Report on global sexually transmitted infection surveillance 2018

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Abbreviations and acronyms

ABO	adverse birth outcome
AMR	antimicrobial resistance
ANC	antenatal care
EMTCT	elimination of mother-to-child transmission
ESC	extended-spectrum cephalosporins
FSW	female sex worker
GAM	Global AIDS Monitoring
GARPR	Global AIDS Response Progress Reporting
GASP	Gonococcal Antimicrobial Susceptibility Programme
GUD	genital ulcer disease
HPV	human papillomavirus
MIC	minimum inhibitory concentration
MSM	men who have sex with men
MTCT	mother-to-child transmission
NGO	nongovernmental organization
PID	pelvic inflammatory disease
PMTCT	prevention of mother-to-child transmission
PrEP	pre-exposure prophylaxis
PWID	people who inject drugs
RST	rapid syphilis test
SDGs	Sustainable Development Goals
STI	sexually transmitted infection
UD	urethral discharge
UI	uncertainty interval
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNPD	United Nations Population Division (of the Department of Economic and Social Affairs)
WHO	World Health Organization
XDR	extensively drug-resistant

Executive summary

Globally, more than 1 million curable sexually transmitted infections (STIs) occur each day. According to WHO global estimates for 2016, there were roughly 376 million new infections of the four curable STIs – chlamydia, gonorrhoea, syphilis and trichomoniasis.

STI prevention and control have widespread public health benefits and contribute to progress towards the Sustainable Development Goals (SDGs) related to ending preventable deaths of children under 5 years, combating communicable disease, and providing universal access to sexual and reproductive health care.

In 2016, WHO released its *Global health sector strategy on sexually transmitted infections 2016–2021*. The Strategy envisions that by 2030, rates of congenital syphilis will be reduced to less than 50 cases per 100 000 live births in 80% of countries; and the incidence of infections with *T. pallidum* (syphilis) and *N. gonorrhoeae* (gonorrhoea) would have fallen by 90% globally between 2018 and 2030.

To achieve its goals, a critical component of the Global STI Strategy is strengthening STI surveillance and programme monitoring systems. This report summarizes the latest country-reported data from Global AIDS Monitoring (GAM) and the Gonococcal Antimicrobial Susceptibility Programme (GASP) as well as regional- and country-level estimates generated using tools developed with support from WHO for modelling STI epidemics: Spectrum-STI and the WHO congenital syphilis estimation tool.

Towards elimination of mother-to-child transmission of syphilis

Since the launch of the WHO *Global guidance on criteria and processes for validation: elimination of mother-to-child transmission of HIV and syphilis* in 2014, eleven countries have been validated as having achieved elimination of mother-to-child transmission of syphilis (EMTCT). Globally, median syphilis testing coverage in antenatal care (ANC) clinics is 90% among countries that report ANC syphilis indicators into GAM; however, only 51% of countries reported on ANC screening for syphilis. Still fewer countries reported on syphilis treatment among women in ANC found to be positive for syphilis. Reporting of congenital syphilis rates remains severely challenged at the national level, with few countries from high-burden regions reporting these values into GAM.

Syphilis prevalence among key populations

The seroprevalence of syphilis among key populations such as female sex workers (FSWs) and men who have sex with men (MSM) is an important indicator of progress in STI control. About one fifth of countries reported syphilis prevalence among key populations to GAM in 2016–2017.

The median reported syphilis seroprevalence for FSWs was 3.2%, in contrast to 6.0% for MSM. About 40% of the countries (15 out of 38) reported more than 5% prevalence among FSWs, and more than half of the countries (24/41) reported more than 5% prevalence of syphilis among MSM. More effort is needed to scale up programmes to increase the coverage of prevention and treatment services for these most-at-risk populations in order to reduce the burden of syphilis in the general population.

General population case reporting on urethral discharge and gonorrhoea

Case reporting indicators based on STI syndromes and etiological causes were incorporated into GAM in 2013. In 2016–2017, roughly 47% of countries globally (91 out of 194) reported either urethral discharge (UD) or gonorrhoea among men aged 15–49 years. Of these, 35 countries reported both indicators. Case rates varied widely within and across regions, and probably underestimate the burden of UD and gonorrhoea due to limitations and inconsistencies in reporting and diagnosis, as well as barriers to health-care-seeking behaviours. The median case rates per 100 000 men 15–49 years of age were:

- UD: 82.5 (range 1.1–6133.7)
- gonorrhoea: 16.9 (range 0.0–297.1).

Estimating prevalence trends for chlamydia, gonorrhoea and syphilis using epidemic models

To augment STI surveillance systems, two new epidemic modelling tools have been developed to estimate trends in the prevalence and incidence of STIs, and incidence of congenital syphilis. The widespread availability of syphilis prevalence data allowed the application of the Spectrum-STI modelling tool (Avenir Health) to generate national-level syphilis trend estimates for adult women in 132 countries. The countries included in

this exercise represent approximately 90% of the adult burden of syphilis globally. The WHO congenital syphilis modelling tool generates estimates of congenital syphilis as well as associated adverse birth outcomes. This tool has been used in 10 countries to evaluate country readiness for validation of EMTCT and to help countries better target and advocate for EMTCT programming.

Gonococcal antimicrobial susceptibility

Antimicrobial-resistant strains of *N. gonorrhoeae* continue to be a critical challenge to STI prevention and control efforts. Resistance has expanded to include macrolides, sulphonamides, trimethoprim combinations and quinolones. Several isolated ceftriaxone-resistant strains of *N. gonorhoeae* have recently been reported. More than 60 countries in the six WHO regions participate in the Gonococcal Antimicrobial Surveillance Programme (GASP), which seeks to monitor patterns of resistance and provide data to inform treatment guidelines. The number of countries that reported susceptibility data for at least one antibiotic a year grew from 50 in 2013 to 60 countries in 2016.

In 2016, 60 countries reported *N. gonorrhoeae* isolate susceptibility data for one or more antimicrobials. Among 57 countries reporting susceptibility data for extended-spectrum cephalosporins (ESC), 17 (30%) reported that ≥5% of specimens had decreased susceptibility. Among 57 countries reporting on azithromycin susceptibility, 28, or nearly half, reported ≥5% resistance. Of the 59 countries reporting ciprofloxacin resistance testing, 56 (95%) reported that ≥5% of specimens were resistant strains and 10 countries reported >90% resistant strains. Overall, stronger surveillance is needed to better characterize the extent of antimicrobial resistance among gonococcal strains.

Human papillomavirus vaccination to prevent cervical cancer

A critical adverse outcome of certain high-risk types of human papillomavirus (HPV) are precancerous lesions on the cervix that can progress to cervical cancer. Globally, an estimated 280 000 women die of cervical cancer each year; 89.5% of deaths can be attributed to just nine types of HPV. HPV vaccination for young girls aged 9–14 years is a primary prevention strategy for cervical cancer and is part of the Global Strategy to Eliminate Cervical Cancer launched at the World Health Assembly in 2018. Data compiled as of October 2018 show that 85 out of 194 (44%) countries have HPV vaccine incorporated into their national immunization programme. HPV vaccine implementation is strongly related to country income, with more than 80% of high-income countries having the vaccine as part of national immunization programmes compared to 20% of lower-middle-income and 13% of low-income countries. Critical barriers to vaccine access and coverage include cost, logistical challenges to delivering vaccines to the 9–14 years' age group, and low prioritization given to HPV vaccination programmes at country level.

1. Introduction

The global burden of sexually transmitted infections (STIs) remains high *(1)*. In 2016, there were an estimated 376 million new infections (more than 1 million per day) of the four curable STIs – chlamydia, gonorrhoea, syphilis and trichomoniasis (Table 1.1). Prevalence rates vary by World Health Organization (WHO) region (Fig. 1.1 and 1.2). The burden of viral STIs is similarly high, with an estimated 417 million prevalent cases of herpes simplex virus infection and approximately 291 million women infected with human papillomavirus (HPV) *(1)*. In contrast, many countries have achieved successful control of chancroid and lymphogranuloma venereum infections, which have nearly disappeared.

Table 1.1. Global estimates of new cases of curable STIs in 2016

Sexually transmitted infection	No. (million)
Chlamydia	127
Gonorrhoea	87
Syphilis	6
Trichomoniasis	156
Total	**376**

Source: Rowley et al. 2018 *(1)*

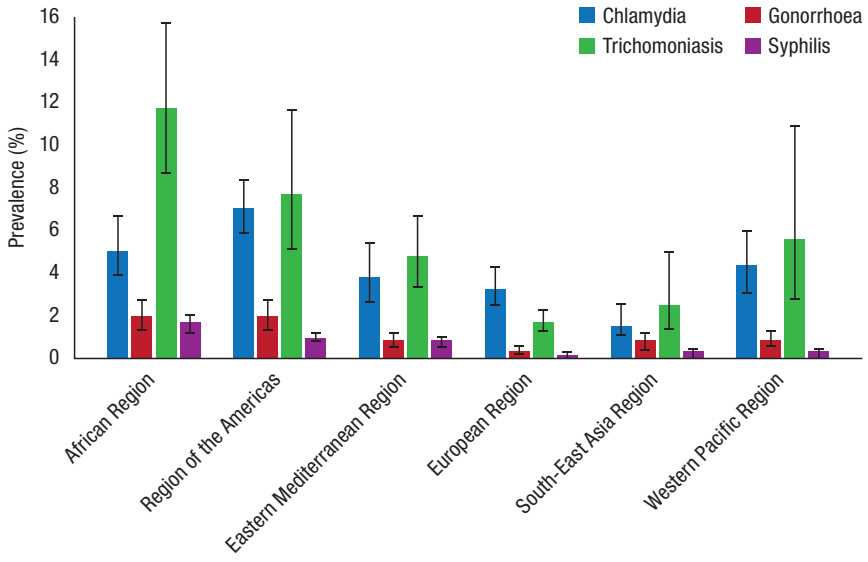
STI prevention and control has widespread public health benefits. Left untreated, some STIs increase the risk of HIV transmission during unprotected sexual contact and lead to complications, such as pelvic inflammatory disease (PID), infertility, ectopic pregnancy, miscarriage, fetal death and congenital infections. Estimated STI-related mortality includes 200 000 fetal and neonatal deaths each year due to syphilis in pregnancy and over 280 000 cervical cancer deaths each year due to HPV *(3, 4)*.

STI control contributes to progress towards multiple Sustainable Development Goals (SDGs), including:

- SDG 3.2 (By 2030, end preventable deaths of newborns and children under 5 years).
- SDG 3.3 (By 2030, end the epidemics of AIDS, combat other communicable diseases).
- SDG 3.7 (By 2030, ensure universal access to sexual and reproductive health care).
- SDG 3.8 (By 2030, achieve universal health coverage).

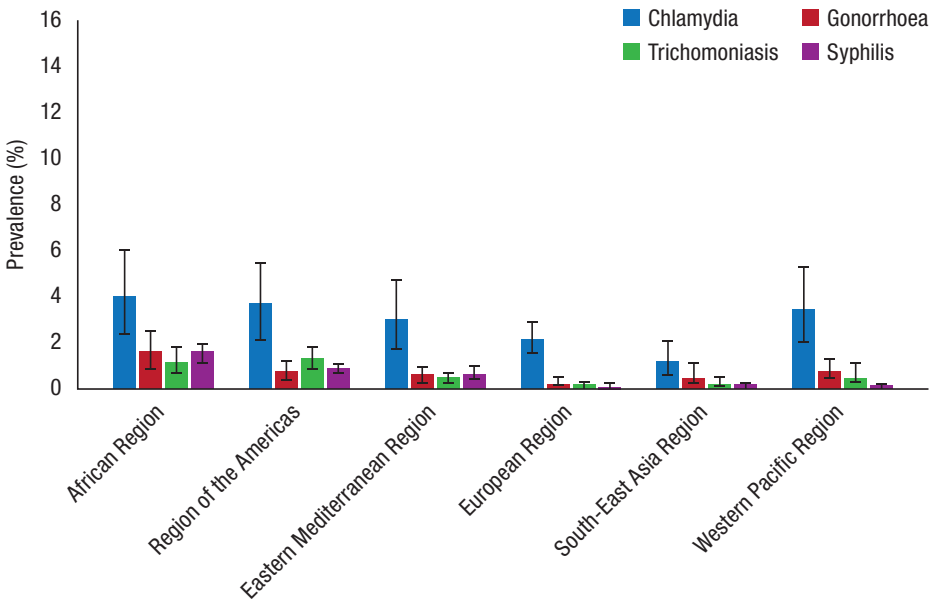
The health-related SDGs can be found at: https://www.un.org/sustainabledevelopment/health/.

Fig. 1.1. Estimated prevalence (and 95% uncertainty interval [UI]) of chlamydia, gonorrhoea, trichomoniasis and active syphilis in women aged 15–49 years by WHO region, based on 2009–2016 data



Source: Rowley et al. 2018 *(1)*

Fig. 1.2. Estimated prevalence (and 95% UI) of chlamydia, gonorrhoea, trichomoniasis and active syphilis in men aged 15–49 years by WHO region, based on 2009–2016 data



Source: Rowley et al. 2018 *(1)*

1.1 The Global health sector strategy on STIs 2016–2021

In 2016, WHO released its *Global health sector strategy on sexually transmitted infections 2016–2021*, with the goal of ending STI epidemics as a major public health concern *(5)*. The principles guiding the Strategy include:

1. achieving universal health coverage;
2. use of evidence-based interventions and policies;
3. promoting human rights, gender equality and health equity;
4. working through partnerships;
5. integration across relevant sectors;
6. engagement and empowerment of people most affected by STIs.

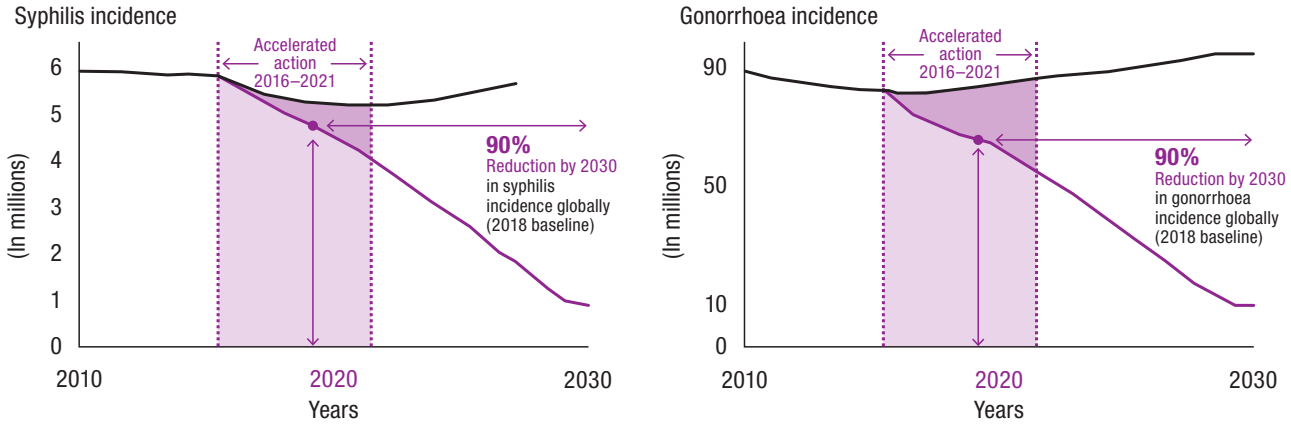
Each of these principles benefits from reliable estimates of STI burden to foster advocacy among national and international stakeholders in support of improvements in STI service delivery.

To measure progress against the Strategy's goal, key targets have been identified:

By 2030:

- ≤50 cases of congenital syphilis per 100 000 live births in 80% of countries;
- 90% reduction in *T. pallidum* incidence globally (2018 global baseline);
- 90% reduction in *N. gonorrhoeae* incidence globally (2018 global baseline);
- 90% national vaccination coverage and at least 80% district coverage in countries with HPV vaccine in their national immunization programme.

Fig. 1.3. Key targets for the WHO Global health sector strategy on STIs 2016–2021



Source: WHO, 2016 *(5)*

The estimated 2016 incidence of syphilis and gonorrhoea, used as the baseline for monitoring progress towards targets of the Global STI Strategy, are included in this report. These estimates were generated using published prevalence data for gonorrhoea, syphilis and congenital syphilis for 2016 (Table 1.2).

Monitoring progress towards the global targets will require improvement in STI surveillance and trend monitoring at the national level. Global estimates are based on general population-based prevalence assessments, which are lacking in many countries and among male populations. As part of implementing the Global Strategy and improving national-level STI surveillance, WHO recommends that countries conduct routine (every 2–3 years) prevalence assessments of bacterial STIs among general populations of men and women. Examples of these general populations include pregnant women, women attending family planning clinics, military recruits, and men undergoing employment physicals.

Table 1.2. 2018 baseline estimates for monitoring the Global STI Strategy: gonorrhoea, syphilis and congenital syphilis (data year 2016)

Infection	Incidence
Gonorrhoea	20 cases per 1000 population (UI 14–28) in women, and 26 cases per 1000 population (UI 15–41) in men (ages 15–49 years)
Syphilis	1.7 cases per 1000 population (UI 1.4–2.0) in women, and 1.6 cases per 1000 population (UI 1–1.9) in men (ages 15–49 years)
Congenital syphilis	473 cases/100 000 live births (UI 385–561)

UI = uncertainty interval

Sources: Rowley et al. 2018 *(1)*; Korenromp et al. 2018 *(3)*

Box 1. Key milestones of the Global STI Strategy

The Global Strategy also identifies key milestones that STI control programmes need to achieve in terms of systems development and service availability.

By 2020:

- 70% of countries have STI surveillance systems in place.
- 70% of countries have at least 95% of pregnant women screened for syphilis and 90% tested for HIV, and 95% of pregnant women who test positive receive effective treatment.
- 70% of countries provide STI services (or link to services) in all primary HIV, reproductive health, family planning, and antenatal/postnatal care services.
- 70% of countries deliver HPV vaccine through the national immunization programme.
- 70% of countries report on antimicrobial resistance (AMR) in *N. gonorrhoeae*.
- 70% of key populations have access to a full range of STI and HIV services, including condoms.

The Global STI Strategy's emphasis on strengthening public sector STI surveillance systems is becoming more important for addressing concerns related to the growing AMR to *N. gonorrhoeae* as well as the sexual mode of transmission newly recognized as relevant to epidemics such as those caused by the Ebola and Zika viruses. Table 1.3 summarizes progress against some of the Strategy's targets for systems development and surveillance.

Table 1.3. Progress on implementation of the Global Strategy for prevention and control of sexually transmitted infections, selected indicators

WHO region (No. of countries in the region)	No. (%) of reporting countries having an STI strategy or action plan (GAM 2016)	No. (%) of countries screening at least 95% of pregnant women for syphilis & treating 95% of positive pregnant women (GAM 2016–2017)	No. (%) of countries monitoring AMR in *N. gonorrhoeae* (GASP 2016)	No. (%) of countries reporting syphilis prevalence for at least one key population (GAM 2016–2017)
African Region (47)	35 (74)	4 (9)	4 (6)	10 (21)
Region of the Americas (35)	23 (66)	4 (11)	9 (23)	16 (46)
Eastern Mediterranean Region (21)	9 (43)	1 (5)	1 (5)	5 (24)
European Region (53)	14 (26)	4 (8)	27 (51)	9 (17)
South-East Asia Region (11)	6 (55)	1 (9)	6 (55)	6 (55)
Western Pacific Region (27)	17 (63)	4 (15)	13 (48)	9 (33)
Overall (194)	104 (54)	18 (9)	60 (31)	55 (28)
2020 target		**70%**	**70%**	

Source: GAM, 2016–2017 *(6)*; WHO/GASP, 2016 data *(7)*

1.2 Data systems and tools for STI surveillance

Surveillance is a key element of the WHO Global STI Strategy, since reliable data are essential for measuring the success of prevention and control interventions. In 2012, WHO updated the STI surveillance guidelines to better address emerging issues in the epidemiology of STIs and promote the use of new technologies in diagnosis *(8)*.

The core components of STI surveillance are:

1) case reporting using syndromic and etiological approaches;

2) prevalence assessments in specific populations;

3) assessment of etiologies of STI syndromes; and

4) AMR monitoring.

As of 2018, WHO utilizes two primary data collection systems and two tools for interpreting STI surveillance data at the national and regional levels. These two data collection systems are as follows:

- the Joint United Nations Programme on HIV/AIDS (UNAIDS) Global AIDS Monitoring (GAM)[1] system, which captures country-level case reporting for urethral discharge (UD) and gonorrhoea, syphilis testing, prevalence and treatment among antenatal care (ANC) attendees, congenital syphilis rates, and prevalence assessments of syphilis among key populations (*see* Box 2);
- the Gonococcal Antimicrobial Surveillance Programme (GASP), which collates data on AMR of *N. gonorrhoeae* isolates from participating countries *(7).*

The two tools for modelling national-level gonorrhoea, chlamydia, syphilis and congenital syphilis case numbers, prevalence and incidence are:

- the WHO congenital syphilis estimation tool *(9)*, which uses GAM ANC syphilis indicator data to estimate congenital syphilis rates, progress towards achievement of case rate targets for elimination of mother-to-child transmission (EMTCT), adverse birth outcomes (ABOs) associated with maternal syphilis, and quantities of benzathine penicillin needed to treat pregnant women with syphilis; and
- the Spectrum-STI modelling package *(10)*, which uses available STI prevalence studies to estimate the prevalence and incidence of syphilis, gonorrhoea and chlamydia among the general and high-risk populations.

Together with etiological assessments of STI syndromes, these data systems and tools are used to conduct global STI surveillance. Following from previous global reports of STI surveillance in 2012, 2013 and 2015 (*11, 12, 13),* this report summarizes the most recent GAM and GASP data as well as selected modelling results from the Spectrum-STI modelling and WHO congenital syphilis estimation tools.

This report is organized according to the Global STI Strategy and presents surveillance values for indicators reported through GAM for syphilis and gonorrhoea (including UD as a surrogate measure). It also presents country snapshots of the epidemic trajectory of STIs as projected by the national use of the Spectrum-STI and congenital syphilis estimation tools. In addition, progress in expanding gonorrhoea surveillance and AMR are presented. Finally, as a new component of this report, HPV vaccine targets are presented alongside programme planning towards the goal of elimination of cervical cancer.

1.3 Overall data quality and considerations for interpretation

Data for the eight core STI indicators were obtained from the GAM system database for 2016 and 2017. For countries that did not report in 2016 or 2017, data from prior years were obtained from previous reports on global STI surveillance and included in tables in the annexes.

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[1] Prior to 2017, the system of global monitoring for AIDS was referred to as Global AIDS Response and Progress Reporting (GARPR). The system and associated guidance for reporting are now referred to as Global AIDS Monitoring (GAM) *(6)*.

The calculation of case rates for UD among men, and etiological diagnosis of gonorrhoea and congenital syphilis require population denominators. When country reports of UD or gonorrhoea have missing denominators, these figures are obtained from the United Nations Population Division of the Department of Economic and Social Affairs (UNPD) population estimates for men aged 15–49 years or live births in the corresponding year of data collection *(15)*. As part of routine GAM data review, reported population denominators were checked for countries with extremely high case rates or large fluctuations across multiple years and replaced with the UNPD estimates when obvious errors were found.

Updated data for this report on AMR surveillance for *N. gonorrhoeae* isolates were obtained from WHO GASP reported by regional reference laboratories participating in the programme for 2015 and 2016.

Several considerations need to be taken into account when interpreting surveillance data. In general, comparability between countries is limited by varying case definitions and completeness of reporting. For example, in some countries, routine programme data may be reported comprehensively, or for only certain types of sites or selected geographical areas. Special studies, such as integrated biobehavioural surveys, may be limited to intervention areas and consequently biased towards persons who access services. In general, surveillance data are most useful for monitoring trends within a given country when data collection methods and resources remain constant over time. A discussion of specific data quality and interpretation issues associated with each indicator is included in each chapter.

Box 2. STI indicators for Global AIDS Monitoring (GAM)

As the primary source of STI indicators submitted annually by Member countries, these estimates present the most recent data available. Among these, the five most critical STI indicators are also included in the *Consolidated strategic information guidelines for HIV in the health sector*; two as priority national indicators and three as additional indicators *(14)*.

2.4A Percentage of women accessing antenatal care (ANC) services who were tested for syphilis[2]

2.4B Percentage of ANC attendees tested who were positive for syphilis

2.4C Percentage of ANC attendees positive for syphilis who received treatment[2]

2.5 Number and rate (per 100 000 live births) of reported congenital syphilis cases (live births and stillbirths) in the past 12 months[3]

3.11 Percentage of sex workers with active syphilis

3.12 Percentage of men who have sex with men with active syphilis

10.4 Number and rate (per 100 000 men ages 15–49 years) of men reported with gonorrhoea in the past 12 months[3]

10.5 Number and rate (per 100 000 men ages 15–49 years) of men reported with urethral discharge in the past 12 months[3]

[2] National indicators in the WHO *Consolidated strategic information guidelines for HIV in the health sector*

[3] Additional indicators in the WHO *Consolidated strategic information guidelines for HIV in the health sector*

2. Towards elimination of mother-to-child transmission of syphilis

Key points

- From 2015 to 2018, 11 countries and territories have been validated as having eliminated mother-to-child transmission (MTCT) of syphilis (in order of elimination year): Cuba, Thailand, Belarus, Moldova, Anguilla, Antigua and Barbuda, Bermuda, Cayman Islands, Montserrat, St Kitts and Nevis, and Malaysia *(16).*
- Many countries still have low coverage of syphilis screening in ANC due to limited procurement of syphilis test kits.
- Many countries have experienced limited availability and provider use of benzathine benzylpenicillin, especially in the African Region.
- Elimination of congenital syphilis requires coordinated efforts to improve advocacy and investment in intervention efforts.

