



Public Health
England

Protecting and improving the nation's health

Addressing the increase in syphilis in England: PHE Action Plan

June 2019

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. We do this through world-leading science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

Public Health England

Wellington House

133-155 Waterloo Road

London SE1 8UG

Tel: 020 7654 8000

www.gov.uk/phe

Twitter: [@PHE_uk](https://twitter.com/PHE_uk)

Facebook: www.facebook.com/PublicHealthEngland

Prepared by: Kirsty Foster, Ann K Sullivan, Gwenda Hughes, Ian Simms, Helen Fifer, Hamish Mohammed, Sharon Webb, Stephanie J Migchelsen, Hester Allen, Natasha Ratna and O Noel Gill.

For queries relating to this document, please contact: HIV & STI Department; Blood Safety, Hepatitis, Sexually Transmitted Infections and HIV Division (hivsti@phe.gov.uk)



© Crown copyright 2019

You may re-use this information (excluding logos) free of charge in any format or medium, under the terms of the Open Government Licence v3.0. To view this licence, visit [OGL](https://www.ogil.io). Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

Published June 2019

PHE publications

gateway number: GW-458

PHE supports the UN

Sustainable Development Goals



Contents

Glossary	4
Summary	5
Introduction	6
Background	7
Clinical Presentation and Outcomes	7
Recent Syphilis Incidence in England	8
Geographical Hotspots	8
Populations at Risk	9
Diagnostic testing and reference services	11
Surveillance and monitoring	11
Actions	13
Increase testing frequency of high-risk MSM and re-testing of syphilis cases after treatment	13
Deliver partner notification to BASHH standards	14
Maintain high antenatal screening coverage and vigilance for syphilis throughout antenatal care	15
Sustain targeted health promotion	15
Maintain medical professionals' awareness and knowledge of syphilis	16
Improve and share epidemiological intelligence	16
Diagnostics and Research	17
Appendix: Professional resources	18
References	20

Glossary

BASHH	British Association of Sexual Health and HIV
GB-MSM	Gay and bisexual men who have sex with men
GUM	Genitourinary medicine
HI-MSM	Heterosexual identifying men who have sex with men
MSM	Gay, bisexual and other men who have sex with men
PHE	Public Health England
PN	Partner notification
PrEP	Pre-exposure prophylaxis for HIV
SGSS	Second generation surveillance system
SHS	Sexual health services
STI	Sexually transmitted infection
U=U	Undetectable = untransmittable
WGS	Whole genome sequencing
WHO	World Health Organization

Summary

There has been a substantial increase in the number of infectious syphilis diagnoses made in England between 2008 and 2018. Following a gradual increase between 2000 to 2012, new diagnoses of syphilis increased rapidly from 2013 to 2018 (3,344 to 7,541), with an increase of 5.5% between 2017 and 2018. Most (75%) syphilis diagnoses are made in gay, bisexual and other men who have sex with men (MSM) but there has also been an increase in the number of diagnoses among heterosexuals between 2013 and 2018 (775 to 1,391), as well as in cases of congenital syphilis.

There is a need to strengthen public health measures to reduce transmission of syphilis. National clinical guidelines recommend frequent testing in high-risk MSM ^[1], but surveillance data suggests this is not uniformly carried out. There are also concerns about poor knowledge and awareness of syphilis among MSM ^[2].

The actions specified in this plan are aimed at clinicians, public health specialists, specialty societies and commissioners of specialist sexual health services and focus on the key affected populations.

A successful response to the current increase in syphilis incidence is dependent upon action that optimises 4 prevention pillars fundamental to syphilis control and prevention:

1. Increase testing frequency of high-risk MSM and re-testing of syphilis cases after treatment,
2. Deliver partner notification to BASHH standards,
3. Maintain high antenatal screening coverage and vigilance for syphilis throughout antenatal care.
4. Sustain targeted health promotion.

The detailed actions set out in this report need to be underpinned by maintaining professional awareness and knowledge of syphilis, by improving epidemiological intelligence, and by developing diagnostics and research.

Introduction

There has been a substantial increase in the number of diagnoses of syphilis in recent years in England. Following a gradual increase in the number of new syphilis diagnoses between 2000 and 2012, a 126% increase from 3,344 diagnoses in 2013 to 7,541 in 2018 has been seen, including a 5.5% increase between 2017 and 2018. Although this increase has been seen primarily among gay, bisexual and other men who have sex with men (MSM), who account for 75% of cases in 2018, increases have also been seen in the number of diagnoses made among heterosexuals and in the number of cases of congenital syphilis since 2011 ^[3, 4].

The large increase in diagnoses, the potentially significant reservoir of undiagnosed infection associated with unidentified or anonymous sexual partners (limiting the effectiveness of partner notification), and the epidemiological heterogeneity of the syphilis epidemic, emphasise the importance of re-evaluating and planning national and local control and prevention strategies.

A wide range of measures to control transmission already exists, but the continued increase in cases suggests that these are either not being applied consistently or that new, additional measures should be considered.

