Chlamydia, gonorrhoea, trichomoniasis and syphilis: global prevalence and incidence estimates, 2016

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Objective To generate estimates of the global prevalence and incidence of urogenital infection with chlamydia, gonorrhoea, trichomoniasis and syphilis in women and men, aged 15–49 years, in 2016.

Methods For chlamydia, gonorrhoea and trichomoniasis, we systematically searched for studies conducted between 2009 and 2016 reporting prevalence. We also consulted regional experts. To generate estimates, we used Bayesian meta-analysis. For syphilis, we aggregated the national estimates generated by using Spectrum-STI.

Findings For chlamydia, gonorrhoea and/or trichomoniasis, 130 studies were eligible. For syphilis, the Spectrum-STI database contained 978 data points for the same period. The 2016 global prevalence estimates in women were: chlamydia 3.8% (95% uncertainty interval, UI: 3.3–4.5); gonorrhoea 0.9% (95% UI: 0.7–1.1); trichomoniasis 5.3% (95% UI: 4.0–7.2); and syphilis 0.5% (95% UI: 0.4–0.6). In men prevalence estimates were: chlamydia 2.7% (95% UI: 1.9–3.7); gonorrhoea 0.7% (95% UI: 0.5–1.1); trichomoniasis 0.6% (95% UI: 0.4–0.9); and syphilis 0.5% (95% UI: 0.4–0.6). Total estimated incident cases were 376.4 million: 127.2 million (95% UI: 95.1–165.9 million) chlamydia cases; 86.9 million (95% UI: 58.6–123.4 million) gonorrhoea cases; 156.0 million (95% UI: 103.4–231.2 million) trichomoniasis cases; and 6.3 million (95% UI: 5.5–7.1 million) syphilis cases.

Conclusion Global estimates of prevalence and incidence of these four curable sexually transmitted infections remain high. The study highlights the need to expand data collection efforts at country level and provides an initial baseline for monitoring progress of the World Health Organization global health sector strategy on sexually transmitted infections 2016–2021.

Introduction

Sexually transmitted infections are among the most common communicable conditions and affect the health and lives of people worldwide. The World Health Organization (WHO) periodically generates estimates to gauge the global burden of four of the most common curable sexually transmitted infections: chlamydia (etiological agent: *Chlamydia trachomatis*), gonorrhoea (*Neisseria gonorrhoeae*), trichomoniasis (*Trichomonas vaginalis*) and syphilis (*Treponema pallidum*). The estimates provide evidence for programme improvement, monitoring and evaluation.

These sexually transmitted infections cause acute urogenital conditions such as cervicitis, urethritis, vaginitis and genital ulceration, and some of the etiological agents also infect the rectum and pharynx. Chlamydia and gonorrhoea can cause serious short- and long-term complications, including pelvic inflammatory disease, ectopic pregnancy, infertility, chronic pelvic pain and arthritis, and they can be transmitted during pregnancy or delivery. Syphilis can cause neurological, cardiovascular and dermatological disease in adults, and stillbirth, neonatal death, premature delivery or severe disability in infants. All four infections are implicated in increasing the risk of human immunodeficiency virus (HIV) acquisition and transmission. Moreover, people with sexually transmitted infections often experience stigma, stereotyping, vulnerability, shame and gender-based violence.

In May 2016, the World Health Assembly adopted the Global Health Sector Strategy on Sexually Transmitted Infections, 2016–2021. This strategy includes rapid scale-up of evidence-based interventions and services to end sexually transmitted infections as public health concerns by 2030. The strategy sets targets for reductions in gonorrhoea and syphilis incidence in adults and recommends the establishment of global baseline incidences of sexually transmitted infections by 2018. The primary objectives of this study were to estimate the 2016 global and regional prevalence and incidence of chlamydia, gonorrhoea, trichomoniasis and syphilis in adult women and men.

Methods

Prevalence estimation

*Chlamydia, gonorrhoea and trichomoniasis*

We generated estimates for these three infections through systematic reviews using the same methods as for the 2012 estimates.
We searched for articles published between 1 January 2009 and 29 July 2018 in PubMed without language restrictions. We used PubMed Medical subject heading (MeSH) terms for individual country names combined with: “chlamydia”[MeSH Terms] OR “chlamydia”[All Fields], “gonorrhoea”[All Fields] OR “gonorrhoea”[MeSH Terms] OR “gonorrhoea”[All Fields], “trichomonas infections”[MeSH Terms] OR (“trichomonas”[All Fields] AND “infections”[All Fields]) OR “trichomonas infections”[All Fields] OR “trichomoniasis”[All Fields]). We also asked WHO regional sexually transmitted infection advisors and other leading experts in the field for additional published and unpublished data.