Untreated syphilis in pregnancy is a major cause of morbidity and mortality, resulting in fetal deaths and stillbirths, preterm or low-birth-weight infants, neonatal death and syphilis infections in infants. In addition, maternal syphilis leads to an increase in the risk of mother-to-child transmission (MTCT) of HIV.

In 2007, WHO and its partners launched *The global elimination of congenital syphilis: rationale and strategy for action*, a global effort to eliminate MTCT of syphilis *(17)*. This was followed in 2014 by the WHO integrated initiative and guidance on the global elimination of mother-to-child transmission of HIV and syphilis *(18).* To be considered for EMTCT of syphilis, countries must meet WHO criteria for two years for process indicators and one year for the impact indicator before review by regional and global validation committees to confirm elimination (Box 3).

Box 3. Required indicators for validation of EMTCT of syphilis

Impact indicator

Case rate of congenital syphilis ≤50 cases per 100 000 live births

Process indicators

ANC coverage (at least one visit) ≥95%

Coverage of syphilis testing of pregnant women ≥95%

Treatment of syphilis-seropositive pregnant women ≥95%

Source: WHO, 2017*(18)*

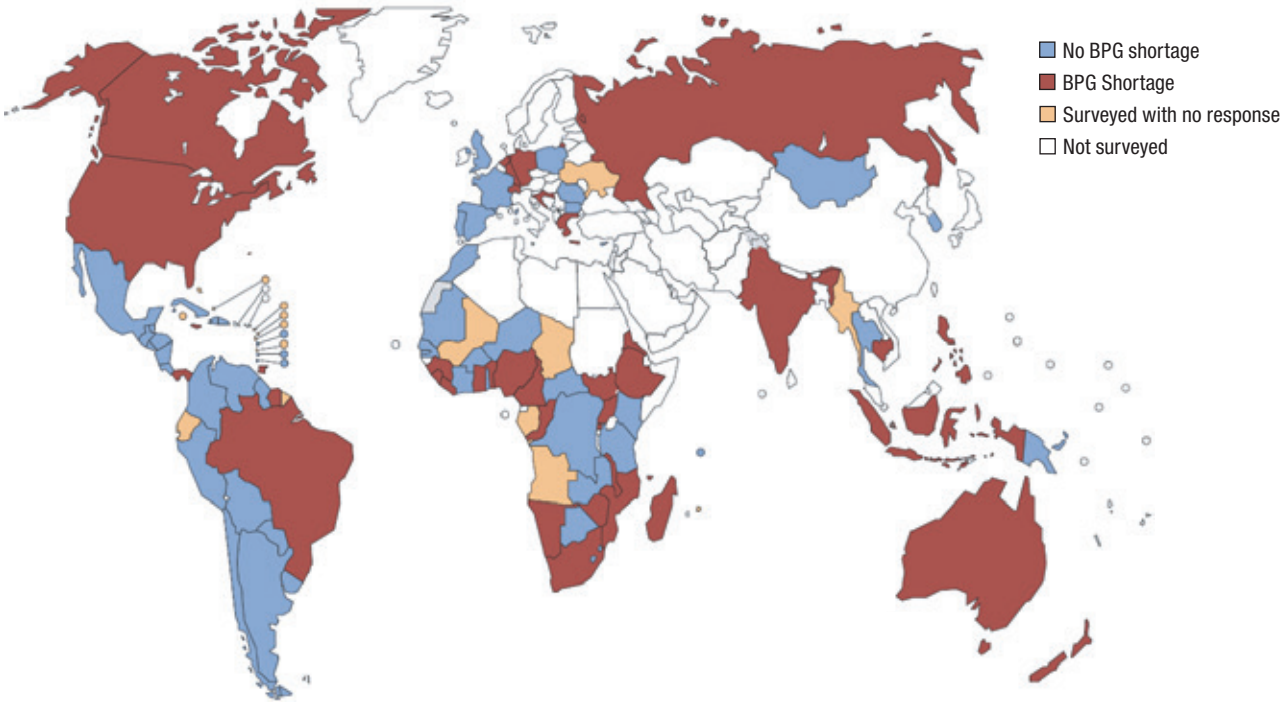
In June 2017, a global meeting convened by the WHO Department of Reproductive Health and Research and the Bill and Melinda Gates Foundation brought global experts together to review the progress made to eliminate congenital syphilis in the decade since the launch of the strategy on congenital syphilis *(19).* As shown in Table 1.3, only 9% of GAM-reporting countries have achieved the milestone of ≥95% testing of ANC women and ≥95% treatment of pregnant women who test positive, a great distance away from the 2020 milestone of 70% of countries.

The consensus view of meeting participants was that limited progress has been made due to several critical challenges, including:

- limited access to and performance of syphilis testing in ANC clinics;
- limited availability and provider use of benzathine benzylpenicillin, the only recommended treatment for pregnant women with syphilis (*see* Fig. 2.1);
- poor visibility of advocates, and lagging stakeholder support and investment in elimination efforts;
- inadequate surveillance measures for attributing adverse health outcomes to congenital syphilis, hampering efforts to draw attention to the severity of the problem;
- the stigma surrounding syphilis infection.

To address these challenges, partners at the meeting agreed to prioritize the following five activities: (1) promotion of cost-effective rapid syphilis diagnostics, including the dual rapid HIV/syphilis test; (2) broader use of modelling tools to estimate the burden of maternal and congenital syphilis; (3) identifying and addressing the causes of benzathine penicillin shortages; (4) educational support for providers to administer benzathine penicillin; and (5) positive reframing of screening and treatment for syphilis as part of a healthy pregnancy and infancy.

Fig. 2.1. Reported benzathine penicillin shortages in 40 countries during 2014–2017



Forty countries reported shortages of benzathine penicillin at some point during 2014–2017. As of June 2018, the global supply of this medication has been restored with lingering national shortages due to national-level procurement rather than manufacturer production or global supply.

Source: Nurse-Findlay et al. 2017 *(20)*

2.1 Monitoring the ANC syphilis testing and treatment cascade

The assessment of progress towards prevention of congenital syphilis (MTCT) begins with monitoring the performance of ANC syphilis testing and treatment, as shown in Table 2.1.

Since 2012, median ANC testing coverage has been 85% or higher globally among countries that report. Trends in testing coverage may improve as countries take advantage of improved diagnostic tools, which increase the feasibility of testing in more settings (Box 4).

Over the same period, the median prevalence among ANC attendees tested for syphilis was similar in 2014 (0.7%) and 2016–2017 (0.8%). Although fewer countries report on treatment coverage for pregnant women diagnosed with syphilis, the median reported treatment rate has remained more than 95% since 2014 (Table 2.1). More detailed analysis of each indicator in the cascade is reviewed in subsequent sections.

Table 2.1 Proportion of pregnant women in antenatal care (ANC) who were tested for syphilis, who tested positive and who received treatment, by WHO region, 2012, 2014 and 2016 (or 2017)

WHO region	Percentage of ANC attendees tested for syphilis						Percentage of ANC attendees tested who were positive for syphilis						Percentage of syphilis-positive ANC attendees who received treatment					
	2012		2014		2016–2017		2012		2014		2016–2017		2012		2014		2016–2017	
	No. of reporting countries	Median value	No. of reporting countries	Median value	No. of reporting countries	Median value	No. of reporting countries	Median value	No. of reporting countries	Median value	No. of reporting countries	Median value	No. of reporting countries	Median value	No. of reporting countries	Median value	No. of reporting countries	Median value
African Region	21	71.8%	34	40.1%	31	56.0%	22	1.9%	31	1.6%	30	2.0%	13	100.0%	21	98.0%	23	100.0%
Region of the Americas	17	82.6%	19	87.5%	30	92.7%	18	0.5%	21	0.4%	27	0.7%	13	80.5%	19	92.9%	23	89.8%
Eastern Mediterranean Region	0	–	5	42.6%	7	58.1%	2	–	4	0.0%	6	0.2%	0	–	3	80.0%	5	100.0%
European Region	6	93.1%	9	93.4%	12	97.9%	7	0.1%	9	0.1%	12	0.0%	4	–	7	10%	8	100.0%
South-East Asia Region	7	37.4%	7	58.3%	7	31.2%	4		7	0.5%	6	0.1%	4	–	6	89.9%	7	71.4%
Western Pacific Region	10	98.3%	15	100.0%	13	94.5%	11	2.0%	13	1.8%	14	0.6%	9	93.0%	11	100.0%	10	100.0%
Global	**61**	**86.1%**	**89**	**85.5%**	**100**	**89.7%**	**64**	**1.0%**	**85**	**0.7%**	**95**	**0.8%**	**43**	**94.2%**	**67**	**95.6%**	**76**	**99.6%**

Source: WHO, 2014 *(13)*; GAM database, 2015, 2017 *(6)*

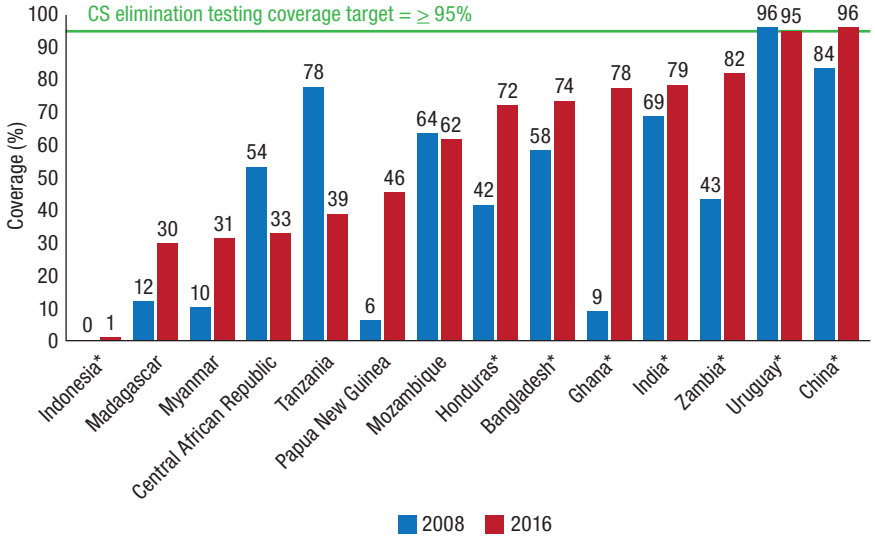
Box 4. Rapid syphilis tests may increase the coverage of ANC syphilis testing

Increases in ANC syphilis testing coverage may be observed as diagnostic tools improve. For example, increasingly, countries have begun to adopt rapid syphilis tests (RSTs) that allow for point-of-care testing in settings with limited laboratory resources. Rapid dual HIV/syphilis tests are now available for use in ANC settings. Good performance of these tests has been reported from both laboratory and field settings *(21)*. Currently, one rapid dual HIV/syphilis test is WHO prequalified.

Source: WHO Information note on use and interpretation of rapid dual HIV/syphilis tests. Geneva: WHO; 2017 (http://apps.who.int/iris/bitstream/handle/10665/252849/WHO-RHR-17.01-eng.pdf;jsessionid=B9B90326182E950890CE32EA8E5B143C?sequence=1, accessed 02 December 2018).

There are 172 countries that have reported on congenital syphilis indicators since 2008, including 14 priority investment case countries for elimination *(22)*. A more systematic look at data from the priority countries shows that 10 of 14 countries have increased testing coverage, sometimes significantly (e.g. Ghana, Zambia), and two countries report achieving the programme target of ≥95% testing coverage (China and Uruguay) (Fig. 2.2).

Fig. 2.2. Antenatal syphilis testing coverage in 14 priority countries, 2008 and 2016



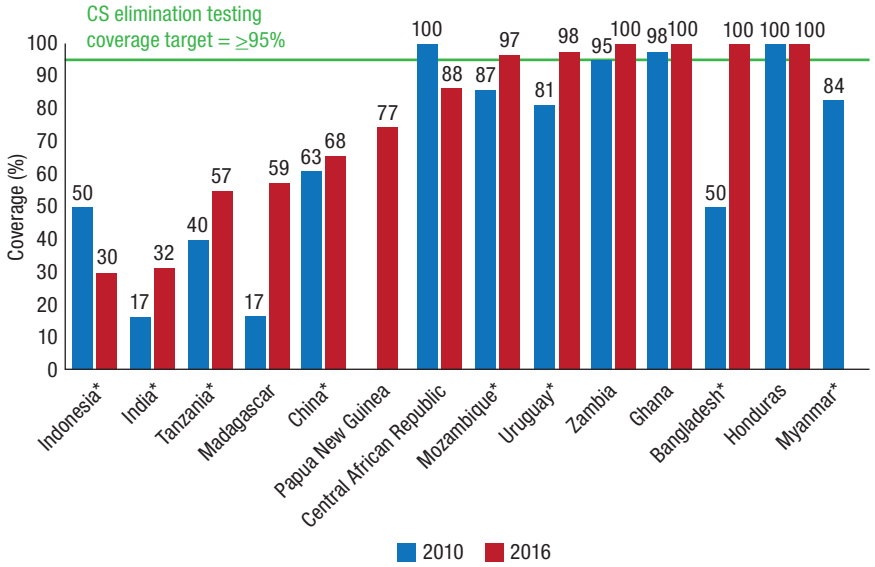
*When data were not reported in 2008 or 2016, the next closest year's data were used.

CS: congenital syphilis

Source: GAM, 2008, 2016 *(6, 13)*; WHO, 2012 *(22)*

All 14 priority countries reported on treatment coverage between 2010 and 2016; however, Myanmar and Papua New Guinea reported only once during this period. In Tanzania, steep declines in treatment coverage may be due to both an expansion of reporting in 2016 to include lower-performing facilities and benzathine penicillin shortages. In Indonesia, the use of non-penicillin regimens may account for lower treatment coverage (Fig. 2.3).

Fig. 2.3. Antenatal syphilis treatment (IM benzathine penicillin) coverage in 14 priority countries, 2010 and 2016



*When data were not reported in 2010 or 2016, the next closest year's data were used.

CS: congenital syphilis

Source: GAM, 2010, 2016 *(6, 13)*; WHO, 2012 *(21)*

However, among the 14 priority countries with data between 2010 and 2016, six met the congenital syphilis elimination indicator target of ≥95% of diagnosed mothers treated with intramuscular (IM) benzathine penicillin, and all reported increased treatment coverage over this period. Note that some countries with high testing coverage have moderate levels of treatment coverage (e.g. China), while other priority countries report high treatment coverage, but moderate testing coverage. (e.g. Central African Republic).

2.2 ANC syphilis data quality and interpretation

When interpreting ANC indicator data, it is important to take into account local factors affecting the quality, generalizability and representativeness of the data. Data may be reported from routine programme monitoring or sentinel surveillance. Some countries only report data from intervention sites for prevention of mother-to-child transmission (PMTCT), sites with access to syphilis testing or from limited geographical areas, thereby limiting data generalizability. In addition, most countries do not include private sector data. How well ANC data represent all pregnant women also depends on the proportion of antenatal women who attend ANC services. In countries with low rates of ANC attendance, the indicators do not reflect the majority of pregnant women. Annex 1 provides the most recently reported data on the proportion of pregnant women with at least one ANC visit.

The laboratory methods and case definitions used affect the comparability of ANC syphilis prevalence data between countries. Two positive tests (one treponemal and one non-treponemal) are required to maximize the sensitivity and specificity of a diagnosis of syphilis. Of those that reported the type of test, nearly 50% reported using only non-treponemal tests, and 20% used only treponemal tests. To avoid overestimation of positivity associated with different testing practices, various correction factors should be applied to results from countries that use a single reactive non-treponemal test, a reactive treponemal test only, and those not specifying the type of test used *(23)*. About 31% of countries (25 out of 81) reporting the prevalence of syphilis among ANC attendees to GAM in 2016 did not specify the type of test used.

Differences exist in service indicator definition within countries. For example, the ANC visit during which syphilis screening occurred may not be consistent among countries. Some countries reported testing coverage for the first ANC visit,

others reported screening coverage at any visit, and some reported both values. Some countries reported the same data for both first-visit testing and testing on any visit, while others reported first-visit testing one year and testing on any visit the following year. Therefore, for some countries, it is not clear whether the data were entered correctly. For the purpose of this analysis, either value (testing on the first visit or on any visit) was used if countries reported one value; for countries that reported both values, screening at any visit was used.

ANC syphilis testing coverage (Indicator 2.4A)

Based on 100 countries reporting in 2016–2017, the median proportion of ANC attendees who were tested for syphilis was 89.7% (range 0.3–100%).

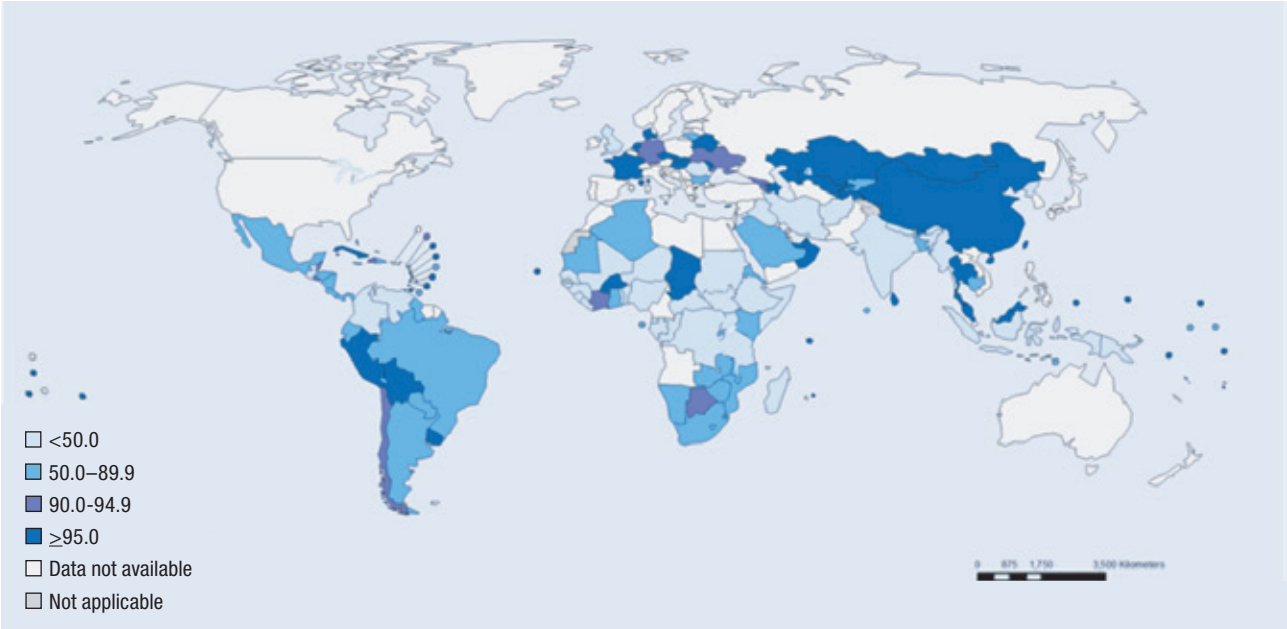
The largest number of reporting countries (*N*=31 and 30, respectively) were from the African Region and Region of the Americas (Table 2.2). The South-East Asia Region reported the lowest median testing coverage (31%). The highest median ANC testing coverage (98%) was reported by countries in the European Region, but a wide range of results were reported from every region. Overall, 36 countries reported at least 95% testing coverage (mostly in the European Region and the Region of the Americas). In contrast, 27 countries reported less than 50% coverage (mostly in the African Region) (Fig. 2.4). Country-specific ANC testing coverage is shown in Annex 1.

Table 2.2. Percentage of ANC attendees who were tested for syphilis (ANC syphilis testing coverage) as reported by 100 countries, by region, 2016–2017

WHO region	No. of countries reporting this indicator (% reporting)	Median ANC syphilis testing coverage (%) (range [%])
African Region	31 (66)	56.0 (3.1–100)
Region of the Americas	30 (86)	92.7 (30.6–100)
Eastern Mediterranean Region	7 (33)	58.1 (14.3–100)
European Region	12 (23)	97.9 (77.8–100)
South-East Asia Region	7 (64)	31.2 (0.3–99.1)
Western Pacific Region	13 (48)	94.5 (42.9–100)
Overall	**100 (51)**	**89.7 (0.3-100)**

Source: GAM, 2017 *(6)*

Fig. 2.4. Reported percentage of ANC attendees tested for syphilis during pregnancy based on the most recent data available since 2007 (using data available through 2017)



Source: WHO Global Health Observatory, 2018 *(24)*

ANC syphilis seroprevalence (Indicator 1.17.2)

In 2016–2017, 95 countries reported the percentage of ANC attendees tested for syphilis who were found to be positive. The largest number of countries reporting was from the African Region, followed by the Region of the Americas. The median syphilis prevalence was 0.8% (range 0–10.4%) and was highest in the African Region (Table 2.3 and Fig. 2.5).

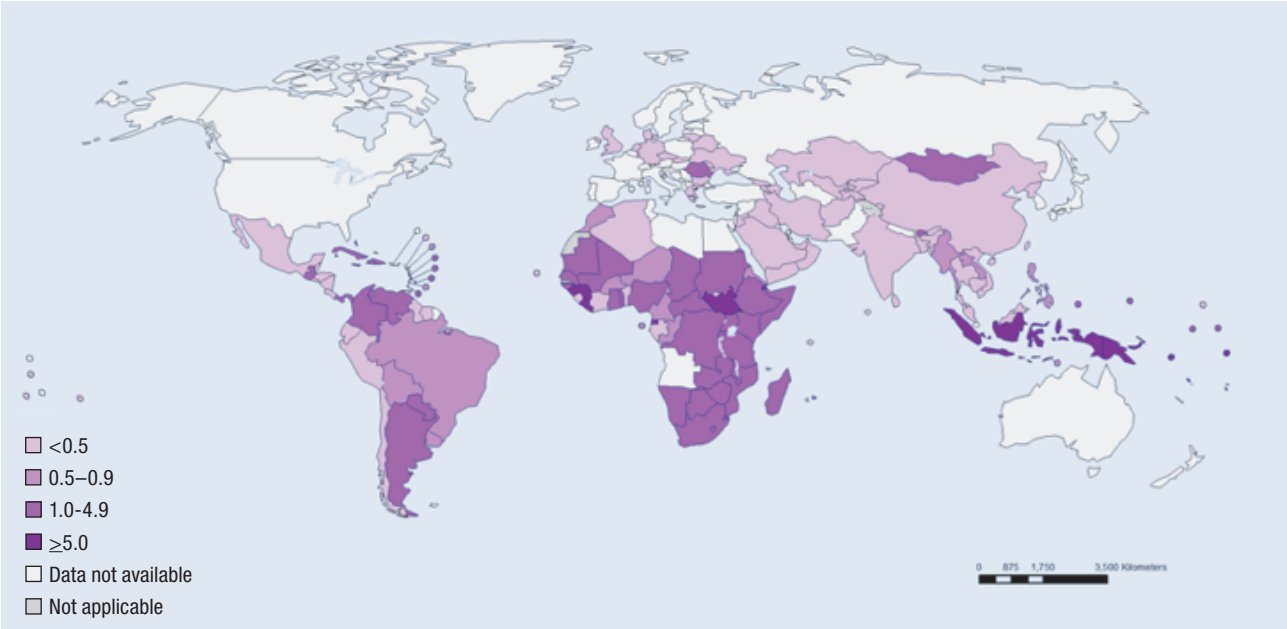
Overall, 40 countries reported ≥1% ANC seroprevalence; among these, 22 were from the African Region and nine from the Region of the Americas. Methodologies varied between countries, with some reporting results from routine programme data and others reporting data based on sentinel surveillance.

Table 2.3. Proportion of ANC attendees who tested positive for syphilis (ANC syphilis seroprevalence) as reported by 95 countries, by region, 2016–2017

WHO Region	No. of countries reporting (% reporting)	Median ANC syphilis seroprevalence (%) (range [%])
African Region	30 (64)	2.0 (0.1–7.6)
Region of the Americas	27 (77)	0.7 (0.0–3.9)
Eastern Mediterranean Region	6 (29)	0.2 (0.0–1.3)
European Region	12 (23)	0.0 (0.0–0.4)
South-East Asia Region	6 (55)	0.1 (0.0–3.2)
Western Pacific Region	14 (52)	0.6 (0.0–10.4)
Overall	**95 (49)**	**0.8 (0.0–10.4)**

Source: GAM, 2017 *(6)*

Fig. 2.5. Reported percentage of ANC attendees who tested positive for syphilis based on the most recent data available since 2008 (using data available through 2017)



Source: WHO Global Health Observatory, 2018 *(25)*

ANC syphilis treatment (Indicator 1.17.3)

Out of 95 countries reporting on syphilis test results, 16 identified no cases of syphilis among pregnant women. Among the 76 countries that reported during 2016-17 on treatment of ANC attendees who were positive for syphilis during 2016-17, the median coverage was 99.6% (range 16.7–100%). The median proportion of women receiving treatment was 100% in all regions except the Region of the Americas and South-East Asia Region (Table 2.4).