Background

Syphilis is a complex, multistage disease caused by *Treponema pallidum* subspecies *pallidum*. When left untreated, syphilis can result in severe cardiovascular, ocular and neurological complications. Infectious syphilis is also associated with an increased risk of HIV transmission.

Syphilis is commonly transmitted by direct contact with an infectious lesion during sexual intercourse, however transmission can also occur through nonsexual contact, such as blood transfusion or vertical transmission. If left untreated, syphilis transmitted from mother to child can lead to serious morbidities including late foetal loss and low birth weight, as well as stillbirth and neonatal death [5].

Clinical presentation and outcomes

The clinical presentation of syphilis is divided into three stages: primary, secondary, and tertiary, and is most infectious in primary and secondary stages of infection [6].

Primary syphilis: Typically, primary syphilis is characterized by a painless ulcer (chancre) which usually occurs in genital sites but, in approximately one-third of cases seen in MSM, may be at extra-genital (anal, rectal, or oral) sites. Transmission occurs through direct contact with the chancre.

Secondary syphilis: If left untreated, 25% of patients will develop signs of secondary syphilis, a systemic disease resulting from the dissemination of treponemes through the body accompanied by a symmetrical maculopapular rash involving the palms and soles.

Latent stage and tertiary syphilis: Secondary syphilis will resolve spontaneously in 3 to 12 weeks and all untreated cases will go on to latent infection for weeks to years with one-third developing signs and symptoms of tertiary syphilis. Latent syphilis, when *T. pallidum* is still present in the body, is divided into 'early' (within 2 years of primary infection) and 'late' (more than 2 years after primary infection). Manifestations of tertiary syphilis include lesions of the skin, bone, viscera, the central nervous system and cardiovascular systems.

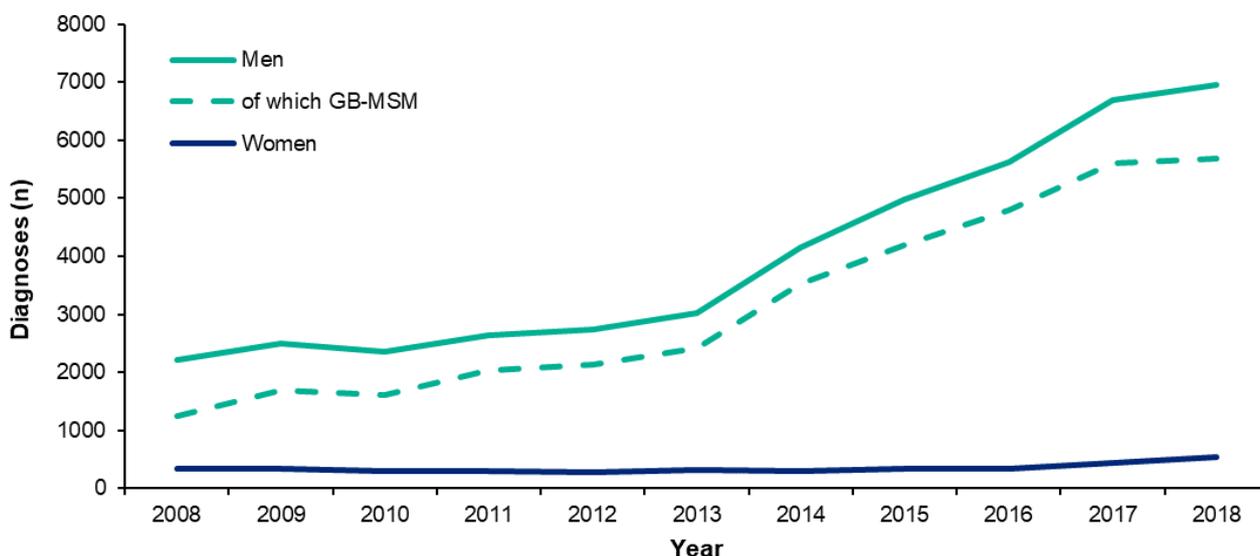
Congenital syphilis: Congenital syphilis occurs when women with syphilis vertically transmit the infection to their foetus during pregnancy. It is estimated that up to 40% of babies with congenital syphilis may be stillborn or die as a newborn [5]. Congenital syphilis causes a variety of symptoms after birth, including jaundice, severe anaemia and neurological complications [6].

Recent syphilis incidence in England

Since 2000 the epidemiology of syphilis and other sexually transmitted infections (STI) has changed significantly, influenced by behaviour change among MSM [7-11].

Between 2008 and 2018, diagnoses increased by 162% (2,874 to 7,541) rising by 5.5% between 7,149 in 2017 and 7,541 in 2018 (Figure 1). The increase in men, especially MSM has accelerated since 2013.

Figure 1. Diagnoses of syphilis (primary, secondary & early latent), by gender and male sexual orientation, England: 2008 to 2018



Data source: GUMCAD STI surveillance System [12].

Geographical hotspots

The current rise in diagnoses has been characterised by outbreaks and clusters in London, Manchester and Brighton [11], with London having the greatest incidence and absolute number of cases. The clusters also show substantial variation in case characteristics by proportion with diagnosed HIV-coinfection, sexual orientation, age, country of birth and stage of infection. Local intelligence is essential to guide public health investigation, determine outbreak characteristics, and evaluate local control and prevention strategies.

