probable & Confirmed Cases of Gonorrhoea Treatment Failure v1.0 09/09/2016

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Section A: Patient Information

1. Patient Clinic ID: | | | | | | | | | | |

2. Clinic/Practice Name/Service:

3. Patient First name:

4. Patient Second name:

5. County / Postcode of residence:

6. HSE Area:

7. Sex: F ☐ M ☐

8. Date of birth: | | | | | | | | |

9. Country of birth:

10. Ethnicity:

White:		*Black:*		*Asian:*			
Irish	☐	African	☐	Chinese	☐	Unknown	☐
Irish Traveller	☐	Black other	☐	Asian other	☐	Other / Mixed ethnicity	☐
White other	☐					If other ethnicity, please specify:	

11. Mode of transmission: Heterosexual ☐ Men who have sex with men ☐ Other ☐ Unknown ☐

Section B: Treatment Failure Classification

12. Treatment failure classification:

☐ Probable treatment failure ☐ Confirmed treatment failure

Case definition for probable treatment failure:	**Case definition for confirmed treatment failure:**
A gonorrhoea patient who returns for test of cure or who has persistent genital symptoms after having received treatment for laboratory-confirmed gonorrhoea with a recommended cephalosporin regimen (ceftriaxone or cefixime in appropriate dose) AND remains positive for one of the following tests for *N. gonorrhoeae*: • presence of intracellular Gram-negative diplococci on microscopy taken at least 72 hours after completion of treatment; OR • isolation of *N. gonorrhoeae* by culture taken at least 72 hours after completion of treatment; OR • positive nucleic acid amplification test (NAAT) taken two to three weeks after completion of treatment AND denies sexual contact during the post-treatment follow-up period.	A gonorrhoea patient who returns for test of cure or who has persistent genital symptoms after having received treatment for laboratory-confirmed gonorrhoea with a recommended cephalosporin regimen (ceftriaxone or cefixime in appropriate dose) AND remains positive for one of the following tests for *N. gonorrhoeae*: • presence of intracellular Gram-negative diplococci on microscopy taken at least 72 hours after completion of treatment; OR • isolation of *N. gonorrhoeae* by culture taken at least 72 hours after completion of treatment; OR • positive nucleic acid amplification test (NAAT) taken two to three weeks after completion of treatment AND denies sexual contact during the post-treatment follow-up period AND decreased susceptibility to cephalosporin used for treatment: • cefixime: MIC>0.12 mg/L • ceftriaxone: MIC>0.12 mg/L

13. Did the patient have any type of sexual contact between the start of treatment and the test of cure (second visit)?

Section C: Description of the event

14. Please provide a short description of the circumstances of the event:

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Section D: Diagnosis and treatment - first visit

15. Clinical service where the patient was first seen:

☐ General practice ☐ Family planning clinic ☐ Student/Youth clinic
☐ STI clinic ☐ Other hospital setting ☐ Other

16. Date of first visit: | | | | | | | | |

17. Site(s) of infection: ☐ Genital ☐ Pharyngeal ☐ Other
☐ Ano-rectal ☐ Unknown
If other, please specify:

18. Is the patient symptomatic? ☐ Yes ☐ No

19. If yes, please describe:

20. Diagnostic test(s):

	Genital	*Pharyngeal*	*Ano-rectal*	*Other*
Microscopy:				
Culture:				
DNA probe (culture confirmation):				
DNA probe (direct):				
PCR:				

21. If culture was performed, please provide MICs:

	Genital	*Pharyngeal*	*Ano-rectal*	*Other*
Ceftriaxone:				
Cefixime:				
Azithromycin:				
Gentamicin:				
Ciprofloxacin:				
Spectinomycin:				
Other antibiotic tested:				

22. Treatment provided: ☐ Ceftriaxone 500 mg intramuscularly (IM) as a single dose **together with** azithromycin 1 g as single oral dose

☐ Other - please specify: Antibiotic: Route: Dose:
Antibiotic: Route: Dose:

23. Date of treatment: | | | | | | | | |

Section E: Test of cure - Second visit

24. Date of second visit: | | | | | | | | |

25. Did patient complete treatment? ☐ Yes ☐ No ☐ Unknown

26. Is the patient symptomatic? ☐ Yes ☐ No

27. If yes, please describe:

28. Test for cure? ☐ Yes ☐ No ☐ Unknown

29. If yes, date of test | | | | | | | | |

30. If yes, test(s) done:

	Genital	*Pharyngeal*	*Ano-rectal*	*Other*
Microscopy:				
Culture:				
DNA probe (culture confirmation):				
DNA probe (direct):				
PCR:				

31. If culture was performed, please provide MICs:

	Genital	*Pharyngeal*	*Ano-rectal*	*Other*
Ceftriaxone:				
Cefixime:				
Azithromycin:				
Gentamicin:				
Ciprofloxacin:				
Spectinomycin:				
Other antibiotic tested:				

32. Treatment provided: Antibiotic: Route: Dose:
Antibiotic: Route: Dose:

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Section F: HIV status

33. HIV Status: Positive ☐ Negative ☐ Unknown ☐ **34.** If positive, year of diagnosis: ☐☐☐☐

Section G: Contacts

	Yes	No	Unknown
35. Is the patient a contact of another case of antimicrobial resistant gonorrhoea?	☐	☐	☐

36. Total number of sexual contacts in the last 3 months (prior to diagnosis) ☐☐☐

37. Places and number of recent sexual contacts:

38. How many of the patient's sexual contacts were tested for *N. gonorrhoeae*? ☐☐☐

39. How many of the patient's sexual contacts tested positive for *N. gonorrhoeae*? ☐☐☐

Section H: Travel history

	Yes	No	Unknown	
40. Has the patient had sexual contacts abroad in last 3 months?	☐	☐	☐	If yes, country:
41. Have any of the patients sexual partners had sexual contacts abroad in the last 3 months?	☐	☐	☐	If yes, country:

42. Probable country of infection:

Section I: Risk factors

	Yes	No	Unknown
43. Is the patient a commercial sex worker?	☐	☐	☐
44. Has the patient had contact with a commercial sex worker?	☐	☐	☐
45. Has the patient used illicit drugs (injection or non-injection) in the last 12 months?	☐	☐	☐

46. If yes, please specify drug, frequency of use and whether injection or non-injection?

Section J: Comments

Section K: Form completed by

47. Date first reported to public health: ☐☐/☐☐/☐☐☐☐

48. Completed by:

49. Date: ☐☐/☐☐/☐☐☐☐

50. Position:

51. Public Health Lead:

Please return this completed form to your local Department of Public Health.
See www.hpsc.ie/NotifiableDiseases/NotifyingInfectiousDiseases/ for names and contact details

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