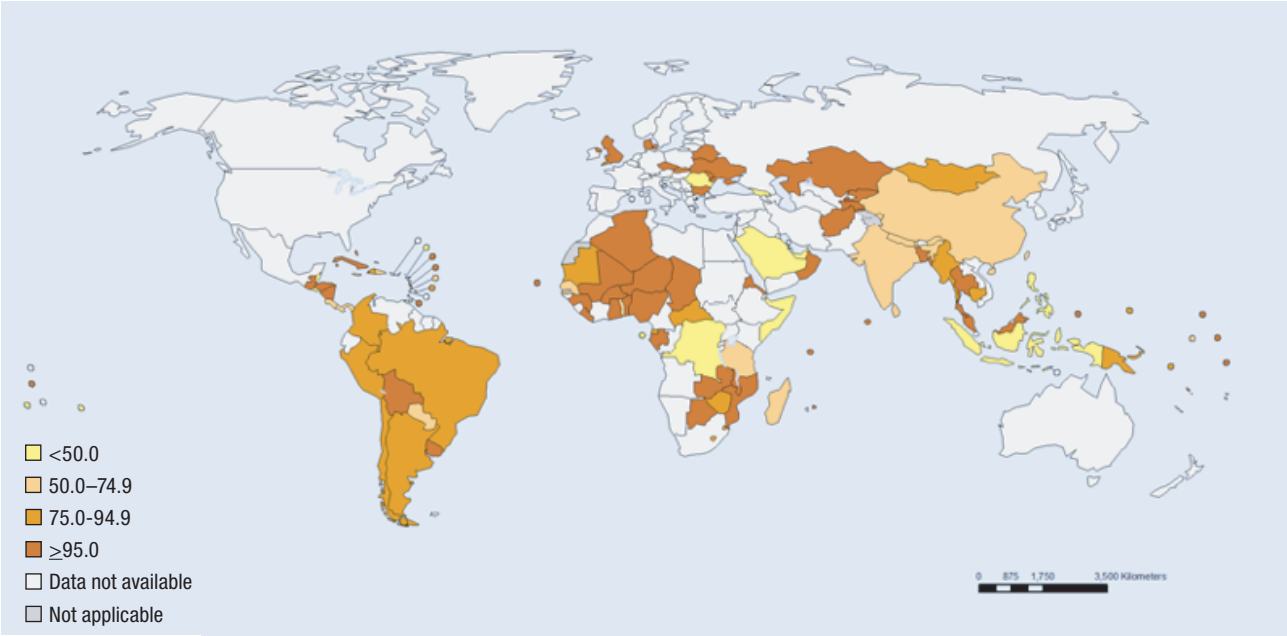
In contrast, 16 countries reported less than 75% of the syphilis-positive pregnant women diagnosed through ANC testing received treatment. Fig. 2.6 and Annex 1 show the most recently reported data on syphilis treatment. As mentioned previously, global shortages of benzathine penicillin during 2014–2017 likely resulted in reductions in treatment coverage in some reporting countries (see Fig. 2.1 *(20)*).

Table 2.4. Percentage of ANC attendees testing positive for syphilis who received treatment as reported by 76 countries, by region, 2016–2017

WHO Region	No. of countries reporting (% reporting)	Median % receiving treatment (range [%])
African Region	23 (49)	100 (56.9–100)
Region of the Americas	23 (66)	89.8 (50.6–100)
Eastern Mediterranean Region	5 (24)	100 (50.0–100)
European Region	8 (15)	100 (86.6–100)
South-East Asia Region	7 (64)	71.4 (16.7–100)
Western Pacific Region	10 (37)	100 (70.0–100)
Overall	**76 (39)**	**99.6 (16.7–100)**

Source: GAM, 2017 *(6)*

Fig. 2.6. Percentage of ANC attendees positive for syphilis who received treatment as reported by countries since 2010 (using data available through 2017)



Source: WHO Global Health Observatory, 2018 *(26)*

Congenital syphilis rate (Indicator 1.17.7)

The incidence of congenital syphilis is an indicator of progress towards the EMTCT of syphilis. This was piloted as an indicator in two regions in 2012 and became a routine GAM indicator in 2013. The WHO global congenital syphilis case definition[4] is recommended for monitoring and reporting. WHO tools are available to assist countries in incorporating congenital syphilis into existing reporting systems, and to estimate congenital syphilis case numbers and rates based on maternal syphilis screening and treatment coverage, and maternal syphilis prevalence as reported into GAM *(6, 9, 27)*.

Since 2014, more countries have reported data on congenital syphilis into GAM. Overall, 59 countries reported in 2016–2017, of which more than 40% were from the Region of the Americas. Only 8% of countries in the African Region reported case rates of congenital syphilis. The overall median rate was 5.2 cases per 100 000 live births (range 0–669.0) (Table 2.5 and Fig. 2.7). Overall, 45 out of 59 countries reported rates of less than 50 cases per 100 000 live births, the cut-off level to meet the EMTCT criteria.

However, the data on congenital syphilis have many limitations. Several factors result in underestimation of the scale of the problem, including lack of diagnosis and follow up of syphilis-positive pregnant women and their infants, inconsistent case definitions for congenital syphilis and incomplete reporting.

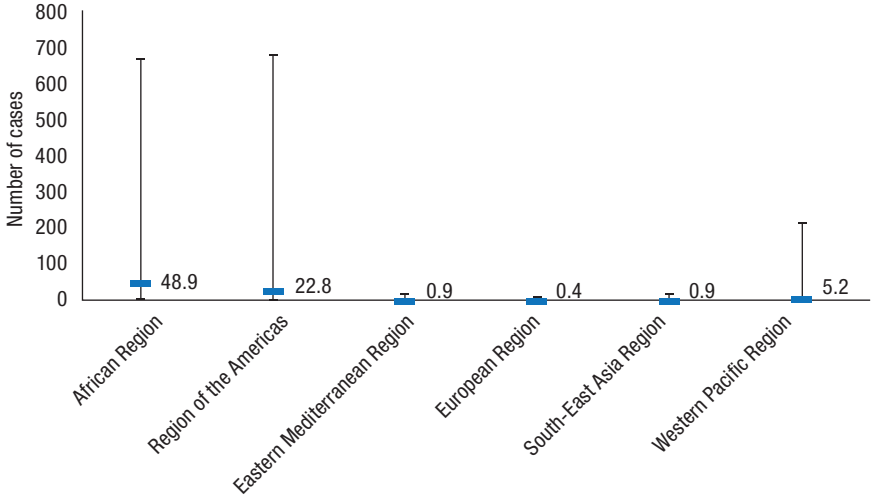
[4] Live birth or fetal death at >20 weeks of gestation or >500 g (including stillbirth) born to a woman with positive syphilis serology and without adequate syphilis treatment OR stillbirth, live birth or child age <2 years born to a woman with syphilis serology or with unknown serostatus, and with laboratory and/or radiographic and/or clinical evidence of syphilis infection (regardless of the timing or adequacy of maternal treatment). Laboratory and radiographic evidence consistent with a diagnosis of congenital syphilis includes any of the following: (a) demonstration by dark-field microscopy or detection by fluorescent antibody testing of *Treponema pallidum* in the umbilical cord, placenta, nasal discharge or skin lesion material or autopsy material of a neonate or stillborn infant; (b) analysis of cerebrospinal fluid (CSF) is reactive for the Venereal Disease Research Laboratory (VDRL) test or elevated CSF cell count or protein; (c) long bone radiographs suggestive of congenital syphilis (e.g. osteochondritis, diaphyseal osteomyelitis, periostitis; (d) infant with a reactive non-treponemal serology test with titre fourfold or more than that of the mother; (e) infant with a reactive non-treponemal serology test with titre less than fourfold more than that of the mother but that remains reactive ≥6 months after delivery; (f) infant with a reactive non-treponemal serology test of any titre AND any of the clinical signs born to a mother with positive or unknown serology, independent of treatment; (g) in settings where a non-treponemal titre is not available, an infant born to a mother with positive or unknown serology, independent of treatment, and whose 6-month examination demonstrates any of the early clinical signs; (h) for stillborn infants, maternal syphilis serostatus should be determined. Any case with a reactive maternal test should be considered a congenital syphilis case *(18)*.

Table 2.5. Congenital syphilis rate as reported by 59 countries, by region, 2016–2017

WHO region	No. of countries reporting (% reporting)	Estimated congenital syphilis case rate/100 000 live births
African Region	4 (8)	48.9 (6.5–669.0)
Region of the Americas	25 (71)	22.8 (0–679.5)
Eastern Mediterranean Region	4 (19)	0.9 (0–22.5)
European Region	15 (28)	0.4 (0–20.8)
South-East Asia Region	4 (36)	0.9 (0–14.7)
Western Pacific Region	7 (26)	5.2 (0–213.8)
Overall	**59 (30)**	**5.2 (0–669.0)**

Source: GAM, 2017 *(6)*

Fig. 2.7. Congenital syphilis rate (cases per 100 000 live births, median and range) as reported by 59 countries, by region, 2016–2017

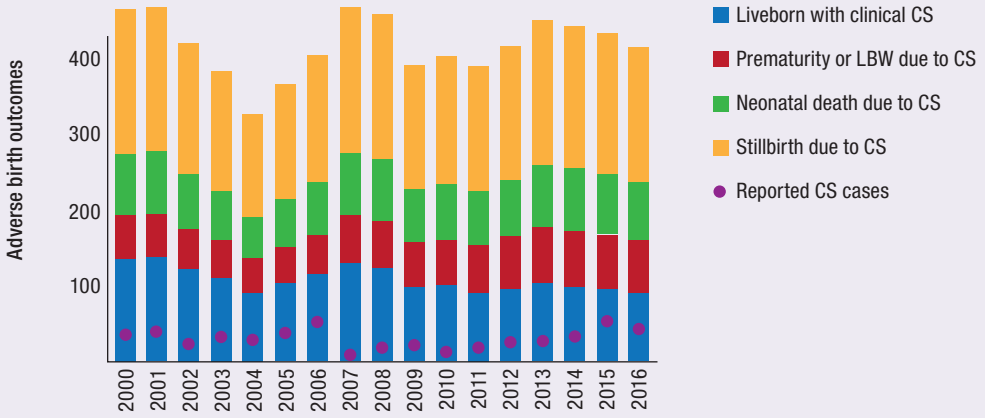


Source: GAM, 2017 *(6)*

Box 5. Estimating the magnitude of different types of adverse birth outcomes (ABOs) attributed to congenital syphilis: a case study in Mongolia

Although countries report rates of congenital syphilis to GAM, these data are likely to underestimate the true incidence of congenital syphilis in a country. Similarly, ABOs attributed to congenital syphilis are difficult to measure directly and are not included in global reporting. Using the Spectrum-STI modelling tool *(10)* and the WHO congenital syphilis estimation tool *(9),* data from ANC populations, including the core indicators for testing and treatment of women for active syphilis, can be used to project the types and magnitude of ABOs at a national level. This model applies fixed global estimated risk probabilities for women with untreated maternal syphilis. Fig. 2.8 shows the results of this type of modelling conducted in Mongolia *(28).* The white bar indicates the large proportion of stillbirths among ABOs attributed to congenital syphilis, which are perhaps the most difficult to measure directly.

Fig. 2.8. Estimated number of congenital syphilis-related ABOs by type in Mongolia, 2000–2016



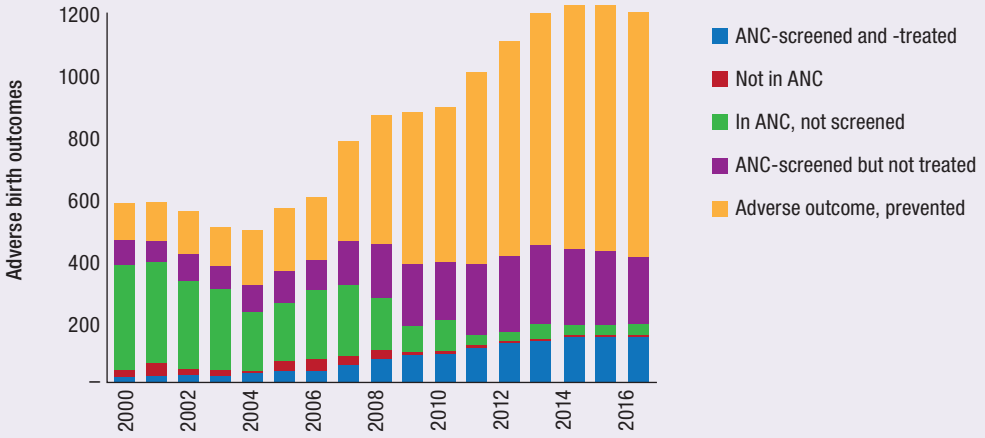
CS: congenital syphilis; LBW: low birth weight

Source: Enkhbat et al. 2018 *(28)*

These data should be interpreted in the context of an increasing number of averted ABOs estimated, from 125 in 2000 to 789 in 2016, due to expanded access to ANC during this period.

Fig.2.9 shows the estimated number of ABOs related to gaps in testing and treatment as well as the number of averted ABOs. These estimates are heavily influenced by underlying trends in increasing maternal syphilis prevalence and increasing number of annual pregnancies in Mongolia during the same time period (data not shown.)

Fig. 2.9. Number of congenital syphilis-related ABOs related to ANC screening and treatment for syphilis in Mongolia, 2000–2016



Source: Enkhbat et al. 2018 *(28)*

2.3. Country validation of EMTCT of syphilis and HIV

As of 2014, 60% of reporting countries have implemented a national strategy for EMTCT of syphilis that is either vertical or integrated with other strategies *(13).* WHO is collecting updated data on the proportion of countries reporting a national EMTCT strategy.

To date, 11 countries and territories have been validated as having eliminated MTCT of syphilis (in order of validation year): Cuba, Thailand, Belarus, Moldova, Anguilla, Antigua and Barbuda, Bermuda, Cayman Islands, Montserrat, St Kitts and Nevis, and Malaysia *(16).*

In 2017, WHO launched the Path to Elimination to provide a set of criteria for recognition of the impressive achievements of high-burden countries as they progress towards EMTCT of HIV and syphilis. This approach includes a three-tiered system (bronze, silver and gold), which recognizes stages of progress towards EMTCT targets. Each tier requires progressively increasing levels of service coverage for pregnant women and progressively lower HIV and/or syphilis case rates of new infections in children (per 100 000 live births). To date, four countries in the African Region have convened national validation committees to begin the processes required for country evaluation and recognition of being on the Path to Elimination.

The 2017 *Global guidance on criteria and processes for country validation of EMTCT of HIV and syphilis* is found alongside other evaluation tools at: http://www.who.int/reproductivehealth/congenital-syphilis/surveillance/en/.

3. Prevalence of syphilis among key populations

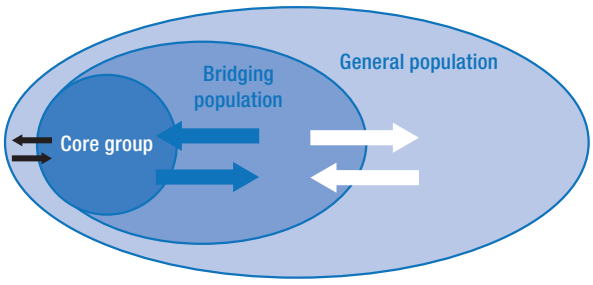
Key points

- A critical measure of a country's progress in STI control is monitoring the syphilis seroprevalence among key populations, including female sex workers (FSWs) and men who have sex with men (MSM).
- About one fourth of countries reporting to GAM (*N*=53) report syphilis prevalence among at least one key population (MSM, FSWs).
- Syphilis seroprevalence remains high in key populations worldwide, with at least three regions having a median seroprevalence of >5% among FSWs and MSM.
- Data sources for syphilis seroprevalence among key populations vary widely in target population, laboratory methodology and national representativeness, limiting the comparability of results between countries.

Recognition of the contribution of key populations at high risk of exposure to the trajectory of STIs and HIV epidemics within general populations is essential to the understanding of the STI burden within countries *(5, 29).* The WHO Global STI Strategy prioritizes FSWs, people who inject drugs (PWID), MSM and transgender women for the prevention and treatment of STIs *(5).* According to 2016 guidance from WHO on services for key populations, the recommended package of health services for key populations includes condom and lubricant programmes, and STI screening and treatment *(30).* Improving access to these services requires structural interventions to reduce legal and social barriers, combat stigma and discrimination, reduce violence targeted at key populations, as well as efforts to create community empowerment. Evidence suggests that an STI and HIV control programme must address these structural issues to effectively improve early diagnosis and treatment of STIs *(31–35).*

Understanding the role of sexual networks among key populations is critical for effectively targeting control efforts to stop transmission of STIs in the general population as a whole. Fig. 3.1 illustrates how clients of FSWs act as a bridging population as they pass the infection to lower-risk/general populations, including their wives and unborn children. Similarly, transmission between MSM and their female sexual partners are an example of how infection can spread to populations with low-risk behaviour through contact with members of the core group where high transmission occurs. A recent review from Asia found that countries with high levels of condom use among male and female sex workers had declining (or low and stable) trends in the incidence of both STIs and HIV *(35).* Importantly, the decreasing trends occurred in both sex workers and in the general population. As of 2015, targeted interventions for sex workers were ongoing in 53% of countries in the European Region and more than 90% of countries in the South-East Asia and Western Pacific regions. Increasingly, countries have developed programmes focusing on the delivery of prevention services to MSM and transgender women *(13).* As part of measuring the Global STI Strategy targets of 70% of countries having interventions for key populations by 2020, assessments will be conducted of programme availability in each region.

Fig. 3.1. Transmission dynamics of STIs at the population level



Source: WHO, 2007 *(36)*

This report reviews data from two indicators of STIs among key populations. These are among the core STI indicators included in GAM, the seroprevalence of syphilis among MSM and that among FSWs.

3.1 Data quality and interpretation

Data on syphilis seroprevalence among MSM and FSWs are obtained from special surveys, sentinel surveillance or routine health information systems. As different methodologies may be used, it is not possible to compare results across countries. Even within countries, results are seldom representative of key populations at the national level due to the uneven distribution of these communities geographically. Most countries report data from special studies in a small number of areas, usually large cities. Due to the challenges in engaging hard-to-reach populations in these types of surveys, many samples may be biased toward people in intervention areas and key population members who are in regular contact with the services. Surveys of key populations are resource intensive and done only periodically in selected areas. Countries without the resources to do probability surveys may also report programmatic data for syphilis prevalence. These data reflect test positivity on syphilis screening or diagnostic testing among symptomatic patients from key populations, which impacts the interpretation of results. Finally, laboratory and data quality control and survey methodologies also vary between countries, and many countries do not specify laboratory methods when reporting data to GAM. For these reasons, these data give a snapshot of the seroprevalence of syphilis among key populations.

Syphilis in female sex workers (Indicator 1.17.4)

In 2016–2017, 38 countries reported data on syphilis prevalence among FSWs. In previous STI surveillance reports, many countries shared results based on special surveys, including integrated biobehavioural surveys. However, in 2016–2017, 21 countries (55%) reported routine programme data.

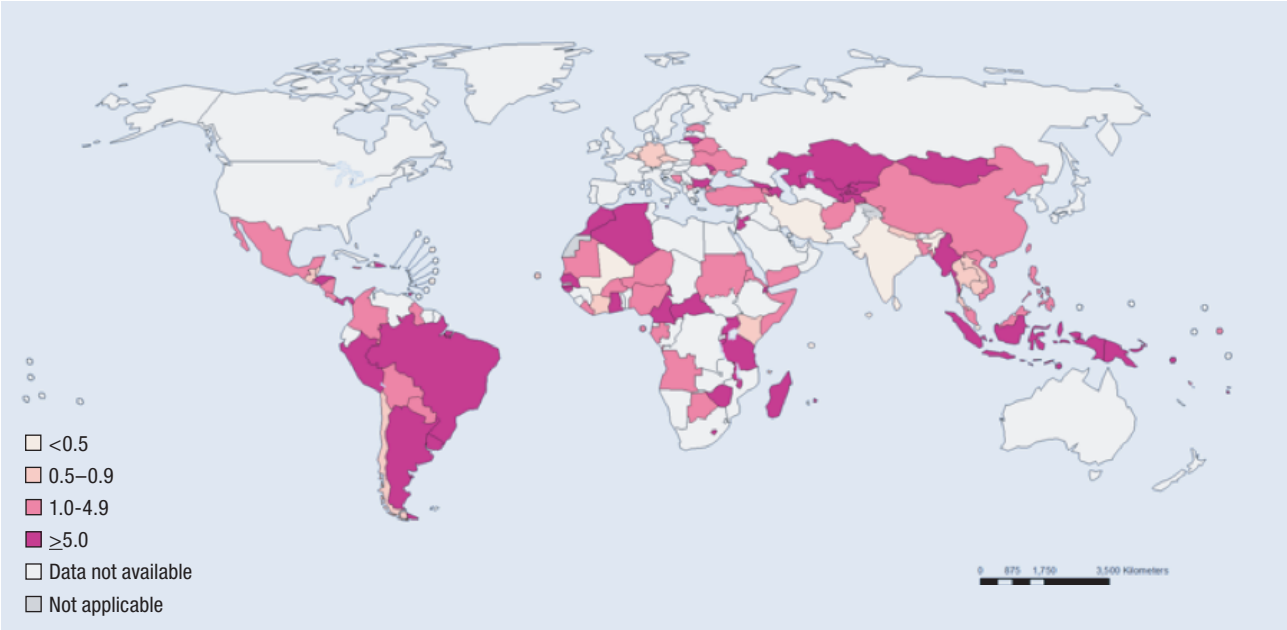
The median reported syphilis seroprevalence was 3.2% (range 0.0–35.2%), as shown in Table 3.1. The highest prevalence was reported from the African Region (median prevalence of 13.2%). The median reported prevalence for the European and Western Pacific regions was also more than 5%. Overall, 15 countries reported 5% or higher prevalence. Among them, nine countries reported more than 10% prevalence, including four that reported a prevalence of 20% or higher (Mongolia, the Republic of Moldova, the Solomon Islands and Zimbabwe) (*see* Annex 2 and Fig. 3.2 for the global distribution of syphilis prevalence among FSWs based on the latest reported data since 2005).

Table 3.1. Syphilis seroprevalence among FSWs reported by 38 countries, by region, 2016–2017

WHO region	No. of countries reporting (% reporting)	Median FSW syphilis prevalence (%) (range[%])
African Region	7 (15)	13.2 (0–21.6)
Region of the Americas	11 (31)	3.1 (0.4–9.5)
Eastern Mediterranean Region	3 (14)	1.3 (0.4–2.7)
European Region	6 (11)	5.4 (0.7–20.0)
South-East Asia Region	5 (45)	2.2 (0–10.9)
Western Pacific Region	6 (22)	5.9 (0.3–35.2)
Overall	**38 (20)**	**3.2 (0–35.2)**

Source: GAM, 2017 *(6)*

Fig. 3.2. Percentage of FSWs with syphilis (latest reported data since 2008 and through 2017)



Source: WHO Global Health Observatory, 2018 *(37)*

Syphilis in men who have sex with men (Indicator 1.17.5)

Data on syphilis prevalence among MSM were reported to GAM by 41 countries in 2016–2017. In 22 countries (53%), these data came from special surveys, including integrated biobehavioural surveys, while in 19 countries, these were based on routine programme data. In some countries, syphilis prevalence estimates among MSM were based on very small samples (i.e. <50) so these results should be interpreted with caution.

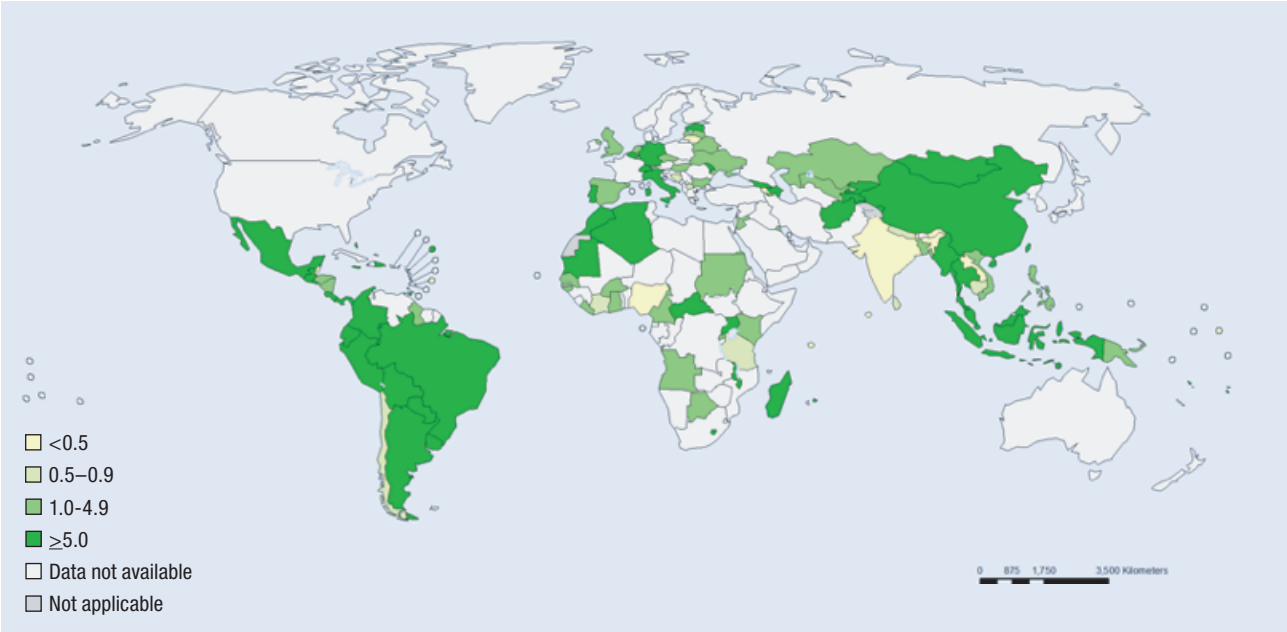
The median reported syphilis seroprevalence among MSM was 6.0% (range 0–36.7%), with the highest values reported from the Region of the Americas, as shown in Table 3.2. Only four countries from the African Region (9% of countries in the Region) reported syphilis prevalence data among MSM. In the Region of the Americas, 14 countries (40% of countries in the Region) reported syphilis prevalence among MSM. Of the 41 countries that reported data, more than half of them (24 out of 41) reported more than 5% prevalence, with 14 countries reporting more than 10% and five countries (Brazil, Colombia, Fiji, Georgia and Mexico) reporting more than 20% (*see* Fig. 3.3 and Annex 2).