Populations at risk

Gay, bisexual and other men who have sex with men

In 2018, 75% of diagnoses of infectious syphilis were in MSM, after a 1.5% increase between 2017 and 2018 [13]. The rise in syphilis diagnoses in MSM is related to the increase in reported number of condomless anal intercourse partners, together with behaviours such as sex parties (group sex) facilitated by geospatial social networking applications, and ‘chemsex’ [14-16].

The number of syphilis diagnoses in MSM who are HIV negative or of unknown HIV status is around 6 times higher than in MSM with prior awareness that they are living with HIV at the time of syphilis acquisition (Figure 2). The situation is reversed when syphilis diagnoses are expressed as population rates (Figure 3) [13].

The higher syphilis incidence in MSM with prior awareness that they were living with HIV when their syphilis was acquired may reflect increases in condomless anal sex and behavioural changes associated with the evidence of treatment effectiveness for preventing HIV transmission (ie. Undetectable=Untransmittable; “U=U”) [17, 18]. The more recent effect in England of HIV pre-exposure prophylaxis (PrEP) scale-up on syphilis incidence in high-risk MSM is the subject of intense study [7, 19, 20].

Figure 2. Diagnoses of syphilis (primary, secondary & early latent), by sex, risk group and awareness of HIV status when syphilis acquired, England: 2013 to 2018

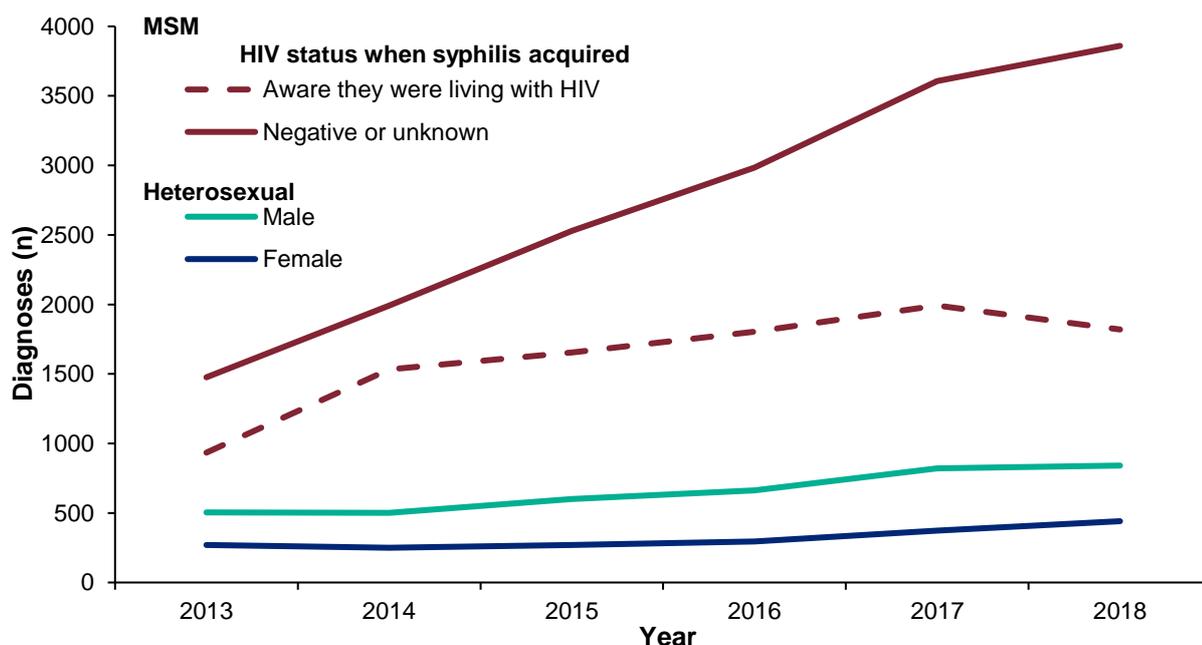
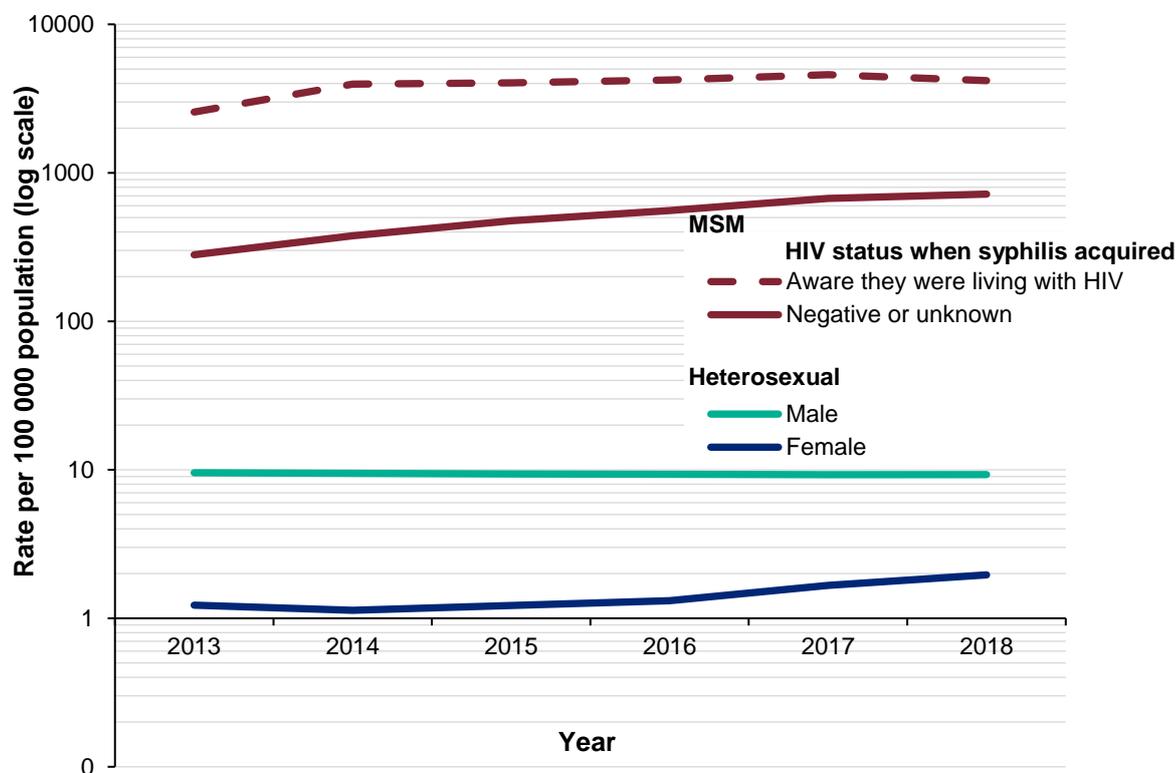


Figure 3. Rates of syphilis (primary, secondary & early latent), by risk group and awareness of HIV status when syphilis acquired, England: 2013 to 2018



Data sources:

GUMCAD and Country and PHE region HIV data tables: <https://www.gov.uk/government/statistics/hiv-annual-data-tables>.^[12]

Notes: i) The population denominator for heterosexual women is based on the difference between all women and the estimated total number of women who have sex with women exclusively (WSW). The proportion of WSW is estimated using Natsal-3 data (0.89% of women aged 16-74 years; unpublished data: at least one same-sex partner in the last 5 years and no different-sex partners in the same time period); ii) The proportion of men who are men who have sex with men (MSM) is estimated using Natsal-3 data (2.6% of men aged 16-74 years^[21]); iii) The number of MSM seen for HIV care that reside in England (from 'Prevention groups HIV data tables': <https://www.gov.uk/government/statistics/hiv-annual-data-tables>); iv) Rates of diagnoses in women who have sex with women are excluded due to small numbers.

Heterosexual-identifying MSM

Heterosexual-identifying men who have sex with men (*HI-MSM*) are men who have sex with other men and with women, who do not report identifying as gay or bisexual.

Although the number of diagnoses made in heterosexual men and women is considerably lower than that seen in gay and bisexual men who have sex with men (*GB-MSM*), diagnoses in these groups increased by 63% and 35%, respectively, between 2013 and 2018 (Figures 2 & 3)^[13]. The greater number of diagnoses and higher diagnosis rate seen in heterosexual men compared to women may in part be due to *HI-MSM*. *HI-MSM* men may be less likely to engage with prevention messages targeted to gay and bisexual men. They may also be reluctant to access sexual healthcare services^[22, 23], and as a result may be less aware of their risk of acquiring STIs, HIV and other virus infections.

Recent STI outbreak investigations suggest behaviourally bisexual men may contribute to sustained transmission between heterosexual and MSM networks [24-27].

Pregnant women and their babies

Syphilis screening coverage in pregnancy is over 99% at present [28]. Nevertheless, while the UK incidence of congenital syphilis is below the World Health Organization (WHO) elimination threshold ($\leq 0.5/1000$ live births) and measures of health service provision recommended by WHO have been achieved, congenital syphilis continues to present a complex clinical, social and public health problem [5]. Recent cases of congenital syphilis have been born both to women who encountered barriers to antenatal care and to women who acquired syphilis following a first trimester antenatal screen negative syphilis test. Between 2010 and 2017, 21 cases of congenital syphilis were reported in England [3, 4]. A small number of cases have been seen over recent calendar years: 10 (2010/11), 4 (2012/13), 1 (2014/15) and 6 (2016/17(January)). Of the 21 mothers involved, 9 women had a record of antenatal screening of whom 7 (including 4 reported in 2016/17) had a negative test at their first trimester antenatal screen, suggesting they were infected during the progress of their pregnancy.

Diagnostic testing and reference services

Syphilis has a wide range of clinical presentations. Although most cases are diagnosed and managed in specialist sexual health services (SHS), the infection may also be diagnosed in other clinical specialities such as dermatology, dentistry, general medicine and obstetrics and gynaecology.