Table 3.2. Syphilis seroprevalence among MSM reported by 41 countries, by region, 2016–2017

WHO region	No. of countries reporting (% reporting)	Median syphilis prevalence among MSM (%) (range [%])
African Region	4 (9)	2.3 (0.8–2.9)
Region of the Americas	14 (40)	12.4 (0.8–61.5)
Eastern Mediterranean Region	3 (14)	8.9 (3.8–10.8)
European Region	8 (15)	4.7 (0–36.7)
South-East Asia Region	5 (45)	1.9 (0.4–13.5)
Western Pacific Region	7 (26)	6.0 (4.1–26.5)
Overall	**41 (21)**	**6.0 (0–36.7)**

Source: GAM, 2017 *(6)*

Fig. 3.3. Percentage of MSM with syphilis (latest reported data since 2008 and through 2017)



Source: WHO Global Health Observatory, 2018 *(38)*

4. Case reporting for urethral discharge and gonorrhoea in the general population

Key points

- About 37% of countries globally report either syndromic and/or etiological case rates of UD and gonorrhoea among men (as reported through GAM).
- Case rates values vary widely within and across regions and underestimate the burden of STIs due to limitations in reporting and diagnosis, as well as barriers to health-care-seeking behaviours.
- Variations in methodology and completeness of reporting limit the comparability of results between countries. When measured consistently, the results are best used for assessment of trends within countries.

Case reporting is an essential component of STI surveillance and provides information on the facility-based detection of STIs. STI case reporting indicators were added to the Global AIDS Response Progress Reporting (GARPR) in 2013. A disease is prioritized for surveillance and reporting according to the burden of the disease and its impact on health, epidemic potential, changing patterns of the disease, preventability of the disease, and its social and economic impact. Based on these criteria, indicators for genital ulcer disease (GUD) and adult syphilis were removed from GAM in 2016 to reduce the reporting burden for countries and due to the difficulty in interpreting the syndrome etiologically as herpes simplex virus or syphilis. The inclusion of GUD in periodic studies to determine the etiology of STI syndromes is still recommended *(8)*. Syndromic case reporting based on a clinical diagnosis of UD and etiological case reporting based on a laboratory diagnosis of gonorrhoea were retained for GAM 2016 and 2017.

The remaining STI case reporting indicators are UD and gonorrhoea in men. Compared to 2014, there was a moderate increase (~8%) in the number of countries that included gonorrhoea and/or UD case reporting data among men in their 2016–2017 GAM reporting.

Box 6. Improving the availability of STI prevalence data

Due to the limitations in STI case reporting, effective measurement of the burden of STIs at a national level requires prevalence studies among general populations. These periodic prevalence assessments are needed from male and female populations and can be performed among pregnant women, women attending family planning clinics, male military recruits, and work-based health screening programmes. These groups serve as proxies for the general population in countries where demographic health surveys are not routinely performed or where health surveys do not include STI screening. WHO recommends syphilis screening among all pregnant women and data from these prevalence surveys can be used to estimate the national syphilis burden. However, prevalence data for other STIs, including chlamydia, gonorrhoea and trichomoniasis, in general populations of women and men are very limited, challenging STI burden estimation at the national, regional and global levels. In 2018, WHO released a standard protocol for conducting chlamydia and gonorrhoea prevalence assessments among pregnant women *(39).* This protocol can be used and adapted to the local context to facilitate routine prevalence assessments among pregnant women and other general and high-risk populations of women and men.

4.1 Data quality and interpretation

Facility-based case reporting has many advantages. It is simple to implement, is easily integrated into other disease surveillance systems and provides important information for health planning of STI services. To the extent that reporting mandates apply to all facilities, facility-based case reporting provides data from all geographical areas of a country. However, case rates are often underestimates of disease incidence due to undetected asymptomatic infections and variable access and health-care-seeking behaviours among those infected. As a result, low case rates may indicate either a low burden of STIs or a high burden of undiagnosed and untreated infections.

The calculation of accurate case rates also depends on the selection of up-to-date population denominators. Case rates reported through GAM are routinely reviewed for outliers. Population denominators used in extremely high case rates are compared to UNPD population estimates. When large discrepancies are identified, the case rates are recalculated using the UNPD 2017 estimate of the adult male population (over 15 years).

Direct comparison of case rates from different countries is problematic because case definitions and reporting practices may vary between countries. Some countries include results of active case-finding, such as screening asymptomatic women in ANC clinics as a prevalence survey, contact tracing or screening among higher-risk key population groups, while others do not. With respect to the comprehensiveness of case reporting, some countries report cases based on a limited geographical area or restrict reporting to a limited number or type of facilities.

When consistently measured over time, STI case rates are best used within a country to monitor trends rather than for comparison of absolute rates between countries. Even so, an increase in cases in a given country could signal better case-finding and diagnosis rather than a worsening STI problem. The local situation needs to be taken into account when interpreting findings. Triangulation with other sources of data, such as prevalence assessments (*see* Box 6), screening interventions and special studies, will lead to a better understanding of the actual STI burden. Annexes 3 and 4 present the case report data for UD and gonorrhoea by year (from 2014 to 2017) and by country. The number of countries with data for all four years using consistent population denominators are highlighted for each indicator in the subsequent sections.

4.2 Syndromic case reporting

A majority of countries within WHO regions continue to use syndromic management, with the exception of countries within the European Region, where the greater availability of laboratory resources allows for the use of etiological diagnosis *(2)*. Current WHO STI surveillance recommendations include monitoring UD in men.

UD is a key syndrome for STI surveillance, which affects only men. It is a preventable and treatable syndrome with an overall high burden, most commonly caused by *N. gonorrhoeae* and *Chlamydia trachomatis*. Left untreated, UD leads to complications in men and in their women partners and unborn children.

Urethral discharge rate among men 15–49 years of age (Indicator 10.5)

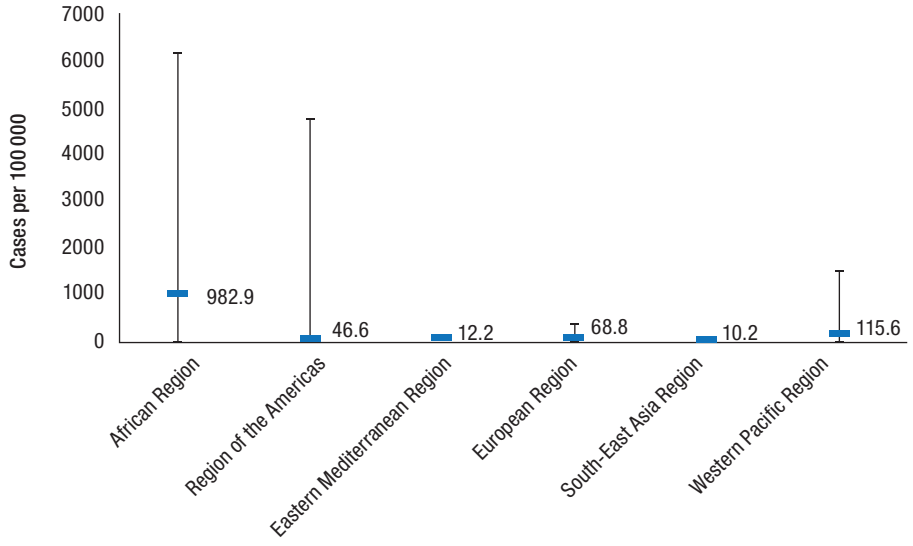
In 2016–2017, 61 countries reported UD case data among men to GAM. Compared to 2014, twice as many countries in the Region of the Americas reported on UD among men during this period. The global median case rate for UD cases among men was 96.7 per 100 000 men 15–49 years old. As observed with the 2014 data, the highest case rates were reported from the African Region, followed by the European and Western Pacific regions (Table 4.1). As shown in Fig. 4.1, in most regions, a wide range of rates were reported across Member countries. The 2014–2017 UD case rates for countries that reported any time during this period are shown in Annex 3.

Table 4.1. Urethral discharge rate (cases per 100 000 adult men) reported by 61 countries, by region, 2016–2017

WHO region	No. of countries reporting (% reporting)	Median UD case rate among men (range)
African Region	17 (36)	982.9 (3.7–6133.7)
Region of the Americas	21 (60)	46.6 (1.4–4761.9)
Eastern Mediterranean Region	5 (24)	12.2 (10.1–99.7)
European Region	4 (7)	68.8 (2.0–363.7)
South-East Asia Region	5 (45)	10.2 (1.1–51.2)
Western Pacific Region	9 (33)	115.6 (5.8–1469.4)
Overall	**61 (31)**	**96.7 (1.1–6133.7)**

Source: GAM, 2017 *(6)*

Fig. 4.1. Urethral discharge rate (cases per 100 000 adult men, median and range) reported by 61 countries, by region, 2016–2017



Source: GAM, 2017 *(6)*

4.3 Etiological case reporting

Etiological case reporting is feasible in countries with widespread availability of laboratory services. Case reporting for one etiological cause of STI is included in the current surveillance guidelines: *N. gonorrhoeae*, a common causative agent of UD. This infection is preventable and treatable, although high levels of gonococcal resistance to antimicrobials may result in untreatable infections in the future (*see* Chapter 6: Gonococcal antimicrobial susceptibility). Left untreated, gonorrhoea leads to severe complications and sequelae in both men and women. Only gonorrhoea data among men are included as a GAM indicator due to the high rate of asymptomatic infections in women coupled with the low sensitivity of diagnosis by cervical Gram stain and culture.

Several factors may influence the reported case rates of gonorrhoea. In addition to those described in the introduction to case reporting (section 4.1), the sensitivity and specificity of the diagnostic tests are an important factor. Some countries continue to rely on Gram stain and culture for the diagnosis of gonorrhoea, while others have replaced it with newer DNA-based technology, including nucleic acid amplification tests with higher sensitivity and specificity. In addition, the reported disease rates may be more reflective of the availability of laboratory diagnosis than actual disease rates; countries that lack universal access

to laboratory diagnosis may report low case rates, even in settings with a high burden of disease.

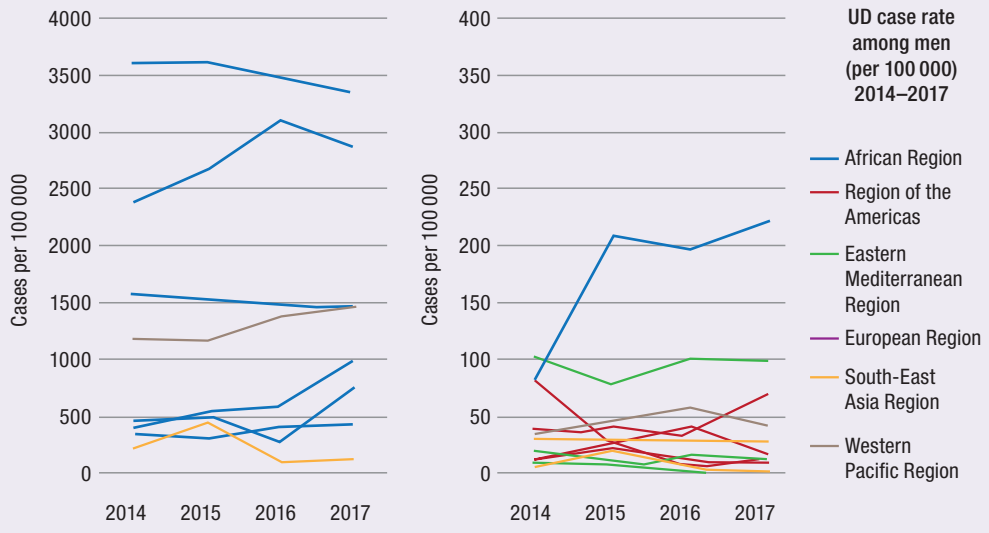
Gonorrhoea case rate among men 15–49 years of age (Indicator 10.4)

As reported by 64 countries in 2016–2017, the median gonorrhoea case rate among men was 18.8 cases per 100 000 adult men (range 0.0–387.5) (Table 4.2 and Fig. 4.3); this is similar in magnitude to the median case rates reported in 2014 (25.5 per 100 000). The Western Pacific Region reported the highest median case rate of 52.4 gonorrhoea cases per 100 000 adult men, followed by the Region of the Americas with a rate of 26.1. The relatively low median case rates reported from the Eastern Mediterranean Region and South-East Asia Region are consistent with the reported case rates for UD. Reported gonorrhoea rates in the African Region were lower than the global median and may reflect limited access to diagnostic testing for gonorrhea. Reporting from countries in the European Region doubled in 2016–2017 compared to 2014. The most recently reported gonorrhoea case rates among men in 87 countries are shown in Annex 4.

Box 7. Trends in UD case reporting: improving the consistency of reporting

Over time, countries have continued to improve the consistency of their STI case reporting data. A review of GAM data from 2014 to 2017 found that 23 out of 61 countries (38%) reported UD data in all the four years of this time period using consistent denominators. These consistently reported rates can more reliably be used to assess trends over time. Fig. 4.2 illustrates these trends, colour-coded by region. Due to the wide range in case rates, trends are presented in two groups: case rates between 400 and 4000 per 100 000 and population on the left, and case rates below 400 per 100 000 population on the right. Consistent case reporting data are most commonly found in the African Region, from where some of the higher case rates are also reported.

Fig. 4.2. Trends in reported urethral discharge cases among adult men in individual countries with consistent denominators, *N*=23 countries



Note: Due to differences in scale, countries were divided into two groups: those with case rates ~ 400–4000 (left) and <400 cases per 100 000 adult men (right).

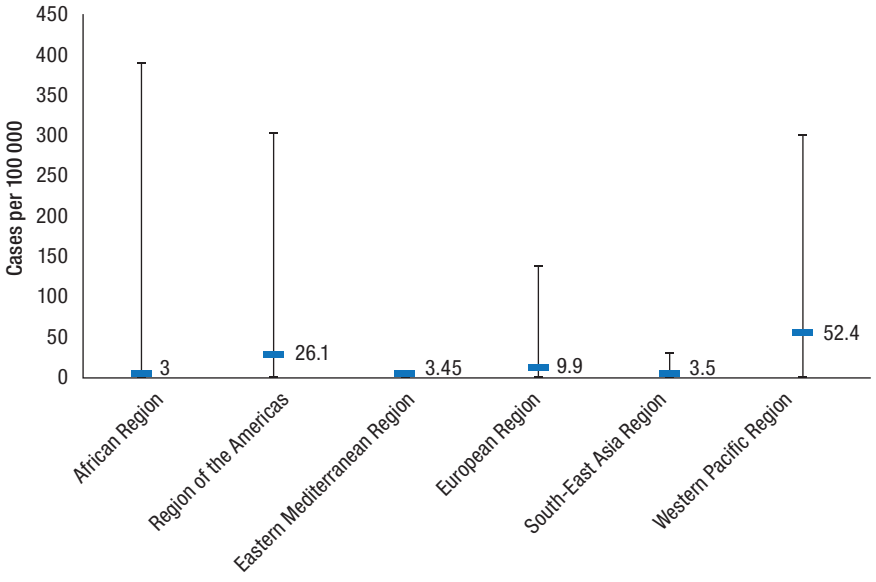
Source: GAM, 2017 *(6)*

Table 4.2. Gonorrhoea rate (cases per 100 000 adult men) reported by 64 countries, by region, 2016–2017

WHO region	No. of countries reporting (% reporting)	Median gonorrhoea case rate among men (range)
African Region	5 (11)	3.0 (0.4–387.5)
Region of the Americas	23 (66)	26.1 (2.0–136.5)
Eastern Mediterranean Region	2 (9)	3.5 (2.2–4.7)
European Region	18 (34)	9.9 (0.2–136.7)
South-East Asia Region	4 (36)	3.5 (0.0–28.9)
Western Pacific Region	12 (44)	52.4 (4.3–297.1)
Overall	**64 (33)**	**18.8 (0.0–387.5)**

Source: GARPR, 2017 *(6)*

Fig. 4.3. Gonorrhoea rate (cases per 100 000 adult men, median and range) reported by 64 countries, by region, 2016–2017

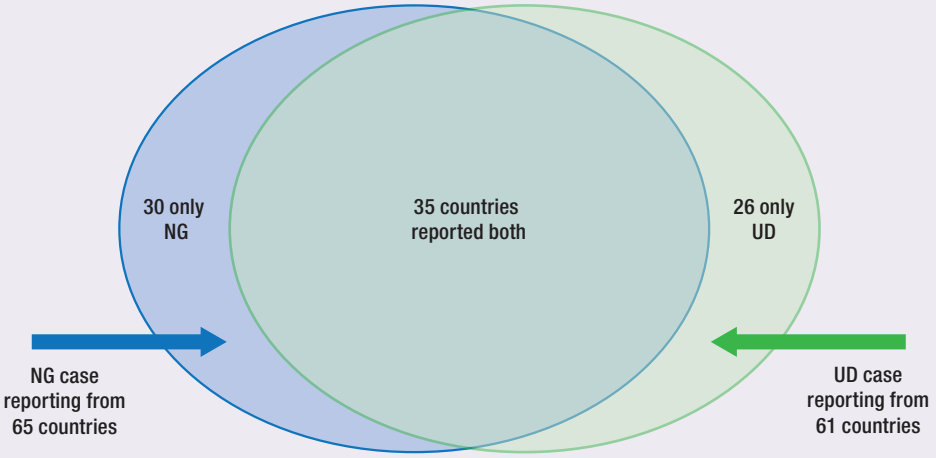


Source: GARPR, 2017 *(6)*

Box 8. Reporting patterns for syndromic and etiological case reporting of gonorrhoea

In the absence of etiological case reporting for laboratory-diagnosed gonorrhoea, countries may use syndromic case reporting of UD among men as a proxy for trends in gonorrhoea infection. In 2016–2017, 35 countries provided both UD and gonorrhoea case reporting data to GAM; 30 countries included only etiological case reporting; and 26 countries reported only on UD.

Fig. 4.4. Overlap between syndromic and etiological case reporting for gonorrhoea



NG: *N. gonorrhoeae*; UD: urethral discharge

Source: GAM, 2017 *(6)*

Due to the asymptomatic nature of some gonorrhoea and chlamydia infections, limited presentation of patients for clinical services, and gaps in provider reporting, these reported case incidence data do not represent the national burden of these infections.

5. Estimating prevalence trends for chlamydia, gonorrhoea and syphilis using epidemic models

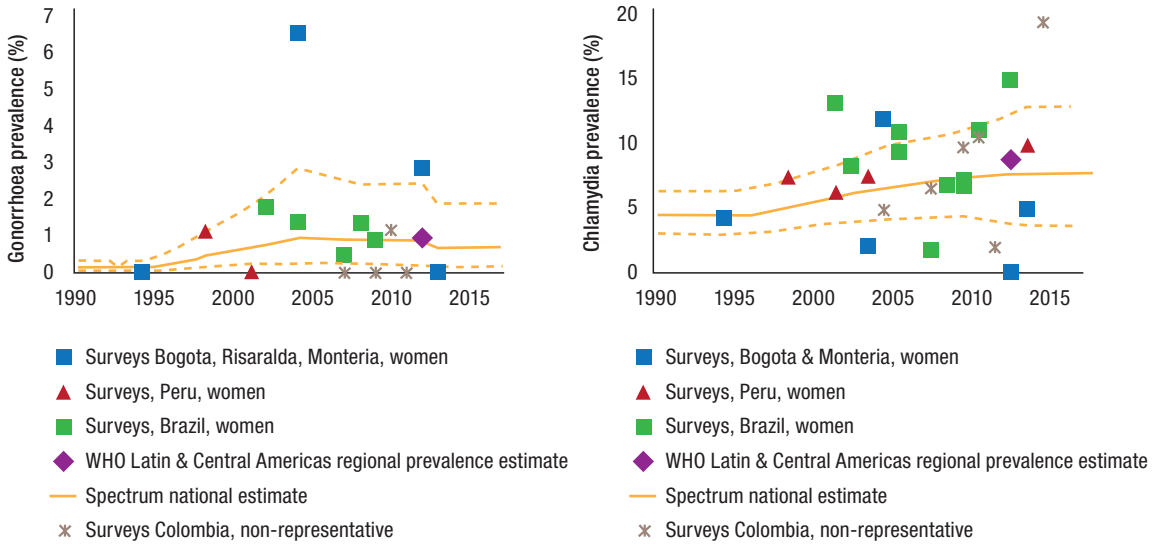
Key points

- The Spectrum-STI module has been applied to model national trends of syphilis, gonorrhoea and chlamydia, and global estimates of syphilis prevalence.
- This modelling tool has also provided insights into national-level STI trends, relationships between case reporting and prevalence data, and the trajectory of epidemics among specific populations such as key populations in selected contexts.
- The utility and reliability of outputs from this modelling tool depend on the availability of routine prevalence assessments of STIs among general and high-risk priority populations.

The Spectrum-STI modelling tool has been developed to estimate national trends in the adult prevalence and incidence of syphilis, gonorrhoea and chlamydia. The tool was piloted in Zimbabwe and Morocco in 2015–2016 and has now been used in 11 countries. The model generates country estimates of prevalence and incidence trends based on national-level general population prevalence data from household surveys, sentinel surveillance surveys, and routine programmatic screening (ANC), and builds on assumptions included in the WHO 2012 and 2016 global estimates of four curable STIs *(1, 40, 41).*

Fig. 5.1 shows the Spectrum-STI prevalence estimates for gonorrhoea and chlamydia from a workshop in Colombia in 2016 *(41).* These included both data from Colombia and from neighbouring countries believed to be similar to Colombia in terms of their STI epidemiology and health-care situation. The wide uncertainty bounds around the estimates reflect the lack of nationally representative prevalence data over time.

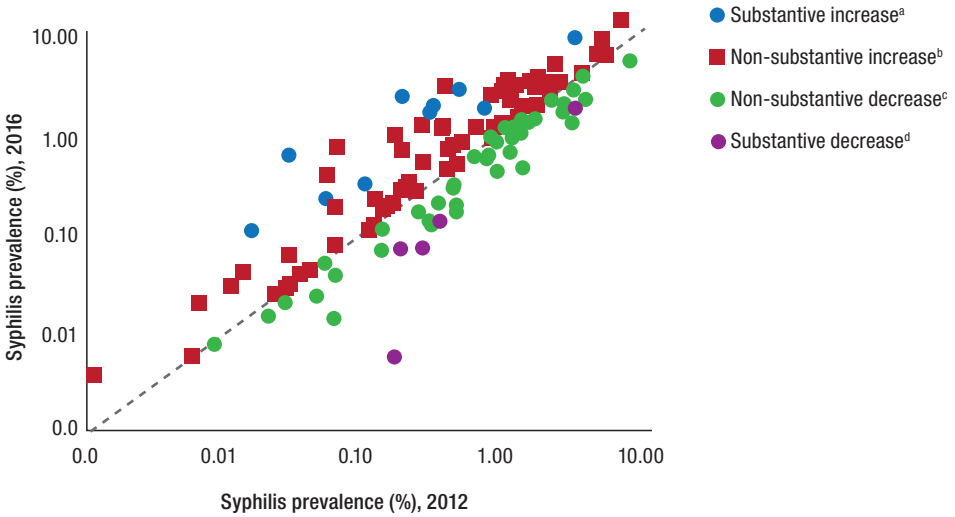
Fig. 5.1. Examples of Spectrum-STI results: modelling gonorrhoea and chlamydia prevalence in women 15–49 years in Colombia, 1990–2016



Source: Korenromp et al., 2018 *(41)*

Recently, the Spectrum-STI model was used on a large scale to estimate the prevalence of syphilis over 2012–2016 among adult women in 132 countries with prevalence data from ANC-based screening and/or general population surveys (Fig. 5.2). Across these countries, most had fairly stable syphilis prevalence over 2012–2016, with only non-substantive increases or decreases.

Fig. 5.2. Changes in adult women's syphilis prevalence between 2012 and 2016 estimated by the Spectrum-STI model for 132 countries



[a]Substantive increase: 2012 prevalence >10% lower than 2016 prevalence, >0.05 percentage point difference, & non-overlapping confidence interval (CI)

[b]Non-substantive increase: 2016 point estimate >2012 point estimate, but did not meet the criteria for "substantive increase"

[c]Non-substantive decrease: 2016 point estimate <2012 point estimate, but did not meet the criteria for "substantive decrease"

[d]Substantive decrease: 2016 prevalence >10% lower than 2012 prevalence, >0.05 percentage point difference, & non-overlapping CI

Source: Korenromp et al., 2018 *(42)*

This is further illustrated in Fig. 5.2, which shows the prevalence estimates for each of the 132 countries in 2012 and 2016 colour-coded to indicate how substantive the trend was between these two time points. Data points shown above the line represent countries with an estimated increase between 2012 and 2016, while data points below the line represent countries with a decrease. Most countries had fairly stable syphilis prevalence over 2012–2016, with only a non-significant increase or decrease. If the 2012–2016 rate of decline is maintained over the next years, then only 12 of the 132 countries are on course to meet the WHO target of a 90% reduction in the incidence of syphilis in adults from 2018 to 2030.

There is some evidence to suggest that lack of demonstrated progress may in part reflect weaknesses in surveillance data. Among the 132 countries included in the analysis, 41% showed a decrease in prevalence from 2012 to 2016. However, among a subset of countries, whose prevalence measurements had consistently used both treponemal and non-treponemal testing for a more reliable estimate of trend, 53% (45 out of 85 countries) showed a decrease (Table 5.1).