Diagnosis is made through a combination of clinical assessment and laboratory tests. Laboratory testing is usually carried out in local clinical laboratories; PHE National Infection Service Clinical Services Unit provides reference testing and expert advice to NHS laboratories and clinicians about the diagnosis and interpretation of laboratory results.

Surveillance and monitoring

Surveillance of syphilis and monitoring of syphilis screening is carried out by PHE and collaborators:

- all syphilis tests and diagnoses at SHSs are collected through the **GUMCAD STI Surveillance System**
- the **Infectious Diseases in Pregnancy Programme** collects antenatal screening for syphilis data from all maternity providers in England
- **NHS Blood and Transplant/PHE Epidemiology Unit** collates data from the screening of all blood, tissues and organ donations in England

- all primary diagnostic labs in England are requested to report all syphilis screening and diagnostic serology tests to PHE via the **Second Generation Surveillance System**

Special local and national data collections have been undertaken over the past twenty years to enhance surveillance. PHE National Infection Services provides detailed guidance on the multidisciplinary expertise and collaboration required to investigate, manage and control an STI outbreak or incident ^[29]. A toolkit of agreed questions to be used in STI outbreak investigation has been developed and is available for use in local and national investigations.^a

^a Available from the PHE Field Service Portal (requires PHE user login).

Actions

The continued increase in syphilis cases together with the potential for severe disease necessitate a strengthening of preventive measures. Success is dependent upon optimising the following four pillars that are essential to syphilis control and prevention. These need to be underpinned by maintaining professional awareness and knowledge of syphilis, by improving epidemiological intelligence, and by developing diagnostics and research.

The wider population of heterosexual men and women should be offered a full sexual health screen when clinically appropriate and especially when attending sexual health services.

Pillar 1: Increase testing frequency of high-risk MSM and re-testing of syphilis cases after treatment

1. More syphilis testing of high-risk MSM is required to ensure new infections are treated promptly and reduce incidence. High-risk MSM (such as those having condomless sex with new or casual partners) should be tested every 3 months for syphilis as part of a full STI screen as recommended by HPA in 2012 ^[30] and BASHH in 2014 ^[31] and 2016 ^[1].
2. Clinicians and health care workers should be alert to the increased risk of syphilis infection in MSM living with HIV. This group should be treated according to BHIVA standards and guidelines ^[32]. Those receiving HIV care should be tested at each six-monthly routine visit and should be referred to local SHS for additional testing at the intervening three-month timepoints.
3. From November 2019 onwards, PHE will be including syphilis testing within its National HIV self-sampling service, which is available through an online portal [www.freetesting.hiv] for persons at higher risk of HIV infection. Local authorities who participate in this HIV self-sampling commissioning framework are encouraged to include dual syphilis and HIV testing as well.
4. MSM taking PrEP should be provided with information about STIs, including facts about syphilis and the need for regular and repeat syphilis testing, in all PrEP-related material that is delivered in clinics, venues and online. PrEP service providers and clinicians should make every contact count to raise awareness of syphilis prevention, including condom usage, testing and treatment.

5. Syphilis testing recommendations for HI-MSM are similar to those described above for GB-MSM, but will require different approaches to raise awareness, provide information and encourage regular testing.
6. Individuals treated for syphilis must have repeated serological testing to monitor outcome in line with BASHH guidelines ^[33].
7. Systematic recall of high-risk MSM should be maximised using technological solutions such as SMS, smart phone applications and e-notifications. Sexual health and HIV services should utilise these techniques to provide regular testing reminders to high-risk MSM and increase the uptake of testing.
8. Sexual Health Commissioners should specify meeting the relevant BASHH and BHIVA standards in contracts for sexual health and HIV care services. They should also commission services that provide syphilis test reminders for high-risk MSM.
9. National and local audits should be undertaken to monitor service delivery against current BASHH standards. Information on best practices for delivering high quality care should be shared widely.

Pillar 2: Deliver partner notification to BASHH standards ^[34-36]

Specialist skills in gathering detailed, sensitive information, are required for effective partner notification (PN). Guidance on the resources required and standards to which PN should be carried out are provided by professional bodies ^[34-36]. As the ways in which people meet their sexual partners change, particularly with the move to using social media and geospatial social networking applications, methods used to deliver PN need to adapt and develop.

1. Close working relationships and protocols, including use of a multidisciplinary approach to ascertaining and managing partners, should bring together clinicians in all relevant specialities to ensure that necessary partner testing and treatment is completed.
2. Service providers and clinicians undertaking notification of male partners of female syphilis cases should specifically inquire about sex (including oral sex) with other men in those identifying as heterosexual.

Pillar 3: Maintain high antenatal screening coverage and vigilance for syphilis throughout antenatal care

1. Screening for syphilis, offered and recommended to all pregnant women in early pregnancy at their first appointment for antenatal care, should be maintained at the PHE Screening standards (acceptable 95% coverage; achievable 99%) [28]. At any stage of pregnancy, women presenting with symptoms consistent with an STI should be offered a full STI screen including another syphilis test.
2. Further syphilis testing in the later stages of pregnancy should be offered to women whose apparent risk of acquiring an STI has changed during the pregnancy. Examples of such changes to be vigilant for include injecting drug use, sex work, a partner with a diagnosed STI, or a known male bisexual partner [33, 37].
3. All those involved in the clinical care of women diagnosed with syphilis during pregnancy should ensure close working relationships and protocols, including use of a multi-disciplinary team approach to ensure all necessary testing and treatment are completed. Care pathways for pregnant women infected with syphilis should be implemented. BASHH provides a birth plan for mothers infected with syphilis which should be followed [38]. As part of this process a neonatal alert should also be applied so that mother and babies are assessed at birth [38].
4. Partners of women who test positive for syphilis should be strongly recommended to get tested with a full STI screen and treated epidemiologically for syphilis. In particular, service providers and clinicians delivering PN need to be aware of the link in some cases between heterosexual and MSM sexual networks through *HI-MSM*, and should specifically enquire about sex with other men, including oral sex.

Pillar 4: Sustain targeted health promotion

1. Simple sexual health promotion messages to improve awareness and knowledge of syphilis, condom use, and access to testing and treatment services, are the mainstay of STI prevention in the general population. More targeted messages and interventions are provided to those groups at higher risk of infection; to date these have mainly focused on messages to *GB-MSM*. Adaptation of this messaging will be required when targeting health messages to *HI-MSM* [22, 39].
2. Risk-reduction counselling of patients attending sexual health clinics who are at risk of, or diagnosed with syphilis, is essential for preventing infection or reinfection and has been shown to be effective for reducing STI incidence [40-42]. Advice should be provided about routes of transmission, symptoms, complications and treatment. Providing advice about preventing re-infection is a key aspect of syphilis control and should be included in the routine management of individual cases.

3. MSM should be made aware about routes of transmission, symptoms, testing, treatment and cure. The importance of repeat testing, as part of a full STI screen should be emphasised as well as general safe sex messages such as correct condom usage. Health promotion messages and delivery methods should be reviewed with stakeholders in the light of best available evidence.
4. Collaboration with community groups about PrEP-related health promotion should ensure inclusion of information about syphilis testing.
5. Understanding the local population, in particular of vulnerable groups, and settings where risks of transmission are higher, is essential to ensure that local interventions and campaigns to raise awareness and promote increased testing are culturally appropriate and targeted effectively.

Maintain medical professionals' awareness and knowledge of syphilis

1. Challenges in syphilis diagnosis occur because cases may present with non-specific symptoms, or to non-STI specialist services, which may delay diagnosis. Health professionals engaging with MSM, pregnant women and young children should be alert to recognising the signs and symptoms of all stages of syphilis.
2. Professional bodies should ensure clinicians and medical professionals are aware of the various presentations of syphilis, and where to find additional information on diagnosis, treatment and partner notification. The Royal College of Paediatrician's Infant Branch's new guidance on infection testing in neonates and infants is in preparation. A list of resources from professional organisations is provided in the Appendix.

Improve and share epidemiological intelligence

1. PHE collects routine surveillance data on STIs via the GUMCAD STI Surveillance System. This includes syphilis tests and diagnoses made in all commissioned SHSs in England. Improvements to GUMCAD are being implemented in 2019 which will include more detailed information on behavioural risk factors, clinical presentation and complications of syphilis infection such as ocular and otosyphilis.
2. Local cluster and outbreak investigations should ensure that locally relevant risk factor information is collected, enhanced by routinely collected data, and that findings are shared to inform development and local implementation of public health interventions ^[29].
3. PHE is implementing enhanced national surveillance of congenital syphilis cases, with support from relevant clinical and professional bodies, to maximise case

ascertainment. The data will be explored to better identify predictors of maternal syphilis and neonatal transmission.

4. Contracts with providers of sexual health services, HIV care services and antenatal screening services should specify the requirement that suitable data are collected and reported to the appropriate surveillance and monitoring systems.

Diagnostics and research

1. Local laboratories should consider accessing PCR testing of swabs taken from suspected syphilis lesions, which is now available.
2. A syphilis serum bank has been established at PHE Colindale which provides a set of reference samples for quality assurance and against which new diagnostic tests could be validated.
3. Surveillance data should be investigated to measure the positive predictive value of syphilis infection indicators in MSM, especially in those taking PrEP.
4. Whole genome sequencing (WGS) should be used to explore the genetic diversity of syphilis in England, provide insight into transmission between and within sexual networks, and identify associations with drug resistance and infection complications [43].