In either case, the Spectrum estimates – as well as other country-specific and regional meta-analyses – indicate that the rate of decline in syphilis prevalence will have to accelerate substantially for those countries and the world to meet the target stipulated in the WHO Global STI Control Strategy, a reduction in syphilis rates by 90% from 2018 to 2030.

Table 5.1. Recent trends in adult women's syphilis prevalence between 2012 and 2016 estimated by the Spectrum-STI model

Scenario	Countries with sufficient data	Countries with prevalence trends from 2012 to 2016			
		Substantive increase[a]	Non-substantive increase[b]	Non-substantive decrease[c]	Substantive decrease[d]
Best estimates	132	14 (11%)	64 (48%)	48 (36%)	6 (5%)
Syphilis infections that tested positive on both treponemal and non-treponemal tests	85	8 (9%)	32 (38%)	42 (49%)	3 (4%)

[a]Substantive increase: 2012 prevalence >10% lower than 2016 prevalence, >0.05 percentage point difference & non-overlapping CI

[b]Non-substantive increase: 2016 point estimate >2012 point estimate, but did not meet the criteria for "substantive increase"

[c]Non-substantive decrease: 2016 point estimate <2012 point estimate, but did not meet the criteria for "substantive decrease"

[d]Substantive decrease: 2016 prevalence >10% lower than 2012 prevalence, >0.05 percentage point difference & non-overlapping CI

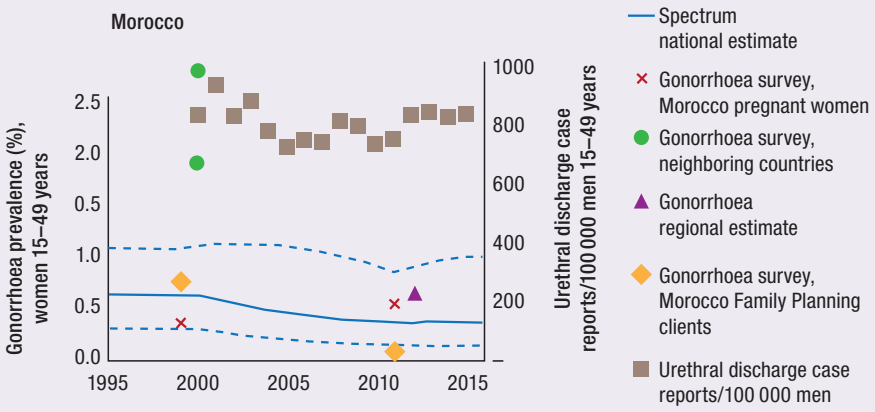
Source: Korenromp et al., 2018 *(42)*

Box 9. Using Spectrum to understand the relationship between case reporting data and prevalence estimates

In Morocco and other countries that undertook a national STI estimation over 2015–2018, the Spectrum-estimated STI rates were compared with national clinical STI case report numbers to gauge the coverage and completeness of the case reporting. In Morocco (Fig. 5.3) *(43),* Spectrum estimated a slight recent decline in gonorrhoea prevalence, which could be explained by Morocco's expanded HIV/STI response. The response included the adoption and nationwide roll-out of syndromic STI treatment around the year 2002, which was estimated to have improved STI treatment coverage and case reporting.

Based on Spectrum-estimated gonorrhoea and chlamydia prevalence among men, the completeness of reporting of syndromic diagnoses of UD treated in clinics was estimated to have improved from around 41–46% in 1995 to 46–77% by 2015. This represents a high reporting completeness compared to other countries where this was estimated *(44),* confirming the appropriateness of syndromic STI case management and surveillance in settings where access to laboratory diagnosis of STIs is not universal or immediate within the site where patients present for treatment.

Fig. 5.3. Spectrum results for gonorrhoea prevalence compared to prevalence studies and UD case reporting: Morocco, 1995–2015

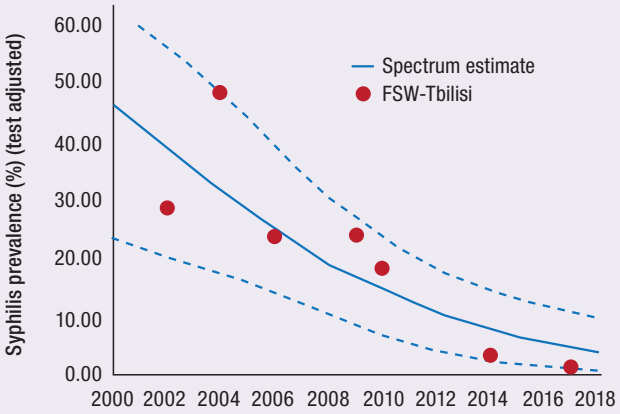


Source: Korenromp et al., 2017 *(43)*

Box 10. Using the Spectrum-STI tool to estimate trends in key populations: case study of estimated syphilis prevalence among FSWs in Georgia, 2000–2016

Since 2018, the Spectrum-STI tool can additionally be used to estimate STI rates and trends separately for subpopulations at higher and lower STI risk within a country. These include low-risk women, low-risk men, FSWs and MSM, as well as any other special key populations that are relevant within a country. Fig. 5.4 shows syphilis prevalence estimates for FSWs in Georgia, using prevalence data collected in its capital Tbilisi through periodic integrated biobehavioural surveys *(45).* The prevalence estimated in 2017 was 6.1%, more than 50-fold higher than in low-risk women, as indicated by routine screening in ANC clinics. Combining these respective estimates, FSWs were estimated to account for 15% of Georgia's overall burden of syphilis in adult women – confirming the country's appropriate focus on this vulnerable group and other key populations for a targeted and cost-effective STI/HIV response.

Fig. 5.4. Syphilis prevalence estimate among FSWs in Georgia, 2000–2018



Source: Rowley, Korenromp, 2017 *(45)*

6. Gonococcal antimicrobial susceptibility

Key points

- Gonococcal AMR continues to increase worldwide and could lead to a pandemic of extensively drug-resistant (XDR) *N. gonorrhoeae* with serious public health consequences.
- Two drugs are currently undergoing clinical evaluation for the treatment of XDR gonorrhoea.
- Surveillance for gonococcal AMR is currently suboptimal and presents many challenges, especially in countries with the highest burden.

One of the greatest challenges to STI prevention and control is the epidemic of AMR strains of *N. gonorrhoeae*. Considering that gonorrhoea is among the most common STIs worldwide, with an estimated 87 million new cases in 2016 (*see* Table 1.1), lack of effective treatment would result in a major public health problem. Unresolved gonorrhoea leads to pelvic inflammatory disease (PID) in women and further reproductive health complications, such as ectopic pregnancy and infertility. It also increases the risk of HIV transmission and ABOs due to vertical transmission *(46).* A higher prevalence of gonorrhoea in the population would also result in an increase in asymptomatic cases, contributing to the spread of disease.

AMR in *N. gonorrhoeae* appeared shortly after the introduction of antimicrobials at the beginning of the 20th century. Factors contributing to increasing resistance include suboptimal diagnosis and surveillance capacity, easy availability of antibiotics (including counterfeit drugs) and lack of drug quality control, which contributes to the rapid development of resistance.

Resistance has expanded to include penicillin, tetracyclines, macrolides (including azithromycin), sulphonamides and trimethoprim combinations, quinolones and, more recently, cephalosporins within a few isolated strains. Countries where appropriate and quality-assured surveillance is in place show rising trends in decreased susceptibility and increased resistance in *N. gonorrhoeae* to cefixime and ceftriaxone, the “last line” of treatment.

Decreased susceptibility to the extended-spectrum (third-generation) cephalosporins – the last option for monotherapy – is becoming more widespread and 10 countries have reported treatment failure. Earlier GASP reports show that XDR strains of *N. gonorrhoeae* have been detected in multiple regions, and a large proportion of the circulating strains worldwide are very close to developing into XDR strains[5] *(47).* To prevent the emergence of drug resistance among *N. gonorrhoeae* strains, WHO recommends dual therapy with ceftriaxone plus azithromycin. In 2018, efficacy data on zoliflodacin and gepotidacin, new medications for the treatment of uncomplicated gonorrhoea, were released *(48).* A majority of uncomplicated gonorrhoea infections were successfully treated; however, these agents were less efficacious in the treatment of pharyngeal infections. There is also interest in exploring the effectiveness of additional drugs that have shown in vitro activity against gonorrhoea and to assess whether older drugs, such as gentamicin and spectinomycin, may be used in the combination treatment of gonorrhoea *(49)*.

6.1 Gonococcal Antimicrobial Surveillance Programme (GASP)

Monitoring the susceptibility patterns of *N. gonorrhoeae* is essential for detecting and tracking emerging resistance and adjusting treatment recommendations for optimal outcomes. Since 1992, countries monitor the emergence of resistance to *N. gonorrhoeae* through WHO GASP, a global laboratory network spanning more than 60 countries in six regions *(7).* This surveillance programme monitors the longitudinal trends in AMR and provides data to inform treatment guidelines. Isolate-based resistance surveillance is reported by national reference laboratories to the

[5] XDR strains are defined as those resistant to two or more of the antibiotic classes currently recommended for the treatment of gonorrhoea, or three or more of the less frequently used antibiotic classes.

regional reference laboratory focal points, and collated data are then submitted to GASP.

The cumulative number of countries participating in GASP is 65 as of 2016. Since 2013, the number of countries reporting susceptibility data for at least one antibiotic each year has increased, from 50 countries in 2013 to 60 countries in 2016. The WHO European Region accounted for the nearly half (46%) of the reporting countries in 2016. As a percentage of countries in the region, the Western Pacific Region has a high level of participation in GASP (41–45% of countries), which is important, considering that an estimated 40% of new gonorrhoea cases globally occur in the Western Pacific Region *(40).* Participation in GASP is much lower among countries in the African Region, but has increased over the past few years (Table 6.1).

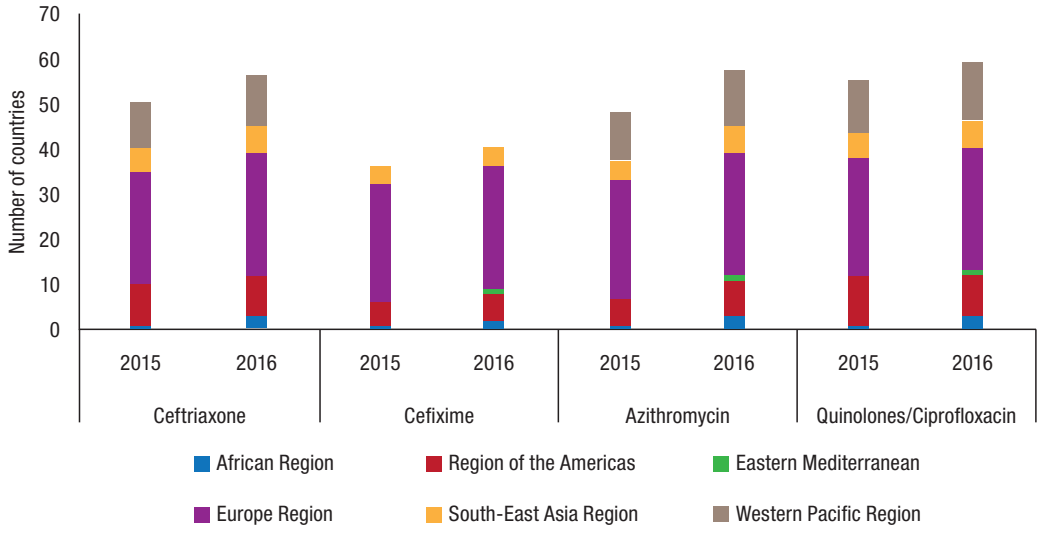
Among countries participating in GASP, most conduct susceptibility testing for more than one drug and there is an upward trend in the number of countries reporting susceptibility data for ceftriaxone, cefixime, azithromycin and quinolones/ciprofloxacin (Fig. 6.1).

Table 6.1. Number of countries reporting susceptibility testing of at least one drug to GASP each year, 2015–2016

WHO region	Number (%) 2015	Number (%) 2016
African Region	2 (6)	4 (11)
Region of the Americas	11 (23)	9 (19)
Eastern Mediterranean Region	0 (0)	1 (5)
European Region	26 (49)	27 (51)
South-East Asia Region	6 (55)	6 (55)
Western Pacific Region	12 (44)	13 (48)
Overall	**57 (29%)**	**60 (31)**

Source: WHO/GASP, 2017 *(7)*

Fig. 6.1. Number of countries testing for drug susceptibility by region, 2015–2016



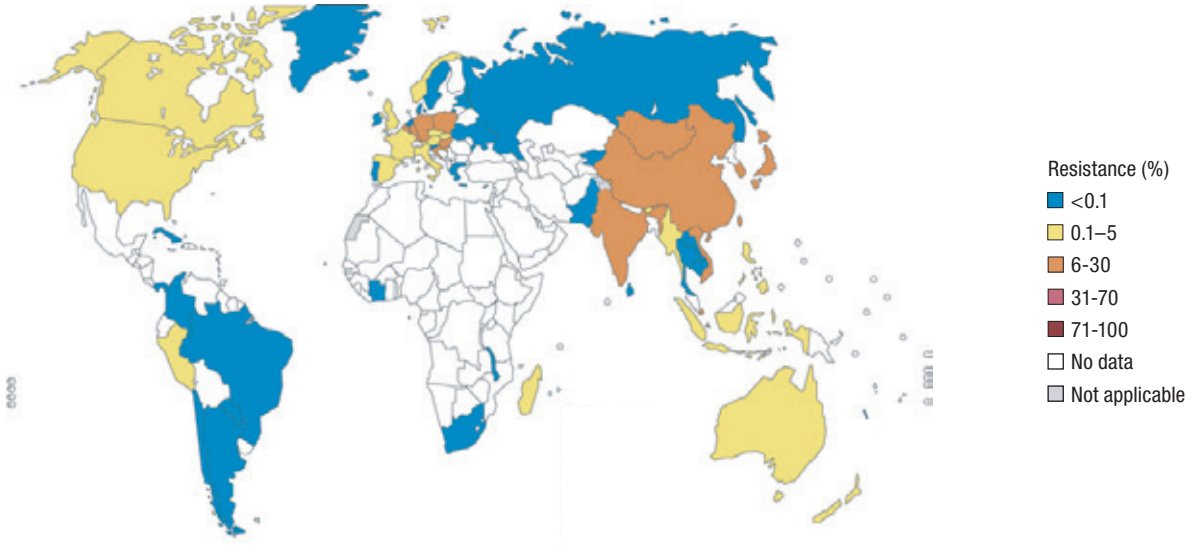
Source: WHO/GASP, 2017 *(7)*

Despite this progress, the full extent of the problem of gonococcal AMR remains unknown due to the lack of data in many countries. The lack of information is particularly acute in countries with the highest gonorrhoea burden and the greatest need for AMR monitoring. Many countries rely on the syndromic management of STIs, resulting in a lack of capacity for routinely collecting laboratory specimens appropriate for the culture and sensitivity testing needed for AMR monitoring. The use of molecular methods for diagnosing gonorrhoea in more developed countries also limits the availability of specimens for AMR testing.

6.2 Antimicrobial susceptibility data

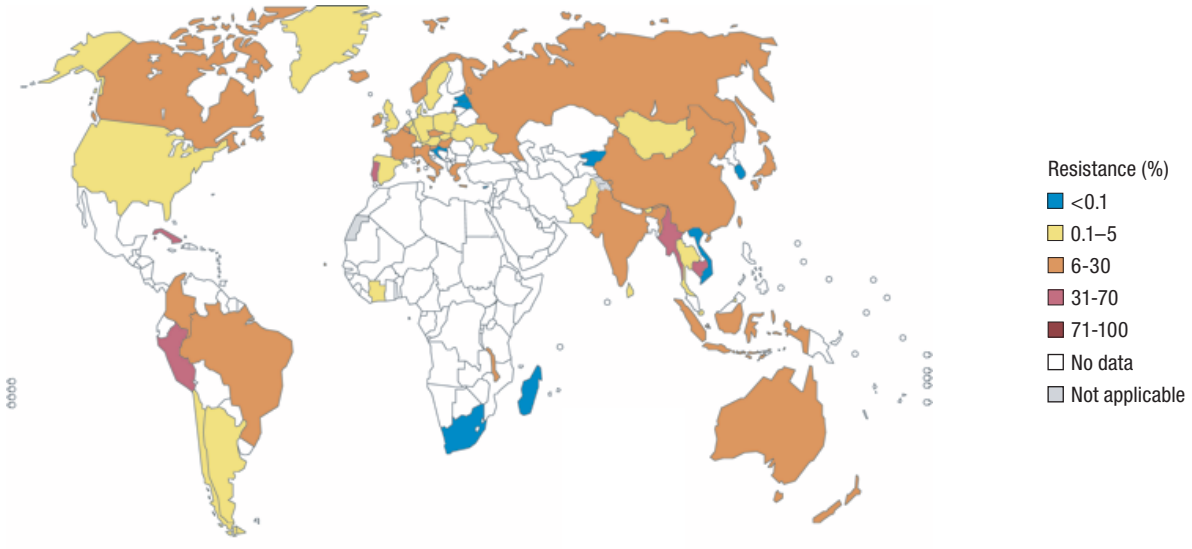
In 2016, 60 countries reported *N. gonorrhoeae* isolate susceptibility data for one or more antimicrobials. Among 57 countries reporting susceptibility data for extended-spectrum cephalosporins (ESC) (ceftriaxone and/or cefixime), 17 (30%) reported ≥5% of specimens had decreased susceptibility (Fig 6.2). Among 57 countries reporting on azithromycin susceptibility, 28 (49%) reported ≥5% resistance (Fig 6.3). Of the 59 countries reporting ciprofloxacin resistance testing, 56 (95%) reported that ≥5% of specimens were resistant strains and 10 countries reported >90% resistant strains (Fig 6.4). Based on these data (Table 6.2), a majority of countries now recommend ceftriaxone with concomitant azithromycin as dual therapy for gonorrhoea or UD in their national guidelines.

Fig. 6.2. Countries reporting antimicrobial resistance to extended-spectrum cephalosporins



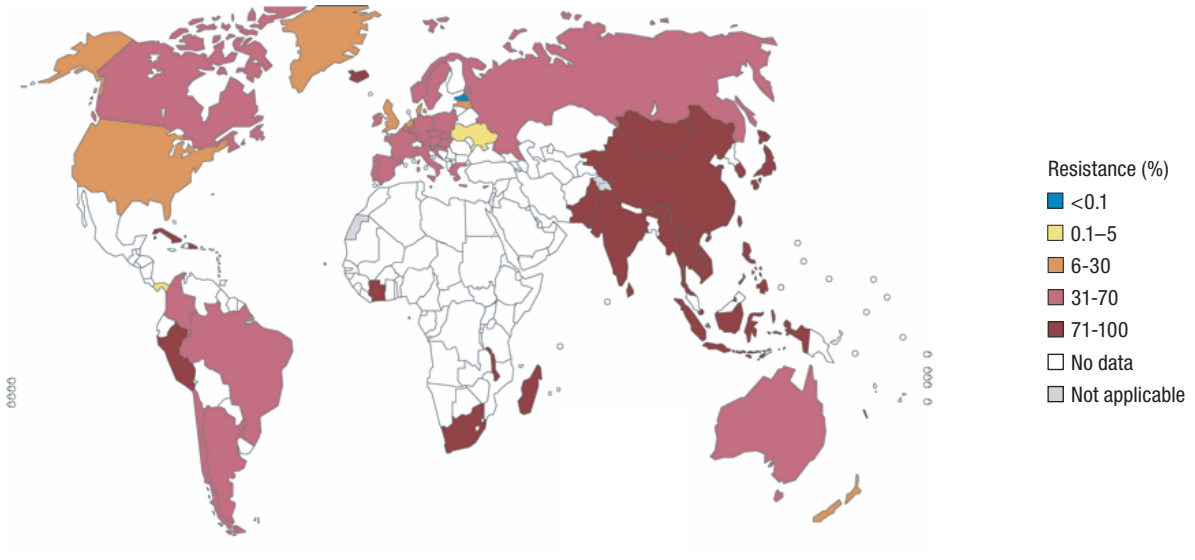
Source: WHO/GASP, 2017 *(7)*

Fig. 6.3. Countries reporting antimicrobial resistance to azithromycin



Source: WHO/GASP, 2017 *(7)*

Fig. 6.4. Countries reporting antimicrobial resistance to ciprofloxacin



Source: WHO/GASP, 2017 *(7)*

Table 6.2. Number of countries reporting gonoccocal isolates with resistance to ceftriaxone, cefixime, azithromycin and ciprofloxacin/quinolones, 2016

Reported % of resistant isolates	Africa	Americas	Eastern Mediterranean	Europe	South-East Asia	Western Pacific	Total
Ceftriaxone (MIC[a] >0.125 µg/mL)							
# countries testing for AMR	4	9	0	27	6	11	57
≥5% decreased susceptibility	2	0	0	0	3	4	9
Of which ≥10% decreased susceptibility	2	0	0	0	2	2	6
Cefixime (MIC[a] >0.25 µg/mL)							
# countries testing for AMR	3	6	1	27	4	0	41
≥5% resistant isolates	0	0	0	6	2	0	8
Of which ≥10% resistant isolates	0	0	0	2	1	0	3
Azithromycin							
# countries testing for AMR	3	8	1	27	6	12	57
≥5% resistant isolates	2	5	0	13	3	5	28
Of which ≥10% resistant isolates	1	3	0	8	2	2	16
Ciprofloxacin/quinolones							
# countries testing for AMR	3	9	1	27	6	13	59

Reported % of resistant isolates	Africa	Americas	Eastern Mediterranean	Europe	South-East Asia	Western Pacific	Total
≥5% resistant isolates	3	9	1	25	6	12	56
50–90% resistant isolates	2	7	0	11	2	5	27
>90% resistant isolates	0	0	1	1	4	4	10

[a] Minimum inhibitory concentration

Source: WHO/GASP, 2017 *(7)*

6.3 Data quality and interpretation

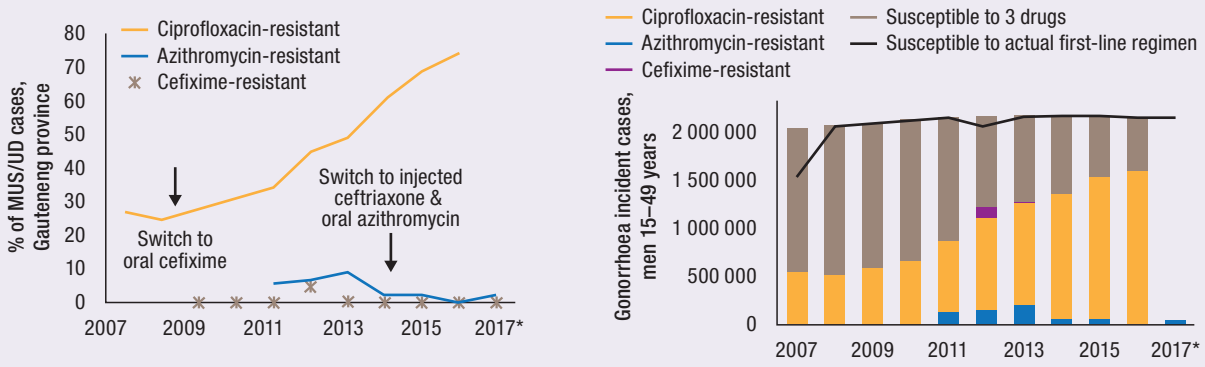
Antimicrobial resistance data are generally based on small sample sizes, resulting in sampling bias. Quality control varies by country. Many countries do not provide data on an annual basis and the proportion of countries reporting varies by region. As a result, wide variations in results in a single country are noted from year to year and AMR data are not comparable across countries and regions.

Improving surveillance and estimation of the burden of gonorrhoea will require routine prevalence studies among general and key populations, alongside AMR surveillance monitoring. WHO has released a standard protocol for conducting chlamydia and gonorrhoea prevalence surveys among pregnant women, a population considered to represent the general population. This prevalence protocol can be adapted for gonorrhoea surveys among other general populations of men and women, and high-risk populations *(39)*.

Box 11. Estimating the impact of antimicrobial resistance on the gonorrhoea epidemic: South Africa

Improved surveillance is needed of gonorrhoea trends within the general population and among high-risk populations to better estimate the occurrence or risk of emergence of AMR. In South Africa, the Spectrum-STI model was applied to estimate the prevalence and incidence of gonorrhoea among the general population, including the subset of gonorrhoea cases resistant to first-line regimens *(50).* Despite the growing annual numbers of gonorrhoea cases (reflecting population growth), the estimated number of first-line treatment-resistant gonorrhoea cases did not increase between 2008 and 2017 (Fig. 6.5, right), due to changes in first-line antimicrobial treatment regimens for gonorrhoea implemented in 2008 and 2014/2015 (Fig. 6.5, left).

Fig. 6.5. Use of the Spectrum model to estimate national-level gonorrhoea prevalence and attributable proportion of infections caused by AMR strains of *Neisseria gonorrhoeae*



MUS: male urethritis syndrome; UD: urethral discharge

Source: Kularatne et al., 2018. *(50)*

* In 2017, ciprofloxacin resistance was not tested by the National Institute for Communicable Diseases, Johannesburg; cefixime, ceftriaxone were tested and no resistance detected to the extended-spectrum cephalosporins. The prevalence of intermediate resistance to azithromycin was 1.8%.

7. Human papillomavirus vaccination to prevent cervical cancer

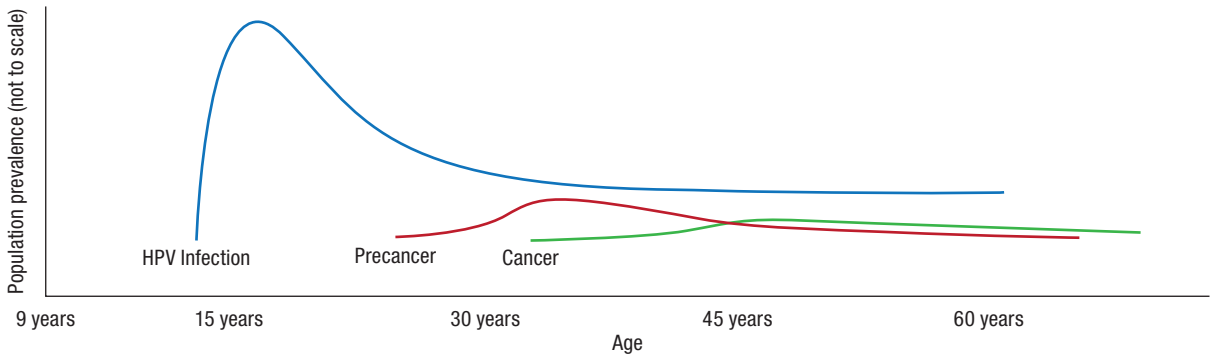
Key points

- WHO launched the Strategy for the Elimination of Cervical Cancer in May 2018.
- This Strategy includes the provision of HPV vaccination to young women and subsequent cancer screening and treatment for women between 35 and 45 years of age within a life-course approach.
- Monitoring the inclusion of HPV vaccination within national immunization programmes and coverage of HPV vaccination of young women are included in the WHO Global STI Strategy 2030 targets.

Cervical cancer is a preventable disease; yet as of 2018, WHO estimates that over 280 000 women die of cervical cancer each year, with 90% of deaths occurring in low- and middle-income countries (2016 data) *(4, 51)*. While a majority of HPV infections resolve within two years, high-risk types of HPV can cause precancerous lesions on the cervix, some of which will progress to cervical cancer. Overall, 89.5% of cervical cancer can be attributed to just nine types of HPV *(52)*.

A highly cost-effective method for the primary prevention of cervical cancer is HPV vaccination of young girls between the ages of 9 and 14 years *(53)*. Vaccination prior to the onset of sexual activity is critical due to the high prevalence of HPV in the population and the high transmissibility of the virus through sexual contact. Fig. 7.1 illustrates the high incidence of HPV infection associated with age at sexual debut, followed by resolution in a majority of cases, and persistent HPV infections that progress to cancer within certain populations.

Fig. 7.1. Progression of HPV infection to cancer through the life-course

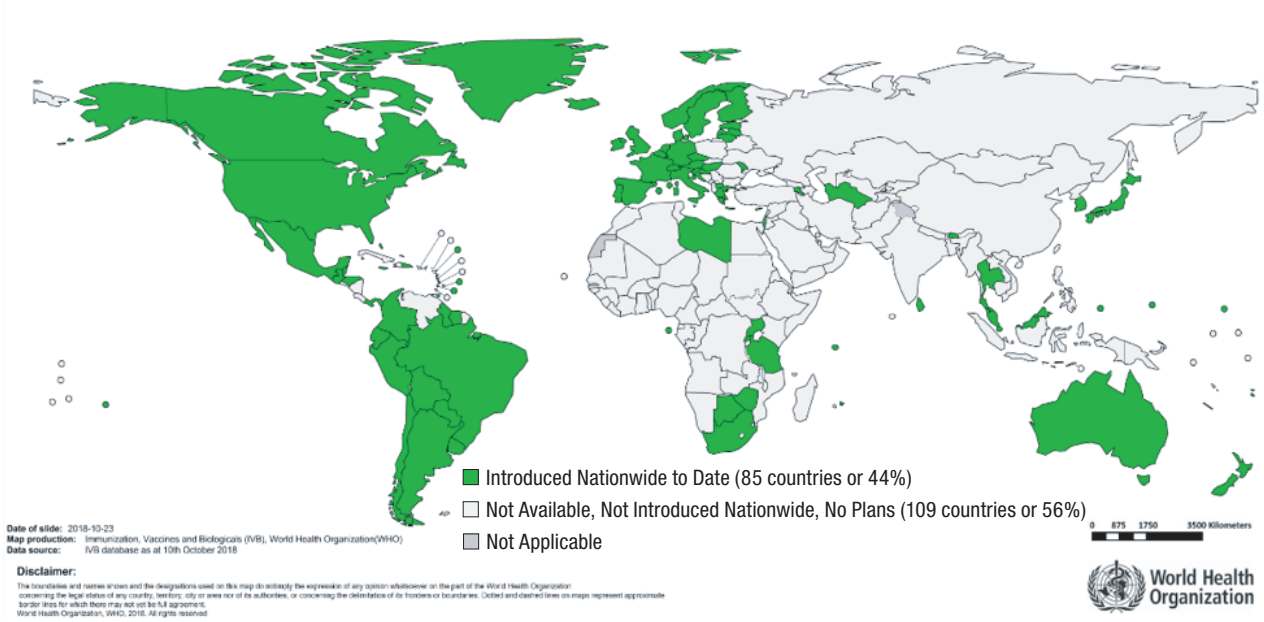


Source: Kuruvilla et al. 2018 *(54)*

Following a global call to action toward the elimination of cervical cancer at the World Health Assembly in May 2018, WHO launched the Global Strategy to Eliminate Cervical Cancer. The Strategy works primarily through the provision of HPV vaccination to young women and subsequent cancer screening and treatment for women between 35 and 45 years of age. The 2030 target for HPV vaccination is for 90% of girls 15 years of age to be fully vaccinated (i.e. two doses) within countries where the HPV vaccine is included in the national immunization programme.

WHO's 2016 Global STI Strategy set a target for 70% of countries to introduce HPV vaccination into the national vaccination schedule by 2020. Data compiled as of October 2018 show that 85 countries (44%) have HPV vaccine incorporated into their national immunization programmes, while 109 countries (56%) do not yet have HPV vaccine included in the national programme (Fig. 7.2) *(55)*.

Fig. 7.2. Eighty-five countries with HPV vaccine incorporated into their national immunization programmes

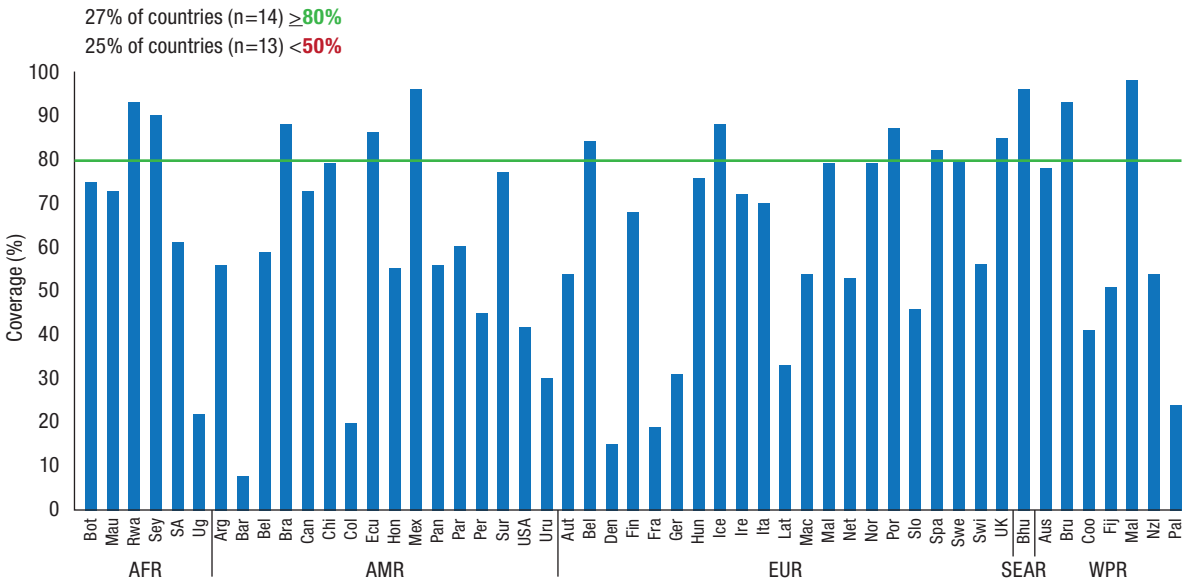


Source: WHO/IVB database as of October 2018 *(55)*

In one study of 51 countries for which recent HPV vaccine coverage data were available, one quarter of the countries had less than 50% coverage, and about one quarter reported more than 80% coverage (Fig. 7.3) *(56)*. Fig. 7.2 and 7.3 show large inequities in access to HPV vaccine across countries and regions.

Fig. 7.3. Reported HPV vaccine coverage, 2014–2016

N = 51 countries



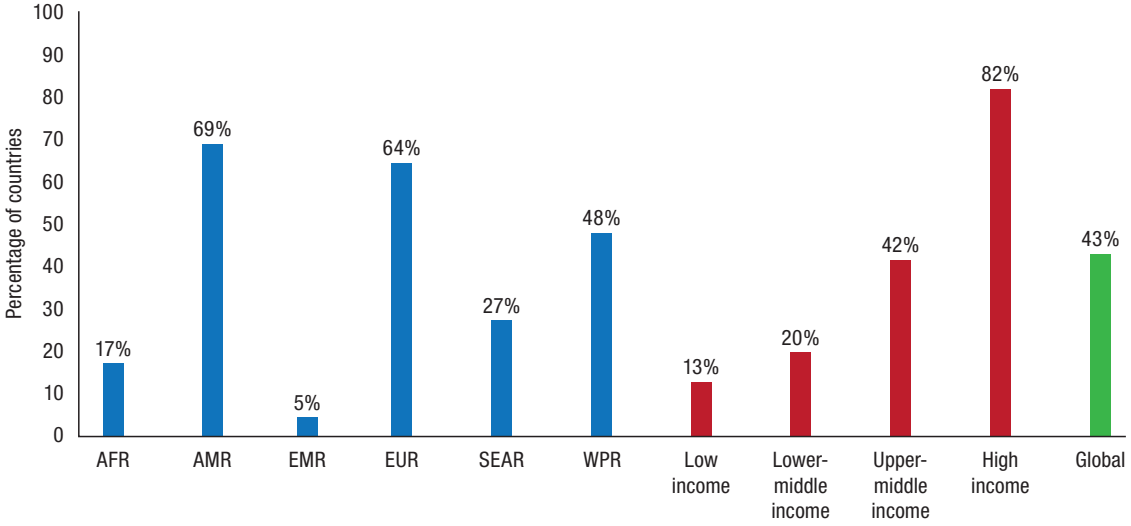
AFR: WHO African Region; AMR: WHO Region of the Americas; EUR: WHO European Region; SEAR: WHO South-East Asia Region; WPR: WHO Western Pacific Region

Source: Brotherton & Bloem, 2017 *(56)*

It is also notable that regions where fewer countries have incorporated HPV vaccine into the national immunization programme also have a high HIV burden. This raises concern due to evidence that women infected with HIV have a higher risk of persistent HPV infection that could result in cervical cancer. Only 17% of countries in the African Region and 27% of countries in the South-East Asia Region have incorporated HPV vaccine into their national programme (Fig. 7.4, left). At the same time, these regions combined have approximately 30 million people living with HIV/AIDS.

The inequity in vaccine access also tracks largely with income. More than 80% of high-income countries have introduced HPV vaccination, compared to only 20% of lower-middle-income and 13% of low-income countries (Fig. 7.4, right).

Fig. 7.4. Percentage of countries with HPV vaccination in the national immunization schedule, by WHO region and World Bank income group, as of October 2018



AFR: WHO African Region; AMR: WHO Region of the Americas; EMR: WHO Eastern Mediterranean Region; EUR: WHO European Region; SEAR: WHO South-East Asia Region; WPR: WHO Western Pacific Region

Source: Goodman, 2018 *(57)*

Factors contributing to delayed vaccine introduction and low coverage level in many countries include: (i) the cost of the HPV vaccine; (ii) the logistical, financial and social challenges of delivering the vaccine to a non-traditional age group; (iii) the need for local adaptation to effectively design and implement cost-effective delivery strategies; and (iv) the low priority given to HPV vaccine in national immunization programmes and budgets.

As part of monitoring the progress of implementation of the WHO Global STI Strategy, incorporation of HPV vaccination into national immunization programmes and HPV vaccine coverage among girls aged <15 years will be regarded as a part of STI surveillance implementation. Monitoring HPV prevalence among women will be considered for future inclusion in national, regional and global estimation of STI burden.

8. Conclusion

This is the fourth global report on STI surveillance since the release of the WHO *Strategies and laboratory methods for strengthening surveillance of sexually transmitted infections 2012 (8).* Since the last report, the Global STI Strategy for 2016–2021 has been launched, setting a course to achieve 90% reduction in *T. pallidum* and *N. gonorrhoeae* infections alongside congenital syphilis elimination, and 90% HPV vaccine coverage of girls by 2030. Strategic direction 1 of the Global Strategy, "Information for focused action", relies on the development and strengthening of country STI surveillance systems to measure progress towards these targets.

National STI surveillance using standardized key programmatic STI indicators and data is being promoted from the global level by inclusion in the GAM reporting system of indicators recommended for routine collation and reporting by all countries. These indicators serve to describe the STI burden, service delivery gaps and opportunities for improvement of national-level STI control programmes. These data also provide baselines for assessing progress made over time.

Rates of reporting to GAM vary between countries; consequently, the interpretation of results from GAM data is limited and potentially biased by the completeness and representativeness of these publicly available data, as well as by differences in diagnostic practices among reporting countries. Nevertheless, data from GAM and GASP presented in the current report suggest that a growing number of countries are able to consistently report and use surveillance data over time.

Country-level collection and use of surveillance data are being bolstered by two modelling tools for estimating trends in STIs and congenital syphilis, Spectrum-STI (Avenir Health) and the WHO congenital syphilis estimation tools. These build on routine surveillance indicator data to estimate recent trends in STI rates and thus mark progress in prevention and control efforts. Application of the Spectrum-STI model generated, for the first time, standardized national-level syphilis trend estimates for 132 countries, which cover an estimated 90% of the global adult syphilis burden. Since 2016, this new model has also been used by 11 countries to estimate national trends in chlamydia and gonorrhoea prevalence and incidence, as well as completeness of clinical STI case reporting and ongoing trends in national numbers of antibiotic-resistant gonorrhoea cases.

The WHO congenital syphilis estimation tool is pre-populated with GAM-reported country data, enabling case rate estimates for over 60 countries. This tool is now routinely used by EMTCT validation teams during country missions to evaluate readiness for application for validation of EMTCT.

Future estimations of the STI burden and trend would benefit from expanded and improved collection of prevalence data, notably prevalence surveys, which are scarce for gonorrhoea and chlamydia in both key populations and lower-risk men and women. Expanded reporting of the coverage of ANC-based maternal syphilis screening and treatment alongside maternal syphilis prevalence allow for more precise estimates of the burden of congenital syphilis and progress towards EMTCT at national, regional and global levels.

Global estimates based on surveillance data and the results of Spectrum trend estimations suggest that many countries are not on track to achieve the 2030 goals of the Global STI Strategy, 2016–2021. The decreased susceptibility of gonococcal strains reported in many countries threatens efforts to reduce new *N. gonorrhoeae* infections by 90%. Syphilis seroprevalence remains high in key populations such as FSWs and MSM worldwide; and overall adult prevalence is stable in most countries. To date, 12 countries have been validated for EMTCT of HIV and/or syphilis. However, prevention of congenital syphilis has not been prioritized, which has led to low investment in both ANC syphilis screening and treatment.

The 2018 launch of the WHO Cervical Cancer Elimination Campaign is likely to result in expanded HPV vaccination programmes in more countries. Efforts to expand coverage in lower-middle-income countries will be critical to closing the gap in rates of cervical cancer deaths currently observed between high-income and resource-constrained settings.

These surveillance and programme monitoring data can be used to advocate for greater investment in STI prevention and control efforts at both the country and regional levels. Moving forward, countries must continue to improve STI

surveillance systems to provide the necessary information and data to guide estimation of the STI burden and implementation of STI control interventions. Of particular importance is collecting routine (every 2–3 years) STI prevalence data (especially for gonorrhoea, chlamydia and trichomoniasis) through prevalence surveys among general populations. These data are critical inputs for calibrating epidemic models and generating reliable STI estimates that can be used for programme planning and evaluation.

There are also multiple opportunities to partner with other programmes to obtain prevalence estimates for the general population. These include: analysis of blood donor data to estimate syphilis prevalence in the general population; collation and analysis of data from studies conducted for other research purposes but for which women or men have been screened for STIs; and collection of screening data from pre-exposure prophylaxis (PrEP) interventions in which STI prevalence may be collected from control populations to establish baseline measures. Although these are promising approaches, leveraging these sources of data will require guidance and protocols to ensure appropriate STI data collection, analysis and interpretation of the results.

Each WHO region has developed plans to address their greatest STI control challenges and leverage their regional strengths. Reports from STI regional advisors at an STI surveillance meeting held on 1 February 2018 indicate steady advancement of STI priorities within regional and country programming. For example, in the African Region, integrating STI surveillance, e.g. case reporting, into national health information systems, will leverage investments to include STIs in routine facility data systems. The Pan American Health Organization/Region of the Americas plans to pool procurement of RSTs to scale up use of this diagnostic technology. In the European Region, efforts to expand GASP into Eastern Europe has been spurred by the increasing global occurrence of untreatable gonorrhoea. In the South-East Asia Region, efforts to strengthen STI surveillance data include more etiological assessments of STI syndromes due to the Region's heavy reliance on syndromic management of STIs. In tandem, this Region will work to expand the availability of rapid diagnostic tests/kits to increase facility-based diagnosis. The Western Pacific Region plans to strengthen the link between gonococcal AMR and the Region's broader AMR agenda, and improve gonorrhoea surveillance efforts within general populations. Strong regional collaboration has supported training, updates of STI treatment and programming guidelines, and establishing a joint prevalence database for STI, hepatitis and HIV studies to further strengthen integrated programming at the country level. New opportunities to engage multiple stakeholders in HPV vaccination programmes will also be key to each region's efforts to prevent cervical cancer.

Across all regions, both STI surveillance and prevention and control efforts require more human resource capacity in the areas of analysis of STI surveillance data, using data to advocate for investment and political commitment to STI control, and applying the results of programme monitoring and STI surveillance to improve service delivery. Renewed commitment by national ministries of health and global stakeholders to improve STI surveillance and STI service delivery will be needed to reach the ambitious targets of the WHO Global STI Strategy.

Annexes

Annex 1. Cascade of indicators for elimination of mother-to-child transmission (EMTCT) of syphilis using the most recent data reported through the Global AIDS Response Progress Reporting (GARPR) system, 2008–2017[a]

Country	% of pregnant women with at least 1 ANC visit [at least 4 ANC visits][a]	Year for 1 ANC visit data[b] [year for 4 ANC visit data]	% of ANC attendees tested for syphilis[c]	Year[b]	% of ANC attendees positive for syphilis	Year[b]	% of infected ANC attendees treated	Year[b]	Congenital syphilis rate (cases per 100 000 live births)	Year[b]
African Region										
Algeria	92.9 [67.3]	2012 [2013]	64.1	2014	0.2	2014	100.0	2014	–	–
Benin	83.5 [58.7]	2012 [2014]	3.1	2017	0.4	2017	100.0	2017	–	–
Botswana	93.6	2007	70.6	2015	1.2	2015	–	–	–	–
Burkina Faso	94.9 [47.2]	2010 [2015]	100.0	2016	0.7	2016	100.0	2017	669	2017
Burundi	98.9 [49.3]	2010 [2017]	0.7	2015	0.0	2014	–	–	–	–
Cabo Verde	90.9	2011	100.0	2015	0.3	2015	100.0	2015	0.0	2015
Cameroon	84.7 [58.8]	2011 [2014]	100.0	2013	0.6	2010			–	–
Central African Republic	54.6 [38.1]	2017 [2010]	56.1	2017	4.7	2017	97.4	2017	–	–
Chad	56.2[31.0]	2014 [2015]	100.0	2014	3.4	2013	100.0	2013	–	–
Comoros	92.1 [48.9]	2012	29.0	2014	0.2	2014	–	–	–	–
Congo	89.7	2012	10.7	2016	0.6	2016	–	–	–	–
Côte d'Ivoire	88.9 [44.2]	2012	92.1	2008	0.2	2010	–	–	–	–
Democratic Republic of the Congo	89.2 [48.0]	2014	12.1	2017	3.7	2017	60.0	2017	–	–
Equatorial Guinea	91.3	2011	37.4	2015	7.7	2015	87.2	2015	110.8	2015
Eritrea	–	–	97.2	2017	1.1	2017	100.0	2017	–	–
Eswatini	96.8 [76.6]	2010	85.2	2016	2.3	2016	90.2	2016		
Ethiopia	33.9 [31.8]	2011 [2016]	44.6	2017	1.1	2017	–	–	–	–
Gabon	94.7 [77.6]	2012	31.1	2017	1.8	2017	100.0	2017	0.0	2015
Gambia	86.2 [77.6]	2013	41.5	2012	–	–			–	–
Ghana	97.0.4 [87.4]	2014	44.6	2017	3.0	2017	91.0	2017	–	–
Guinea	85.2 [55.6]	2012	4.8	2017	5.4	2017	100.0	2017	–	–
Guinea-Bissau	92.6 [64.9]	2010 [2014]	8.9	2014	2.2	2014	–	–	–	–
Kenya	95.9 [57.6]	2014 [2014]	85.7	2017	1.4	2017	–	–	–	–
Lesotho	95.1 [74.5]	2014	91.2	2017	6.0	2016	62.2	2014	–	–
Liberia	95.9	2013	7.8	2015	2.7	2017	100.0	2015	–	–
Madagascar	82.1	2013	28.8	2017	3.0	2017	61.0	2017	–	–
Malawi	95.1 [50.9]	2015	82.0	2017	1.0	2017	100.0	2016	–	–
Mali	74.2 [38.0]	2013 [2015]	21.4	2017	6.1	2017	100.0	2017	–	–
Mauritania	84.2	2011	50.9	2013	3.8	2013	87.5	2013	–	–
Mauritius	–	–	100.0	2017	2.1	2017	100.0	2017	37.1	2017
Mozambique	90.6 [50.6]	2011	71.9	2017	4.6	2017	72.4	2014	417.5	2014
Namibia	96.6 [62.5]	2013	97.9	2017	2.1	2017	–	–	6.5	2017
Niger	82.8 [38.5]	2012 [2015]	19.7	2016	0.9	2016	100.0	2016	–	–
Nigeria	60.6 [51.1]	2013	16.1	2017	0.8	2017	74.8	2017	–	–
Rwanda	99.1 [43.9]	2014 [2015]	84.3	2014	0.9	2014	–	–	–	–
Sao Tome and Principe	97.5 [83.6]	2009 [2014]	91.3	2017	0.8	2017	100.0	2017	–	–

Annex 1 (contd). Cascade of indicators for elimination of mother-to-child transmission (EMTCT) of syphilis using the most recent data reported through the Global AIDS Response Progress Reporting (GARPR) system, 2008–2017[a]

Country	% of pregnant women with at least 1 ANC visit [at least 4 ANC visits][a]	Year for 1 ANC visit data[b] [year for 4 ANC visit data]	% of ANC attendees tested for syphilis[c]	Year[b]	% of ANC attendees positive for syphilis	Year[b]	% of infected ANC attendees treated	Year[b]	Congenital syphilis rate (cases per 100 000 live births)	Year[b]
Senegal	94.8 [53.8]	2015 [2016]	39.0	2017	2.4	2017	62.4	2017	–	–
Seychelles	–	–	100.0	2017	0.1	2017	100.0	2017	60.6	2017
Sierra Leone	97.1[76.0]	2013	8.3	2017	0.1	2017	100.0	2017	–	–
South Africa	97.1 [75.5]	2008 [2016]	100.0	2016	1.6	2011	–	–	–	–
South Sudan	40.3	2010	100.0	2017	7.6	2017	–	–	–	–
Togo	72.7 [57.2]	2013 [2014]	9.3	2017	2.2	2017	100.0	2017	–	–
Uganda	94.9 [59.9]	2011 [2016]	43.3	2016	2.9	2016	–	–	–	–
United Republic of Tanzania	97.9 [50.6]	2015 [2016]	42.0	2017	1.8	2017	56.9	2016	–	–
Zambia	95.7 [55.5]	2014	56.0	2017	3.5	2016	100.0	2017	–	–
Zimbabwe	92.4 [75.7]	2015	98.7	2017	1.9	2017	78.4	2017	–	–
Region of the Americas										
Antigua and Barbuda	100.0 [100.0]	2009 [2014]	100.0	2017	0.8	2017	100.0	2017	0.0	2017
Argentina	98.1 [89.8]	2012	82.8	2017	2.7	2017	84.7	2014	190.8	2017
Bahamas	86.0 [83.1]	2011 [2014]	87.5	2014	1.1	2015	100.0	2016	0.0	2015
Barbados	93.4 [97.0]	2012[2015]	98.0	2017	0.6	2017	85.7	2017	155.5	2016
Belize	96.3 [92.6]	2011 [2016]	93.4	2013	0.3	2013	42.9	2013	0.0	2013
Bolivia (Plurinational State of)	85.8 [85.6]	2008 [2016]	96.0	2017	0.9	2017	100.0	2017	5.5	2012
Brazil	96.0 [90.9]	2012 [2015]	93.5	2011	0.8	2011	88.9	2017	678.5	2016
Canada	100.0 [98.9]	2007	–	–	–	–	–	–	1.5	2015
Chile	–	–	100.0	2016	0.2	2017	94.5	2017	10.6	2016
Colombia	97.7 [89.9]	2015	58.8	2017	3.9	2017	92.5	2017	222.4	2017
Costa Rica	95.0 [97.6]	2012 [2015]	76.0	2016	0.9	2016	58.2	2017	97.1	2017
Cuba	100.0 [97.8]	2009 [2014]	100.0	2017	0.4	2017	99.3	2017	2.6	2017
Dominica	100.0 [70.0]	2009 [2016]	89.3	2017	0.2	2017	100.0	2017	0.0	2016
Dominican Republic	98.1 [92.9]	2014	42.2	2017	1.6	2017	54.1	2017	8.3	2013
Ecuador	84.1 [79.5]	2007 [2012]	100.0	2017	0.4	2017	–	–	32.9	2016
El Salvador	96.4 [75.1]	2014 [2016]	92.9	2017	0.2	2017	50.6	2017	5.5	2017
Grenada	100.0 [59.8]	2009 [2016]	75.8	2016	1.0	2016	100.0	2016	0.0	2016
Guatemala	92.3 [86.2]	2014 [2015]	37.1	2017	0.1	2017	100.0	2014	9.2	2017
Guyana	85.7 [86.7]	2009 [2014]	82.7	2013	0.1	2013	100.0	2010	0.0	2015
Haiti	89.9 [66.6]	2012 [2017]	92.5	2016	2.8	2016	89.8	2017	–	–
Honduras	94.2 [88.9]	2012	69.0	2017	0.2	2017	100.0	2014	89.5	2017
Jamaica	97.6 [85.6]	2011	90.0	2016	1.5	2016	70.9	2016	22.8	2016
Mexico	98.6 [94.3]	2015	51.2	2017	0.2	2017	–	–	9.3	2017
Nicaragua	94.7 [87.8]	2012	76.2	2017	0.1	2017	98.3	2017	3.0	2017
Panama	92.6 [87.9]	2013	92.7	2017	1.8	2017	83.8	2017	530.0	2017
Paraguay	96.1 [77.4]	2008 [2015]	92.7	2017	1.9	2017	66.8	2017	287.6	2017
Peru	95.9 [96.0]	2013 [2016]	82.3	2017	0.3	2017	89.4	2017	34.8	2017
Saint Kitts and Nevis	100.0	2007	99.5	2017	0.0	2017	NA[d]	2016	0.0	2017