Appendix: Professional resources

Royal College of General Practitioners

Sexually Transmitted Infections in Primary Care

<https://www.rcgp.org.uk/clinical-and-research/resources/a-to-z-clinical-resources/sexually-transmitted-infections-in-primary-care.aspx>

Sexual Health in Primary Care e-learning

<http://elearning.rcgp.org.uk/course/info.php?id=179&popup=0>

British Association for Sexual Health and HIV

2013 UK national guideline for consultations requiring sexual history taking

<https://www.bashhguidelines.org/media/1078/sexual-history-taking-guideline-2013-2.pdf>

2016 United Kingdom national guideline on the sexual health care of men who have sex with men.

<https://www.bashhguidelines.org/media/1162/MSM-2016.pdf>

2015 BASHH CEG guidance on tests for Sexually Transmitted Infections

<https://www.bashhguidelines.org/media/1084/sti-testing-tables-2015-dec-update-4.pdf>

Recommendations for Testing for Sexually Transmitted infections in Men who have Sex with Men

<https://www.bashhguidelines.org/media/1083/bashh-recommendations-for-testing-for-stis-in-MSM-final.pdf>

UK national guidelines on the management of syphilis 2015

<https://www.bashhguidelines.org/media/1148/uk-syphilis-guidelines-2015.pdf>

Syphilis in Pregnancy

https://www.bashhguidelines.org/media/1036/sts_pil_digital_2016.pdf

Syphilis Birth Plan

https://www.bashhguidelines.org/media/1196/syphillis-bp_print_2016_p3.pdf

Public Health England

Sexually Transmitted Infections (STIs): annual data tables

<https://www.gov.uk/government/statistics/sexually-transmitted-infections-stis-annual-data-tables>

Sexually Transmitted Infections (STIs): managing outbreaks

<https://www.gov.uk/government/publications/sexually-transmitted-infections-stis-managing-outbreaks>

GUMCAD STI Surveillance System

<https://www.gov.uk/guidance/gumcad-sti-surveillance-system>

Congenital syphilis: UK Surveillance

<https://www.gov.uk/government/publications/congenital-syphilis-uk-surveillance>

Faculty of Sexual and Reproductive Healthcare

Barrier Methods for Contraception and STI Prevention

<https://www.fsrh.org/standards-and-guidance/documents/ceuguidancebarriermethodscontraceptionsdi/>

e-Learning for Sexual and Reproductive Health (eSRH)

<https://www.fsrh.org/education-and-training/e-learning-for-sexual-and-reproductive-healthcare-esrh/>

References

1. Clutterbuck, D., et al., *2016 United Kingdom national guideline on the sexual health care of men who have sex with men*. Int J STD AIDS, 2018: p. 956462417746897.
2. Datta, J., et al., *Awareness of and attitudes to sexually transmissible infections among gay men and other men who have sex with men in England: a qualitative study*. Sexual Health, 2019. **16**(1): p. 18-24.
3. Furegato, M., et al., *Factors associated with four atypical cases of congenital syphilis in England, 2016 to 2017: an ecological analysis*. Eurosurveillance, 2017. **22**(49): p. 17-00750.
4. Simms, I., et al., *A brief recent history of the epidemiology of congenital syphilis in the United Kingdom*. International Journal of STD & AIDS, 2018. **29**(11): p. 1110-1119.
5. World Health Organization, *Global guidance on criteria and processes for validation: elimination of mother-to-child transmission of HIV and syphilis*. 2014, WHO: Geneva.
6. Holmes, K., et al., *Sexually Transmitted Diseases Third Edition ed. Congenital Syphilis*. . 1999, New York: McGraw-Hill Professional.
7. Mohammed, H., et al., *Increase in Sexually Transmitted Infections among Men Who Have Sex with Men, England, 2014*. Emerging infectious diseases, 2016. **22**(1): p. 88-91.
8. Vanden Berghe, W., et al., *International mobility, sexual behaviour and HIV-related characteristics of men who have sex with men residing in Belgium*. BMC Public Health, 2013. **13**: p. 968.
9. Hughes, G. and N. Field, *The epidemiology of sexually transmitted infections in the UK: impact of behavior, services and interventions*. Future Microbiol, 2015. **10**(1): p. 35-51.
10. Abara, W.E., et al., *Syphilis Trends among Men Who Have Sex with Men in the United States and Western Europe: A Systematic Review of Trend Studies Published between 2004 and 2015*. PLoS One, 2016. **11**(7): p. e0159309.
11. Petersen, J., et al., *Identifying and interpreting spatiotemporal variation in diagnoses of infectious syphilis among men, England: 2009 to 2013*. Sex Transm Infect, 2016. **92**(5): p. 380-6.
12. Savage, E.J., et al., *Improving surveillance of sexually transmitted infections using mandatory electronic clinical reporting: the genitourinary medicine clinic activity dataset, England, 2009 to 2013*. Eurosurveillance, 2014. **19**(48): p. 20981.
13. Public Health England, *Sexually transmitted infections and screening for chlamydia in England, 2017, Health Protection Report in Health Protection Report 2017*.
14. Simms, I., et al., *Recent outbreaks of infectious syphilis, United Kingdom, January 2012 to April 2014*. Eurosurveillance, 2014. **19**(24): p. 20833.
15. Aghaizu, A., et al., *Sexual behaviours, HIV testing, and the proportion of men at risk of transmitting and acquiring HIV in London, UK, 2000–13: a serial cross-sectional study*. The Lancet HIV, 2016. **3**(9): p. e431-e440.
16. Daskalopoulou, M., et al., *Condomless sex in HIV-diagnosed men who have sex with men in the UK: prevalence, correlates, and implications for HIV transmission*. Sex Transm Infect, 2017. **93**(8): p. 590-598.
17. The Lancet, HIV., *U=U taking off in 2017*. The Lancet HIV, 2017. **4**(11): p. e475.
18. Rodger, A.J., et al., *Risk of HIV transmission through condomless sex in serodifferent gay couples with the HIV-positive partner taking suppressive antiretroviral therapy (PARTNER): final results of a multicentre, prospective, observational study*. Lancet, 2019.