Country	% of pregnant women with at least 1 ANC visit [at least 4 ANC visits][a]	Year for 1 ANC visit data[b] [year for 4 ANC visit data]	% of ANC attendees tested for syphilis[c]	Year[b]	% of ANC attendees positive for syphilis	Year[b]	% of infected ANC attendees treated	Year[b]	Congenital syphilis rate (cases per 100 000 live births)	Year[b]
Saint Lucia	96.9 [90.3]	2012	99.7	2017	2.5	2017	89.1	2017	321.0	2017
Saint Vincent and the Grenadines	99.5 [99.5]	2008 [2009]	100.0	2017	0.7	2011	–	–	0.0	2017
Samoa	[72.9]	[2014]								
Suriname	90.4 [66.8]	2010	–	–	0.0	2013	–	–	0.0	2010
Trinidad and Tobago	95.3 [100.0]	2006 [2015]	99.4	2017	0.1	2017	94.7	2017	0.0	2017
Uruguay	97.4 [96.1]	2012 [2015]	97.9	2017	0.7	2017	81.5	2017	150.9	2016
Venezuela (Bolivarian Republic of)	[96.2]	[2016]	30.6	2016	2.0	2016	98.1	2016	4.68	2013
Eastern Mediterranean Region										
Afghanistan	59.3 [17.8]	2015	14.3	2017	0.3	2017	100	2017		
Bahrain	100.0 [100.0]	2012 [2014]	–	–	–	–	–	–	–	–
Djibouti	81.0 [25.7]	2006 [2012]	5.6	2013	8.1	2010	–	–	–	–
Egypt	91.1[82.7]	2014								
Iran (Islamic Republic of)	96.9 [94.3]	2010 [2005]	70.0	2017	0.0	2011	–	–	–	–
Iraq	77.7 [49.6]	2011	27.3	2010	0.0	2010	–	–	–	–
Jordan	99.1 [94.5]	2012	0.0	2010	0.0	2009	–	–	–	–
Morocco	77.1 [56.3]	2011	43.0	2017	1.3	2017	52.6	2017	22.5	2017
Oman	99.0 [74.5]	2010 [2016]	97.0	2017	0.0	2017	100.0	2017	0.0	2017
Pakistan	[36.6]	[2013]								
Qatar	91.0 [84.5]	2012								
Saudi Arabia	98.0	2011	58.1	2017	0.0	2017	100.0	2017	0.2	2017
Somalia	22.0 [6.3]	2006	43.4	2016	1.3	2016	46.7	2014	–	–
Sudan	80.5 [50.7]	2014	9.3	2014	2.2	2010	–	–	–	–
Syria Arab Republic	[63.7]	[2009]								
Tunisia	83.6 [85.1]	2012	–	–	–	–	–	–	0.0	2014
United Arab Emirates	100 [99.9]	2011 [2015]	100.0	2017	0.1	2017	50.0	2017	1.6	2017
Yemen	59.8 [25.1]	2013	–	–	0.4	2010	–	–	–	–
European Region										
Albania	97.3 [66.8]	2009	–	–	–	–	–	–	6.6	2017
Armenia	99.1 [96.0]	2010 [2016]	94.5	2017	0.0	2017	–	–	0.0	2017
Azerbaijan	76.6 [66.1]	2006 [2011]	100.0	2008	0.0	2008	–	–	0.12	2011
Belarus	99.7 [99.7]	2012 [2012]	99.8	2017	0.0	2017	100.0	2017	0.0	2017
Bosnia and Herzegovina	85.8 [84.2]	2008 [2012]	–	–	–		–	–	0.0	2010
Bulgaria					0.0	2016	100.0	2016	15.2	2015
Croatia	[97.3]	[2016]								
Cyprus	99.2	2007	100.0	2011	0.0	2011	–	–	0.0	2011
Czech Republic	98.2 [98.8]	2012 [2013]	100.0	2010	0.1	2010	100.0	2010	1.9	2012
Denmark	–	–	99.8	2015	0.0	2015	100.0	2010	0.02	2011
Estonia	98.9 [92.2]	2012 [2016]	–	–	–	–			0.07	2010

Annex 1 (contd). Cascade of indicators for elimination of mother-to-child transmission (EMTCT) of syphilis using the most recent data reported through the Global AIDS Response Progress Reporting (GARPR) system, 2008–2017[a]

Country	% of pregnant women with at least 1 ANC visit [at least 4 ANC visits][a]	Year for 1 ANC visit data[b] [year for 4 ANC visit data]	% of ANC attendees tested for syphilis[c]	Year[b]	% of ANC attendees positive for syphilis	Year[b]	% of infected ANC attendees treated	Year[b]	Congenital syphilis rate (cases per 100 000 live births)	Year[b]
Finland	[98.0]	[2014]								
France	[99.2]	[2016]								
Georgia	97.6 [88.3]	2010 [2015]	92.2	2017	0.3	2017	18.2	2015	20.8	2017
Germany	–		96.8	2016	0.0	2016	–	–	0.4	2016
Iceland	[97.7]	[2016]								
Ireland	99.9	2012	–	–	–	–	–	–	0.0	2015
Italy	98.1 [87.3]	2010 [2014]	–	–	–	–	–	–	0.0	2011
Kazakhstan	99.2 [95.3]	2015	100.0	2016	0.1	2016	100.0	2016	0.8	2017
Kyrgyzstan	98.3 [94.6]	2014	89.4	2017	0.0	2017	100.0	2017	3.2	2017
Latvia	98.4	2012	–	–	–	–	–	–	0.0	2011
Lithuania	100	200410	77.8	2016	0.0	2016	–	–	0.0	2016
Luxembourg	[97.5]	[2013]								
Malta	100.0	2010	100.0	2016	0.1	2016	100.0	2016	0.0	2016
Monaco	–	–	100.0	2014	–	–	–	–	0.0	2014
Montenegro	91.7 [85.6]	2013	–	–	–	–	–	–	0.0	2017
Republic of Moldova	100.0 [95.4]	2011 [2012]	98.9	2017	0.4	2016	86.6	2017	12.0	2017
Romania	[76.0]	[2004]	30.1	2008	1.0	2014	28.8	2014	2.2	2016
Russian Federation	[78.3]	[2011]								
Serbia	98.3 [93.9]	2014	–	–					0.0	2017
Slovakia	–	–	100.0	2015	0.0	2013	100.0	2013	1.8	2015
Tajikistan	78.8 [52.5]	2012	100.0	2016	0.0	2016	100.0	2016	3.5	2017
The former Yugoslav Republic of Macedonia	[93.0]	[2011]								
Turkey	[88.9]	[2014]								
Turkmenistan	100.0[96.4]	2015[2016]								
Ukraine	98.6 [87.2]	2012	92.5	2017	0.1	2017	100.0	2017	0.0	2017
United Kingdom	–	–	97.9	2012	0.1	2012	–	–	0.0	2010
Uzbekistan	98.7	2006	100.0	2015	0.0	2009	–	–	–	–
South-East Asia Region										
Bangladesh	64.3 [37.2]	2014 [2016]	72.3	2017	0.0	2017	100.0	2017	–	–
Bhutan	74.4 [84.9]	2010 [2015]	97.3	2010	1.0	2010	–	–	5.4	2009
Democratic People's Republic of Korea	100.0 [93.5]	2009	0.3	2012	0.0	2012	–	–	–	–
India	75.1 [51.2]	2008 [2016]	19.8	2017	0.1	2016	47.6	2017	–	–
Indonesia	95.7 [83.5]	2012 [2013]	1.7	2017	3.2	2017	30.1	2016	1.2	2016
Maldives	99.2 [85.1]	2009	66.0	2014	0.1	2014	100.0	2014	–	–
Myanmar	84.9 [58.6]	2015	31.2	2017	0.2	2017	71.4	2017	–	–
Nepal	70.2 [69.4]	2014[2016]	0.3	2016	0.2	2016	16.7	2017	0.0	2017
Sri Lanka	99.4 [92.5]	2007	95.7	2017	0.0	2017	93.2	2017	0.6	2017
Thailand	98.1 [90.8]	2012 [2016]	99.1	2017	0.2	2017	97.5	2017	14.7	2017
Timor-Leste	84.4 [76.7]	2010 [2016]	55.6	2014	0.5	2014	–	–	–	–

Country	% of pregnant women with at least 1 ANC visit [at least 4 ANC visits][a]	Year for 1 ANC visit data[b] [year for 4 ANC visit data]	% of ANC attendees tested for syphilis[c]	Year[b]	% of ANC attendees positive for syphilis	Year[b]	% of infected ANC attendees treated	Year[b]	Congenital syphilis rate (cases per 100 000 live births)	Year[b]
Western Pacific Region										
Australia	96.1 [95.0]	2010 [2015]	–	–	–	–	–	–	1.3	2016
Brunei Darussalam	93.2 [100.0]	2012 [2016]	100.0	2013	0.2	2013	–	–	–	–
Cambodia	96.2 [75.6]	2014	62.9	2017	0.0	2017	83.9	2017	–	–
China	95.0	2012	99.5	2014	0.2	2013	68.1	2014	21.9	2017
Cook Islands	–	–	100.0	2017	0.0	2016	NA[d]	2017	0.0	2014
Fiji	98.3 [93.6]	2013	100.0	2015	0.9	2012	–	–	213.8	2017
Japan	–	–	–	–	–	–	–	–	22.2	2013
Kiribati	88.4 [70.5]	2009	85.5	2017	1.1	2017	100.0	2017	–	–
Lao People's Democratic Republic	52.5 [36.9]	2012	–	–	0.8	2009	–	–	–	–
Malaysia	96.5	2012	99.3	2017	0.0	2017	100.0	2017	0.4	2017
Marshall Islands	92.4 [77.1]	2011 [2007]	96.6	2016	0.1	2016	100.0	2016	–	
Micronesia (Federated States of)	80.0	2008	94.5	2017	0.5	2017	70.0	2017	300.0	2013
Mongolia	98.7 [89.6]	2013	97.4	2017	2.4	2017	89.3	2012	79.4	2017
Nauru	94.1 [40.2]	2007	61.8	2016	4.6	2015	61.8	2016	0.0	2014
Palau	90.3 [81.0]	2010	100.0	2014	2.2	2015	100.0	2015	–	–
Papua New Guinea	66.0 [54.9]	2012 [2006]	45.6	2017	6.8	2017	76.9	2017	–	–
Philippines	95.4 [84.3]	2013	–	–	0.9	2017	43.3	2011	–	–
Republic of Korea	100.0 [98.1]	2009 [2015]	–	–	–	–	–	–	5.2	2016
Samoa	93.0	2009	90.9	2017	0.1	2017	100.0	2017	–	–
Solomon Islands	90.6 [68.9]	2009 [2015]	100.0	2014	13.2	2015	100.0	2017	–	–
Tonga	99.0 [70.4]	2012	95.7	2016	0.0	2016	NA[d]	2016	0.0	2017
Tuvalu	93.3 [67.3]	2007	100.0	2016	10.4	2016	100.0	2016	0.0	2013
Vanuatu	75.6 [51.8]	2013	42.9	2017	7.9	2016	100.0	2016	–	–
Viet Nam	95.8 [73.7]	2014	–	–	0.3	2013	–	–	–	–

[a] ANC coverage has historically been defined as % of women with a live birth who had one or more ANC visits (ANC1). However, to align with global guidance on reproductive, maternal, neonatal, child and adolescent health (RMNCAH) indicators, more countries are moving to define ANC coverage as % of women with live births with four or more ANC visits (ANC4). Process indicators for EMTCT validation still define ANC coverage as ANC1, because only one ANC visit is necessary for syphilis or HIV screening. In this table, both ANC1 and ANC4 data are presented.

[b] Year of data collection

[c] ANC first visit data is from Global Health Observatory data (2018). http://apps.who.int/gho/data/node.imr.anc1?lang=en

[d] NA: not applicable, because no women were found to be positive for syphilis.

Annex 2. Syphilis prevalence reported for female sex workers and MSM using the most recent data reported through the Global AIDS Response Progress Reporting (GARPR) system, 2008–2017

Country	Female sex workers		MSM	
	%	Year[a]	%	Year[a]
African Region				
Algeria	16.0	2017	2.9	2017
Angola	3.0	2017	2.0	2017
Botswana	3.5	2012	2.9	2012
Burundi	28.1	2008	1.1	2013
Burkina Faso	1.4	2014	1.1	2013
Cameroon	17.5	2010	2.7	2016
Cabo Verde	0.9	2013	–	–
Central African Republic	5.0	2013	0.8	2017
Comoros	0.8	2014	–	–
Côte d'Ivoire	0.9	2015	0.5	2015
Eritrea	1.3	2008	–	–
Gabon	2.1	2010	–	–
Ghana	6.3	2011	3.8	2011
Guinea	–	–	2.6	2017
Guinea-Bissau	19.6	2010	2.0	2010
Kenya	0.9	2011	1.2	2010
Lesotho	27.2	2014	5.1	2014
Liberia	–	–	1.0	2013
Madagascar	12.1	2016	6.1	2014
Malawi	20.0	2014	9.4	2013
Mali	0.0	2010	–	–
Mauritania	2.5	2014	8.6	2014
Mauritius	6.4	2015	14.2	2015
Niger	2.3	2010	–	–
Nigeria	1.4	2008	0.0	2008
Rwanda	52.3	2015	3.4	2015
Sao Tome and Principe	4.7	2012	–	–
Senegal	9.7	2016	2.7	2014
Seychelles	0.0	2016	6.8	2013
South Sudan	14.4	2017	–	–
Uganda	20.4	2008	9.7	2008
United Republic of Tanzania	7.8	2014	–	–
Zambia	19.0	2017		
Zimbabwe	21.6	2016	–	–
Region of the Americas				
Antigua and Barbuda	–	–	10.0	2012
Argentina	14.1	2014	17.7	2014
Bahamas	0.0	2010	36.0	?
Barbados	0^	2016	13.6	2014
Belize	0.5	2012	0.0	2012
Bolivia (Plurinational State of)	4.8	2017	6.1	2017

Country	Female sex workers		MSM	
	%	Year[a]	%	Year[a]
Brazil	2.5	2010	61.5	2016
Chile	0.5	2017	0.8	2016
Colombia	18.0	2008	24.1	2016
Costa Rica	1.4	2017	14.2	2017
Dominican Republic	9.5	2012	12.9	2012
Ecuador	–	–	6.2	2011
El Salvador	3.1	2016	15.5[b]	2017
Guatemala	0.4	2017	2.2	2017
Guyana	1.6	2014	1.0	2014
Honduras	3.1	2017	6.2	2017
Jamaica	1.2	2010	15.0	2010
Mexico	1.8	2017	–	–
Nicaragua	4.5	2016	2.2	2016
Panama	1.3	2017	18.7	2017
Paraguay	8.6	2017	10.7	2017
Peru	6.1	2014	6.2	2017
Trinidad and Tobago	10.8	2011	16.1	2017
Uruguay	0.7	2013	21.0	2013
Eastern Mediterranean Region				
Afghanistan	1.3	2017	10.8	2017
Djibouti	5.0	2014	–	–
Iran (Islamic Republic of)	0.4	2016	–	–
Jordan	6.7	2008	1.8	2008
Kuwait	–	–	3.8	2016
Morocco	17.7	2011	8.9	2017
Somalia	2.7	2017	–	–
Sudan	4.1	2015	1.5	2015
Yemen	4.9	2008	–	–
European Region				
Armenia	4.0	2016	0.0	2016
Belarus	1.8	2017	4.7	2017
Belgium	0.7	2013	7.7	2010
Bosnia and Herzegovina	4.0	2011	0.6	2011
Bulgaria	7.3	2016	5.7	2016
Czech Republic	0.7	2016	2.3	2016
Estonia	4.4[c]	2015	6.8	2014
Georgia	6.7	2017	36.7	2016
Germany	0.8	2011	8.1	2012
Hungary	–	–	4.4	2010
Italy	–	–	9.1	2010
Kazakhstan	17.7	2008	4.1	2008
Kosovo	1.7	2014	4.1	2014

Annex 2 (contd). Syphilis prevalence reported for female sex workers and MSM using the most recent data reported through the Global AIDS Response Progress Reporting (GARPR) system, 2008–2017

Country	Female sex workers		MSM	
	%	Year[a]	%	Year[a]
Kyrgyzstan	10.4	2010	5.7	2010
Latvia	–	–	1.6	2008
Lithuania	5.7	2008	0.3	2014
Malta	5.0[c]	2016	3.9	2016
Netherlands	0.2	2010	2.3	2010
Republic of Moldova	20.0	2017	13.3	2016
Switzerland	–	–	7.0	2008
Tajikistan	9.6	2010	6.0	2017
The former Yugoslav Republic of Macedonia	1.1	2011	2.4	2017
Turkey	2.9	2010	–	–
Ukraine	4.4	2009	1.9	2010
United Kingdom	–	–	2.5	2010
Uzbekistan	5.4	2011	1.3	2011
South-East Asia Region				
Bangladesh	2.2	2016	1.1	2016
India	0.2	2017	0.4	2017
Indonesia	3.3	2017	7.7	2017
Maldives	0.0	2008	0.0	2008
Myanmar	10.9	2017	13.5	2017
Nepal	2.2	2017	1.9	2017
Sri Lanka	0.0	2016	0.8	2014
Thailand	0.7	2013	24.4	2013
Timor-Leste	9.8	2011	8.3[c]	2014
Western Pacific Region				
Cambodia	0.7	2016	0.9	2012
China	2.3	2014	5.1	2017
Fiji	28.0	2012	26.5	2010
Kiribati	4.5	2017	4.1	2017
Lao People's Democratic Republic	0.5	2011	0.0	2009
Malaysia	0.3	2017	6.0[b]	2017
Mongolia	24.5	2017	9.2	2017
Papua New Guinea	7.3	2017	4.3	2016
Philippines	1.9	2015	2.1	2015
Singapore	0.0	2014	12.4[b]	2017
Solomon Islands	35.2	2017	–	–
Viet Nam	1.3	2014	4.2	2014

[a] Year of data collection

[b] Represents a change of more than 50% from the most recent data reported

[c] Number tested <50

Annex 3. Reported cases of urethral discharge (UD) in men (cases per 100 000 adult males), based on the most recent data reported through the Global AIDS Monitoring (GAM) system, 2014–2017[a]

Country	2014	2015	2016	2017
African Region				
Botswana	3579.2	3600.1	3491.5	3341.9
Burkina Faso	445.4	511.0	278.9	758.1
Burundi				6133.7
Cabo Verde	291.0	296.9		
Central African Republic		76.4		3.7
Comoros				82.5
Congo	38.9			
Côte d'Ivoire		523.8	577.1	626.7
Equatorial Guinea	151.2	39.1		
Eswatini		5257.4		
Gabonb	32.1	0.6		
Gambia	816.9			
Ghana[b]	4.4			
Lesotho			2287.8	
Madagascar	1246.7		1294.2	1079.4
Malawi		5094.9		
Mali	713.6	730.9		
Mauritius			460.4	
Mozambique	2379.1	2687.8	3100.2	2867.6
Namibia	2366.0			
Niger	311.6	326.6		
Senegal	81.0	208.4	196.7	221.2
Seychelles	385.3	544.5	599.3	982.9
South Africa	113.2	1700.5	1398.7	1602.1
Tanzania (United Republic of)		457.4	1350.0	525.6
Togo	342.1	317.0	411.9	429.7
Ugandab	817.4	378.7		
Zambiab	1034.1	1319.2		1407.5
Zimbabwe	1573.7	1524.7	1503.0	1462.0
Region of the Americas				
Antigua and Barbuda	79.8	27.1	41.3	17.4
Argentina	10.0	27.3	5.9	11.6
Bahamas	11.2	21.0	4.1	
Belize			46.6	
Bolivia (Plurinational State of)	135.9	139.3		
Chile		18.1	17.9	15.4
Colombia		9.7	8.5	
Costa Rica		69.5		
Cuba	37.8	30.7	28.2	28.3
Dominica			58.7	107.4
Dominican Republic				294.9
Ecuador	74.6		79.1	33.5
El Salvador		7.6	1.4	
Guatemala	30.6	40.2	35.4	70.1
Guyana	400.4	428.4	445.4	
Honduras	45.7		46.9	41.2
Jamaica				4761.9
Nicaragua	146.5	13.8		
Panama		99.9	26.0	96.7
Paraguay		5.6	3.5	
Peru	54.0	180.2	224.5	69.0
Saint Lucia				108.4

Annex 3 (contd). Reported cases of urethral discharge (UD) in men (cases per 100 000 adult males), based on the most recent data reported through the Global AIDS Monitoring (GAM) system, 2014–2017[a]

Country	2014	2015	2016	2017
Trinidad and Tobago		113.8	160.5	185.1
Venezuela				164.1
Eastern Mediterranean Region				
Bahrain	26.4			
Djibouti	21.7 (2013)			
Iran (Islamic Republic of)	31.2	29.8	27.6	27.1
Jordan		20.3		
Morocco	614.0	614.4		
Oman	7.3	8.9	10.0	12.2
Saudi Arabia	7.9	8.7	16.4	11.5
Sudan	100.6	78.4	100.3	99.7
Tunisia	18.8	7.6	8.3	10.1
European Region				
Armenia	20.8		363.7	
Kyrgyzstan	71.0	46.1	30.9	23.7
Malta		51.4		
Tajikistan	222.7	454.8	89.9	113.9
Ukraine			2.4	2.0
South-East Asia Region				
Bhutan	278.1 (2012)			
India	210.0	26.6	54.8[b]	51.2
Indonesia	12.1	15.8	11.6	10.2
Maldives	5.0	21.2	5.6	1.1
Myanmar	5.0	12.6		17.2
Nepal			27.4	6.0
Timor-Leste	314.2[6]			
Western Pacific Region				
Cambodia			351.2	146.4[b]
Cook Islands	107.1	77.6	564.2	62.5
Fijib	336.4	397.9	398.7	
Kiribati[b]	160.7	125.0	110.7	7.1
Lao People's Democratic Republic[b]	140.3		141.9	115.6
Malaysia	9.0	10.8	10.7	26.3
Marshall Islands	128.8[b]	79.8	530.7	
Mongolia	33.4	47.8	57.5	42.3
Papua New Guinea	756.7			
Singapore	140.6			
Solomon Islands	1170.9	1177.1	1380.7	1469.4
Tonga	1051.7	678.8	1023.5	
Tuvalu	1170.9 (2013)			

[a] Year of data collection

[b] Reported rates were recalculated using denominators based on UNPD population estimates for men 15–49 years.

[6] This value has been corrected from the rate included in the 2015 Global STI report *(13)*.

Annex 4. Gonorrhoea rates among men (cases per 100 000 adult men) based on the most recent data reported through the Global AIDS Response Progress Reporting (GARPR) system, 2013–2017[a]

Country	2013	2014	2015	2016	2017
African Region					
Burkina Faso	4.5				0.4
Cabo Verde		7.2			
Central African Republic	2.0				3.0
Congo		1.8			
Equatorial Guinea	64.8	86.4			
Gabon[b]	12.7	53.5			0.5
Mauritius	28.3	20.8		13.4	14.4
Seychelles[b]	561.3	323.1		376.0	387.5
Region of the Americas					
Antigua and Barbuda	9.2	29.9		150.1	26.1
Argentina		2.5		2.0	
Bahamas	29.3	153.3		60.0	
Barbadosb	63.6	283.1		162.5	136.5
Belize				8.8	
Bolivia (Plurinational State of)		3.4			
Canada				58.8	84.0
Chile		19.6		22.0	24.2
Costa Rica	69.2	60.4		59.9	49.1
Cuba	69.6	59.2		76.6	41.6
Dominica	0.6				
Ecuador				8.2	
El Salvador	22.9			13.7	
Grenada	78.6			65.1	
Guatemala		2.7		15.9	15.1
Guyana	9.2	8.2		29.0	
Honduras	10.8	27.9		14.3	14.2
Mexico		1.9		2.1	4.7
Nicaragua	25.7	28.7		9.9	8.8
Panama	56.6	68.9		51.3	58.5
Perub		3.2		27.9	9.8
Saint Kitts and Nevis					5.6
Saint Lucia					29.1
Saint Vincent and the Grenadines		56.9			
Trinidad and Tobago				51.0	88.5
Venezuela					100.3
Eastern Mediterranean Region					
Bahrain		3.7			
Iran (Islamic Republic of)		2.5	2.2		1.1
Morocco	391.0	385.5			
Oman[b]	5.8	4.4		5.3	4.7
Saudi Arabia		2.7		3.9	2.2
United Arab Emirates		0.9			
European Region					
Albania				0.3	0.2
Armenia	38.6	24.5			27.9
Belarus	57.0	45.5			19.1
Czech Republic				26.1	
Estonia				5.5	
Georgia	30.3	30.4		43.3	43.6
Iceland				49.5	

Annex 4 (contd). Gonorrhoea rates among men (cases per 100 000 adult men) based on the most recent data reported through the Global AIDS Response Progress Reporting (GARPR) system, 2013–2017[a]

Country	2013	2014	2015	2016	2017
Ireland			61.0		
Kazakhstan	60.0				
Kosovo				3.5	4.2
Kyrgyzstan	27.7	25.9		14.8	8.7
Lithuania				9.5	
Malta				136.7	
Montenegro		2.9		1.2	1.6
Republic of Moldova	60.6	61.2		46.2	39.5
Romania				1.3	
Russian Federation		93.7			
Serbia		4.3		3.0	2.7
Tajikistan	10.7	8.0		12.1	10.3
The former Yugoslav Republic of Macedonia					1.1
Turkey	0.1				
Ukraine	30.8	25.5		21.4	18.8
South-East Asia Region					
Indonesia	6.7	7.7		9.9	5.6
Myanmar	1.9	2.4			3.3
Nepal				0.2	0.0
Sri Lanka	5.4	6.3		3.1	3.5
Thailand	25.5	20.4		23.9	28.9
Western Pacific Region					
Australia	104.7	112.8			
Brunei Darussalam	85.1				
China		14.1			
Cook Islands		91.8		169.3	297.1
Fijib	320.3	431.4			49.2
Kiribati[b]	28.6	17.1		14.3	
Malaysia		13.5		21.0	24.5
Marshall Islands		66.6[b]		52.4	
Micronesia (Federated States of)		88.6			
Mongolia	250.6	237.2		248.9	270.6
Nauru	158.9				
New Zealand					150.1
Philippines[b]	10.6	5.1		27.7	23.4
Samoa[b]	12.8				173.5
Singapore	0.5	0.5			
Solomon Islands		40.8		7.7	4.3
Tonga		273.1		161.8	
Tuvalu	27.6				
Vanuatu[b]				38.2	

[a] Year of data collection

[b] Reported rates were recalculated using denominators based on UNPD population estimates for men 15–49 years.

Annex 5. Reported percentage of gonoccocal isolates with resistance to azithromycin and ciprofloxacin/quinolones and elevated minimum inhibitory concentrations (MICs) of cefixime (>0.25 µg/mL) or ceftriaxone (>0.125 µg/mL), 2015 and 2016

	Ceftriaxone				Cefixime				Azithromycin				Quinolones/Ciprofloxacin			
	2015		2016		2015		2016		2015		2016		2015		2016	
	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%
Region of the Americas																
Argentina	728	0	709	0	728	0.1	709	0	728	5.9	709	4.5	728	66.3	709	70.8
Bolivia																
Brazil			550	0			550	0			550	6.9	1	100.0	550	55.6
Canada	4190	3.5	4538	1.8	4190	1.9	4538	0.3	4190	4.7	4538	7.2	4190	38.9	4538	47.1
Chile	1500	0	1599	0			1599	0	1110	3.3	1451	4.3	1500	60.3	1599	62.4
Colombia	98	0	128	0					98	9.2	122	20.5	98	45.9	96	59.4
Cuba	38	0	41	0							41	41.5	38	44.7	41	75.6
Dominican Republic													132	75.8		
Panama	21	0											21	4.8		
Paraguay	35	0	24	0	35	0	24	0					35	74.3	24	58.3
Peru	8	0	42	2.4	8	0			8	0	41	61.0	8	100.0	42	78.6
United States – Gonococcal Isolate Surveillance Project (GISP)	5147	0.3	5256	0.3	5147	0.5	5256	0.3	5147	2.6	5256	3.6	5147	22.3	5256	26.8
African Region																
Cote d'Ivoire	69	0	50	0	69	0	50	0	69	11.59	50	2.0	69	76.80	50	82
Madagascar			35	3.00							35	0			35	100
Malawi			413	92.3			413	0			413	12.6			413	73.6
South Africa	201	0	309	0	201	0	309	0	185	0	271	0	185	64.3	271	71.2
Eastern Mediterranean Region																
Pakistan			64	0			64	0			64	4.7			64	95.3
European Region																
Austria	61	0	192	0	61	0	192	4.2	61	3.3	192	4.7	61	65.6	192	65.6
Belarus																
Belgium	99	0	99	0	99	11.1	99	8.1	99	3.0	99	9.1	99	49.5	99	44.4
Croatia	8	0	9	0	8	0	9	11.1	8	0	9	0	8	37.5	9	66.7
Cyprus	3	0			3	0			3	0			3	66.7		
Czech Republic			90	0			90	1.1			90	10.0			90	52.2
Denmark	110	0	111	0	110	0	111	0	110	2.7	111	1.8	110	30.9	111	18.9
Estonia	18	0	2	0	18	0	2	0	18	0	1	0	18	27.8	2	0
France	105	0	99	0	105	0	99	1.0	105	5.7	99	7.1	105	41.9	99	37.4

Annex 5 (contd). Reported percentage of gonoccocal isolates with resistance to azithromycin and ciprofloxacin/quinolones and elevated minimum inhibitory concentrations (MICs) of cefixime (>0.25 µg/mL) or ceftriaxone (>0.125 µg/mL), 2015 and 2016

	Ceftriaxone				Cefixime				Azithromycin				Quinolones/Ciprofloxacin			
	2015		2016		2015		2016		2015		2016		2015		2016	
	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%
Germany	109	0	109	0	109	1.8	109	6.4	109	1.8	109	0.9	109	61.5	109	58.7
Greece	100	1.0	100	0	100	11.0	100	0	100	22.0	100	14.0	100	77.0	100	60.0
Hungary	64	0	94	0	64	1.6	94	8.5	64	4.7	94	16.0	64	53.1	94	40.4
Iceland	14	0	35	0	12	0	35	0	14	0	35	14.3	14	28.6	35	77.1
Ireland	110	0	100	0	110	0.9	100	0	110	18.2	100	15.0	110	45.5	100	42.0
Italy	100	0	100	0	100	0	100	2.0	100	2.0	100	11.0	100	71.0	100	53.0
Kyrgyzstan			72				72	1.4			72	0			72	91.7
Latvia	9	0	8	0	9	0	8	0	9	0	8	0	9	11.1	8	25.0
Luxembourg			20	0			20	10.0			20	0			20	70.0
Malta	29	0	25	0	29	0	25	0	29	13.8	25	8.0	29	65.5	25	44.0
Netherlands	200	0	255	0	200	0	255	0	200	4.0	255	2.0	200	37.0	255	29.4
Poland	56	0	77	0	56	0	77	5.2	56	5.4	77	2.6	56	57.1	77	57.1
Norway	110	0	111	0	110	0.9	111	1.8	110	3.6	111	16.2	109	58.7	111	45.9
Portugal	110	0	110	0	110	0	110	0	110	17.3	110	34.5	110	37.3	110	46.4
Slovakia	104	0	110	0	104	3.8	110	3.6	104	1.9	110	0.9	104	53.8	110	56.4
Slovenia	109	0	106	0	109	0	106	0	109	0	106	8.5	109	34.9	106	33.0
Spain	167	0	365	0	167	2.4	365	1.6	167	3.0	365	4.1	167	65.3	365	57.5
Sweden	100	0	100	0	100	0	100	0	100	14.0	100	5.0	100	45.0	100	47.0
Ukraine	33		25		33		25		33		25	4.0	33	6.1	25	4.0
United Kingdom	239	0	233	0	239	0.4	233	0.9	239	12.6	233	3.0	239	39.7	233	29.6
South-East Asia Region																
Bhutan	482	2.9	313	1.3	200	0			482	1.4	313	0.6	482	86.1	313	93.9
India	106	2.8	100	8.0	90	0	79	6.3	106	2.8	99	7.1	108	86.1	101	85.1
Indonesia	1	0	5	80.0	1	0					5	20.0	1	100.0	5	100.0
Myanmar	0	0	3	100.0			3	66.7			3	66.7	-	-	3	100.0
Sri Lanka	99	0	67	0			67	0	99	0	67	1.4	99	98.9	67	97.0
Thailand	848	0	697	0	848	0	608	0	664	0.6	609	0.6	593	92.2	709	88.9
Western Pacific Region																
Australia – urban	5142	0.1	6081	1.8					5142	2.7	6081	5.2	5142	28.5	6081	31.3
Australia – remote	269	0	297	0					269	0	297	0.3	269	3.3	297	3.7

	Ceftriaxone				Cefixime				Azithromycin				Quinolones/Ciprofloxacin			
	2015		2016		2015		2016		2015		2016		2015		2016	
	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%	No. of isolates	%
Brunei Darussalam											55	3.6			90	87.8
Cambodia			2	0							2	50.0			2	100.0
China	1029	12.1							1029	19.2			1029	97.6		
China, Hong Kong SAR	1122	4.9	1179	0.8					1122	9.3	1179	7.5	1122	96.5	1179	94.4
Japan	327	25.1	393	20.9					327	15.9	393	12.5	327	73.4	393	74.6
Mongolia			46	23.9					286	6.3	370	1.9	306	34.0	316	82.0
New Caledonia			93	0									133	7.5	93	15.1
New Zealand	563	0.9	361	0.3					282	1.1	80	6.3	563	60.0	361	23.8
Philippines	94	0	109	1.8					113	0	177	0	112	93.8	179	81.6
Republic of Korea	51	27.5	61	8.2					51	0	61	0	51	98.0	61	98.4
Singapore	43	0	46	6.5					160	1.9	160	0.6	160	86.3	160	81.9
Viet Nam	84	11.9							84	-	114	-	84	94.0	114	93.0

Source: WHO/GASP, 2017

References

1. Rowley J, Vander Hoorn S, Korenromp E, Low N, Unemo M, Abu-Raddad LJ, et al. Global and regional estimates of the prevalence and incidence of four curable sexually transmitted infections in 2016. Bull World Health Organ (in press).

2. Implementation of the global strategy for prevention and control of sexually transmitted infections: 2006–2015. Progress report. Geneva: World Health Organization; 2015 (http://apps.who.int/iris/bitstream/10665/183117/1/9789241508841_eng.pdf, accessed 14 November 2018).

3. Korenromp EL, Rowley J, Alonso M, Brito de Mello M, Wijesooriya NS, Mahiané SG, et al. Global burden of maternal and congenital syphilis and associated adverse birth outcomes – estimates for 2016 and progress since 2012. PLoS ONE (in press).

4. Disease burden and mortality estimates. Global summary estimates, 2016. In: World Health Organization (http://www.who.int/healthinfo/global_burden_disease/estimates/en/) accessed 30 November 2018).

5. Global health sector strategy on sexually transmitted infections, 2016–2021. Geneva: World Health Organization; 2016 (https://www.who.int/reproductivehealth/publications/rtis/ghss-stis/en/, accessed 14 November 2018).

6. Global AIDS Monitoring 2018: indicators for monitoring the 2016 United Nations Political declaration on Ending AIDS. Geneva: UNAIDS; 2017 (http://www.unaids.org/sites/default/files/media_asset/2017-Global-AIDS-Monitoring_en.pdf, accessed on 14 November 2018).

7. The Gonococcal Antimicrobial Surveillance Programme (GASP) data. In: World Health Organization [website]. 2017 (https://www.who.int/reproductivehealth/topics/rtis/gonococcal_resistance/en/, accessed 14 November 2018).

8. UNAIDS/WHO Working Group on Global HIV/AIDS and STI Surveillance. Strategies and laboratory methods for strengthening surveillance of sexually transmitted infection 2012. Geneva: World Health Organization; 2012 (http://apps.who.int/iris/bitstream/10665/75729/1/9789241504478_eng.pdf, accessed 14 November 2018).

9. Congenital syphilis estimation tool. In: World Health Organization: Sexual and reproductive health [website] (https://www.who.int/reproductivehealth/congenital-syphilis/surveillance/en/, accessed on 14 November 2018).

10. Avenir Health Spectrum STI module: overview manual (https://spectrummodel.zendesk.com/hc/en-us/articles/115001964191-Spectrum-STI-Module-Overview-Manual, accessed 29 November 2018).

11. Baseline report on global sexually transmitted infection surveillance 2012. Geneva: World Health Organization; 2013 (http://apps.who.int/iris/bitstream/10665/85376/1/9789241505895_eng.pdf, accessed 14 November 2018).

12. Report on global sexually transmitted infection surveillance 2013. Geneva: World Health Organization; 2014 (http://apps.who.int/iris/bitstream/10665/112922/1/9789241507400_eng.pdf, accessed 14 November 2018).

13. Report on global sexually transmitted infection surveillance 2015. Geneva: World Health Organization; 2015 (http://www.who.int/reproductivehealth/publications/rtis/stis-surveillance-2015/en/, accessed 14 November 2018).

14. Consolidated strategic information guidelines for HIV in the health sector. Geneva: World Health Organization; 2015 (http://apps.who.int/iris/bitstream/10665/164716/1/9789241508759_eng.pdf, accessed 14 November 2018).

15. 2017 Revision of World Population Prospects. In: United Nations Department of Economic and Social Affairs, Population Division (UNPD) [online database]. 2017 (http://esa.un.org/unpd/wpp/, accessed 14 November 2018).

16. WHO validation for the elimination of mother-to-child transmission of HIV and/or syphilis. In: World Health Organization [website]. 2018 (http://www.who.int/reproductivehealth/congenital-syphilis/WHO-validation-EMTCT/en/, accessed 14 November 2018).

17. The global elimination of congenital syphilis: rationale and strategy for action. Geneva: World Health Organization; 2007 (http://www.who.int/reproductivehealth/publications/rtis/9789241595858/en/index.html, accessed 14 November 2018).

18. Global guidance on criteria and processes for validation: elimination of mother-to-child transmission (EMTCT) of HIV and syphilis, second edition. Geneva: World Health Organization; 2017 (http://www.who.int/reproductivehealth/publications/emtct-hiv-syphilis/en/, accessed 14 November 2018).

19. Taylor M, Gliddon H, Nurse-Findlay S, Laverty M, Broutet N, Pyne-Mercier N. Revisiting strategies to eliminate mother-to-child transmission of syphilis. Lancet. 2018;6(1):PE26–E28.

20. Nurse-Findlay S, Taylor MM, Savage M, Mello MB, Saliyou S, Lavayen M, et al. Supply, demand, and shortages of benzathine penicillin for treatment of syphilis: a market assessment. PLoS Med. 2017;14(12):e1002473.

21. Gliddon H, Peeling R, Kamb ML, Toskin I, Taylor MM. A systematic review and meta-analysis of studies evaluating the performance and operational characteristics of dual point-of-care tests for HIV and syphilis. Sex Transm Infect. 2017;93(S4):S3–S15.

22. Investment case for elimination of mother-to-child transmission of syphilis. Geneva: WHO; 2012 (https://www.who.int/reproductivehealth/publications/rtis/9789241504348/en/, accessed 15 December 2018).

23. Ham DC, Lin C, Newman L, Wijesooriya NS, Kamb M. Improving global estimates of syphilis in pregnancy by diagnostic test type: a systematic review and meta-analysis. Int J Obstet Gynecol. 2015;130:S10–S14.

24. Percentage of antenatal care attendees test for syphilis at first visit. In: Global Health Observatory [online database]. World Health Organization; 2018 (http://gamapserver.who.int/mapLibrary/Files/Maps/gho_sti_anc_syphilis_test.png , accessed on 14 November 2018).

25. Percentage of antenatal care attendees positive for syphilis. In: Global Health Observatory [online database]. World Health Organization; 2018 (http://gamapserver.who.int/mapLibrary/Files/Maps/gho_sti_anc_syphilis_positive.png, accessed on 14 November 2018).

26. Percentage of antenatal care attendees positive for syphilis who received treatment. In: Global Health Observatory [online database]. World Health Organization; 2018 (http://gamapserver.who.int/mapLibrary/Files/Maps/gho_sti_anc_syphilis_treatment.png, accessed on 14 November 2018).

27. Methods for surveillance and monitoring of congenital syphilis elimination within existing systems. Geneva: World Health Organization; 2011 (http://apps.who.int/iris/bitstream/10665/44790/1/9789241503020_eng.pdf, accessed 14 November 2018).

28. Enkhbat E, Korenromp EL, Badrakh J, Zayasaikhan S, Baya P, Orgiokhuu E, et al. Adult female syphilis prevalence, congenital syphilis case incidence and adverse birth outcomes, Mongolia 2000–2016: estimates using the Spectrum STI tool. Infectious Disease Modelling. 2018;3:13–22.

29. A tool for strengthening STI surveillance at the country level. Geneva: WHO; 2015 (http://apps.who.int/iris/bitstream/handle/10665/161074/WHO_RHR_15.06_eng.pdf?sequence=1, accessed 29 November 2018).

30. Consolidated guidelines on HIV prevention, diagnosis, treatment and care for key populations – 2016 update. Geneva: World Health Organization; 2016 (https://www.who.int/hiv/pub/guidelines/keypopulations-2016/en/, accessed 14 November 2018).

31. Prevention and treatment of HIV and other sexually transmitted infections among men who have sex with men and transgender people: recommendations for a public health approach. Geneva: World Health Organization; 2011 (http://apps.who.int/iris/bitstream/10665/44619/1/9789241501750_eng.pdf, accessed 21 December 2015).

32. Prevention and treatment of HIV and other STIs for sex workers in low- and middle-income countries: recommendations for a public health approach. Geneva: WHO; 2012 (http://apps.who.int/iris/bitstream/handle/10665/77745/9789241504744_eng.pdf;jsessionid=049789AAB68E9E95B41B24FC56142E7C?sequence=1, accessed 2 Decemebr 2018).

33. WHO, UNFPA, UNAIDS, NSWP, the World Bank. Implementing comprehensive HIV/STI programmes with sex workers: practical approaches from collaborative interventions. Geneva: World Health Organization; 2013 (http://apps.who.int/iris/bitstream/10665/90000/1/9789241506182_eng.pdf, accessed 29 November 2018).

34. Consolidated guidelines on HIV prevention, diagnosis, treatment and care for key populations. Geneva: World Health Organization; 2014 (http://apps.who.int/iris/bitstream/10665/128048/1/9789241507431_eng.pdf, accessed 29 November 2018).

35. Steen R, Zhao P, Wi TE, Punchihewa N, Abeyewickreme I, Lo YR. Halting and reversing HIV epidemics in Asia by interrupting transmission in sex work: experience and outcomes from ten countries. Expert Rev Anti Infect Ther. 2013;11(10):999–1015.

36. Global strategy for the prevention and control of sexually transmitted infections: 2006–2015: breaking the chain of transmission. Geneva: World Health Organization, 2007 (http://www.who.int/hiv/pub/toolkits/stis_strategy%5B1%5Den.pdf, accessed 14 November 2018).

37. Percentage of sex workers with active syphilis. In: Global Health Observatory [online database]. World Health Organization; 2018 (http://gamapserver.who.int/mapLibrary/Files/Maps/gho_sti_sexworkers_syphilis.png, accessed 14 November 2018).

38. Percentage of men who have sex with men with active syphilis. In: Global Health Observatory [online database]. World Health Organization; 2018 (http://gamapserver.who.int/mapLibrary/Files/Maps/gho_sti_msm_syphilis.png, accessed 14 November 2018). http://gamapserver.who.int/mapLibrary/Files/Maps/gho_sti_msm_syphilis.png, accessed 14 November 2018).

39. Standard protocol to assess prevalence of gonorrhoea and chlamydia among pregnant women in antenatal care clinics. Geneva: World Health Organization; 2018 (http://www.who.int/reproductivehealth/publications/rtis/gonorrhoea-chlamydia-among-pregnant-women/en/, accessed 14 November 2018).

40. Newman L, Rowley J, Vander Hoorn S, Wijesooriya NS, Unemo M, Low N, et al. Global estimates of the prevalence and incidence of four curable sexually transmitted infections in 2012 based on systematic review and global reporting. PLoS ONE. 2015;10(12):e0143304.

41. Korenromp-EL, Rios-CY et al. Adult syphilis, chlamydia and gonorrhea prevalence and incidence, and congenital syphilis incidence in Colombia, 1995–2016 – estimates using the Spectrum-STI model. Pan-American Journal of Public Health (in press).

42. Korenromp EL, Mahiane SG, Nagelkerke N, Taylor MM, Williams R, Chico RM, et al. Syphilis prevalence trends in adult women in 132 countries – estimations using the Spectrum Sexually Transmitted Infections model. Scientific Reports. 2018;8:11503.

43. Korenromp EL, Mahiane G, Rowley J, Nagelkerke N, Abu-Raddad L, Ndowa F, et al. Estimating prevalence trends in adult gonorrhea and syphilis in low- and middle-income countries with the Spectrum-STI model: results for Zimbabwe and Morocco from 1995–2016. Sex Transm Infect. 2017;93:599–606.

44. Badrakh-J, Zayasaikhan S, Jagdagsuren D, Enkhbat E, Jadambaa N, Munkhbaatar N, et al. Trends in adult chlamydia and gonorrhoea prevalence, incidence and urethral discharge case reporting in Mongolia from 1995 to 2016: estimates using the Spectrum-STI model. Western Pac Surveill Response J. 2017;8(4):20–9.

45. Rowley J, Korenromp EK. A pilot application of the Spectrum-STI model in a low-prevalence setting: estimation of STI prevalence and incidence trends in Georgia. Technical report, based on a workshop in Tbilisi, Georgia, 23–24 August 2017 (https://spectrummodel.zendesk.com/hc/en-us/articles/115003492452-Georgia-Spectrum-STI-estimation-2017-final-report).

46. Ndowa FJ, Ison CA, Cole MJ, Lusti-Narasimhan M. Gonococcal antimicrobial resistance: challenges for public health control. Sex Transm Infect. 2013;89(4):iv3–4.

47. Unemo M, Golparian D, Shafer WM. Challenges with gonorrhea in the era of multi-drug and extensively drug resistance – are we on the right track? Expert Rev Anti Infect Ther. 2014;12(6):653–6.

48. Taylor SN, Marazzo J, Batteiger BE, Hook EW III, Sena AC, Long J, et al. Single-dose zoliflodacin (ETX0914) for treatment of urogenital gonorrhea. N Engl J Med. 2018;379:1835–45.

49. Goire N, Lahra MM, Chen M, Donovan B, Fairley CK, Guy R, et al. Molecular approaches to enhance surveillance of gonococcal antimicrobial resistance. Nat Rev Microbiol. 2014;12:223–9.

50. Kularatne RS, Niit R, Rowley J, Kufa-Chakezha T, Peters RPH, Taylor MM, et al. Adult gonorrhea, chlamydia and syphilis prevalence, incidence, treatment and syndromic case reporting in South Africa: estimates using the Spectrum-STI model, 1990–2017. PLoS ONE. 2018;13(10):e0205863.

51. Global Health Estimates 2016: deaths by cause, age, sex, by country and by region, 2000–2016. Geneva: World Health Organization; 2018 (http://www.who.int/healthinfo/global_burden_disease/estimates/en, accessed 14 November 2018).

52. de Martel C, Plummer M, Vignat J, Franceschi S. Worldwide burden of cancer attributable to HPV by site, country and HPV type. Int J Cancer. 2017;141(4):664–70.

53. Ng SS, Hutubessy R, Chaiyakunapruk N. Systematic review of cost-effectiveness studies of human papillomavirus (HPV) vaccination: 9-Valent vaccine, gender neutral and multiple age cohort vaccination. Vaccine. 2018;36(19):2529–44.

54. Kuruvilla S, Sadana R, Montesinos EV, Beard J, Vasdeki JF, de Carvalho IE, et al. A life-course approach to health: synergy with sustainable development goals. Bull World Health Organ. 2018;98(1):42–50.

55. Immunization, Vaccines and Biologicals: monitoring and surveillance. In: World Health Organization [online database]. October 2018 (http://www.who.int/immunization/monitoring_surveillance/en/, accessed 14 November 2018).

56. Brotherton JML, Bloem PN. Population-based HPV vaccination programmes are safe and effective: 2017 update and the impetus for achieving better global coverage. Best Pract Res Clin Obstet Gynaecol. 2018;37:42–58.

57. Goodman T. Update on HPV vaccine introduction and programmatic perspectives (PowerPoint presentation). World Health Organization, SAGE Meeting, Geneva, Switzerland. 24 October 2018 (http://www.who.int/immunization/sage/meetings/2018/october/SAGE_october_2018_HPV_Goodman.pdf, accessed 14 November 2018).

Notes

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