19. Fenton, K.A. and J. Imrie, *Increasing rates of sexually transmitted diseases in homosexual men in Western Europe and the United States: why?* Infect Dis Clin North Am, 2005. **19**(2): p. 311-31.
20. PrEP Impact Trial. *PrEP Impact Trial: A pragmatic health technology assessment of PrEP and implementation*. 2017; Available from: <https://www.prepimpacttrial.org.uk/>.
21. Mercer, C., et al., *Changes in sexual attitudes and lifestyles in Britain through the life course and over time: findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal)*. The Lancet, 2013. **382**(9907): p. 1781-1794.
22. Service, R.R., *Rapid Response: Sexual health of heterosexually-identified men who have sex with men in Rapid Response Service*. 2014, Ontario HIV Treatment Network: Toronto.
23. Friedman, M.R., et al., *HIV infection and sexual risk among men who have sex with men and women (MSMW): a systematic review and meta-analysis*. PLoS One, 2014. **9**(1): p. e87139.
24. Ragonnet-Cronin, M., et al., *Non-disclosed men who have sex with men in UK HIV transmission networks*. Lancet HIV, 2018. **5**(6): p. e309–e316.
25. Shankar, A.G., S. Mandal, and S. Ijaz, *An outbreak of hepatitis B in men who have sex with men but identify as heterosexual*. Sex Transm Infect, 2016. **92**(3): p. 227.
26. Smolarchuk, C., et al., *Persistence of an outbreak of gonorrhoea with high-level resistance to azithromycin in England, November 2014–May 2018*. Eurosurveillance, 2018. **23**(23).
27. Fifer, H., et al., *Sustained transmission of high-level azithromycin-resistant Neisseria gonorrhoeae in England: an observational study*. Lancet Infect Dis, 2018. **18**(5): p. 573-581.
28. Public Health England. *NHS Infectious Diseases in Pregnancy Screening Programme: Screening standards data report 1 April to 31 March 2017* 2019; Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/800511/IDPS_data_report_2016-17.pdf.
29. Public Health England, *Managing outbreaks of Sexually Transmitted Infections. Operational Guidance*. 2017: London.
30. Health Protection Agency, *HIV in the United Kingdom: 2012 Report*. 2012, Health Protection Services, Colindale.
31. British Association of Sexual Health and HIV, *Recommendations for Testing for Sexually Transmitted infections in Men who have Sex with Men*. 2014, British HIV Association
32. Waters, L., et al., *BHIVA/BASHH/FSRH guidelines for the sexual & reproductive health of people living with HIV*. 2017.
33. Kingston, M., et al., *UK national guidelines on the management of syphilis 2015*. International Journal of STD & AIDS, 2015. **27**(6): p. 421-446.
34. Society of Sexual Health Advisers, *Guidance on Partner Notification*. 2015, SSHA: London.
35. Bell, G. and J. Potterat, *Partner notification for sexually transmitted infections in the modern world: a practitioner perspective on challenges and opportunities*. Sex Transm Infect, 2011. **87 Suppl 2**: p. ii34-6.
36. McClean, H., et al., *2012 BASHH statement on partner notification for sexually transmissible infections*. International Journal of STD & AIDS, 2013. **24**(4): p. 253-261.
37. Public Health England, *Annual review of infections in blood, tissue and organ donors: 2016*, in *Health Protection report*. 2017.
38. Higgins, S., P. McMaster, and M. Kingston. *Syphilis Birth Plan*. 2016 October 2016; Available from: https://www.bashhguidelines.org/media/1196/syphillis-bp_print_2016_p3.pdf.

39. Reback, C.J. and S. Larkins, *Maintaining a heterosexual identity: sexual meanings among a sample of heterosexually identified men who have sex with men*. Arch Sex Behav, 2010. **39**(3): p. 766-73.
40. Ward, H. and N. Low, *Direct transmission: introducing a new feature in STI*. Sex Transm Infect, 2007. **83**(6): p. 425.
41. Rietmeijer, C.A., *Risk reduction counselling for prevention of sexually transmitted infections: how it works and how to make it work*. Sex Transm Infect, 2007. **83**(1): p. 2-9.
42. Barham, L., D. Lewis, and N. Latimer, *One to one interventions to reduce sexually transmitted infections and under the age of 18 conceptions: a systematic review of the economic evaluations*. Sexually transmitted infections, 2007. **83**(6): p. 441-446.
43. Stamm, L.V., *Global challenge of antibiotic-resistant Treponema pallidum*. Antimicrob Agents Chemother, 2010. **54**(2): p. 583-9.