To be eligible, studies had to collect most specimens between 2009 and 2016 or be published in 2010 or later if specimen collection dates were not available. Other study inclusion criteria were: sample size of at least 100 individuals; general population (e.g. pregnant women, women at delivery, women attending family planning clinics, men and women selected for participation in demographic and health surveys); and use of an internationally recognized diagnostic test with demonstrated precision using urine, urethral, cervical or vaginal specimens.

To reduce bias in the estimation of general population prevalence, we excluded studies conducted among the following groups: patients seeking care for sexually transmitted infection or urogenital symptoms, women presenting at gynaecology or sexual health clinics with sexually transmitted infection related issues, studies restricted to women with abnormal Papanicolaou test results, remote or indigenous populations, recent immigrant or migrant populations, men who have sex with men and commercial sex workers.

Two investigators independently reviewed all identified studies to verify eligibility. When more than one publication reported on the same population, we retained the publication with the most detailed information. For each included study, we calculated prevalence as the number of individuals with a positive test result divided by the total number tested. We then standardized these values by applying adjustment factors for the accuracy of the laboratory diagnostic test, study location (rural versus urban) and the age of the study population. If the adjustments resulted in a negative value, we replaced the value with 0.1% when doing the meta-analysis. The methods and adjustment factors were identical to those used to generate the 2012 estimates.

We obtained estimates for 10 geographical areas (referred to as estimation regions). Estimates for high-income North America (Canada and United States of America), were based on the latest published United States estimates that used data from multiple sources.10,11 For the other nine estimation regions, we calculated a summary prevalence estimate by meta-analysis if there were three or more data points.12 There were sufficient data to generate an estimate for chlamydia in women in all regions, but not for gonorrhoea or trichomoniasis. For regions with insufficient data for gonorrhoea and trichomoniasis, we assumed that prevalence was a multiple of the prevalence of chlamydia. The infection specific multiples were based on those studies that met the 2016 inclusion criteria (available from the data repository).13 For men, when there were insufficient data for meta-analysis, the prevalence of an infection was assumed to be proportional to the prevalence in women. The male-to-female ratios were infection-specific and were set at the same values as in 2012 estimates.6

To reflect the contribution of populations at higher risk of infection (e.g. men who have sex with men and commercial sex workers), who are likely to be under-represented in general population samples, we increased prevalence estimates by 10%, as in the 2012 estimates,6 for each estimation region, apart from high-income North America.

We performed the meta-analyses using a Bayesian approach with a Markov Chain Monte Carlo algorithm implemented with the software BRugs in R package (R foundation, Vienna, Austria).14 For each infection, the software generated 10 000 samples from the posterior distribution for the expected mean prevalence in each estimation region based on the β-binomial model, and used these to calculate the 2.5 and 97.5 uncertainty percentiles.15 We calculated global and regional prevalence estimates for each infection by weighting each of the 10 000 samples from estimation regions according to population size, using United Nations population data for women and men aged 15–49 years.16 We present results by WHO region, 2016 World Bank income classification17 and 2017 sustainable development goal (SDG) region.18 All analyses were carried out using R statistical software (R foundation).

Syphilis

We based syphilis estimates on the WHO’s published 2016 maternal prevalence estimates.19 These estimates were generated by using Spectrum-STI, a statistical trend-fitting model in the publicly available Spectrum suite of health policy planning tools20 and country specific data from the global Spectrum-STI syphilis database (available from the corresponding author). As in the 2012 estimation,6 we assumed that the prevalence of syphilis in all women 15–49 years of age in each country was the same as in pregnant women. We then increased the estimate by 10% to reflect the contribution of populations at higher risk. The men to women prevalence ratio of syphilis was set at 1.0 and assumed to have a uniform distribution ± 33% around this value, in agreement with data from a recent global meta-analysis of syphilis.21

We generated regional and global estimates by weighting the contribution of each country by the number of women and men aged 15–49 years. Regional and global 95% uncertainty intervals (UIs) were generated using the delta method;22 uncertainties were assumed to be independent across countries.

Incidence estimation

We calculated incidence estimates for each infection by dividing prevalence by the average duration of infection for all estimation regions except high-income North America where published estimates were used.16,17 Estimates of the average duration of infection were those used in the 2012 estimation6 and assumed to have a uniform distribution of ± 33.3% around the average duration. We calculated uncertainty in incidence for a given region, sex and infection at the national level using the delta method;22 uncertainty in the prevalence estimate was multiplied by uncertainty in the estimated duration of infection. Regional and global uncertainty intervals were generated assuming uncertainties were independent across countries.
Results

Data availability

Chlamydia, gonorrhoea and trichomoniasis

Of the 7244 articles screened, 112 studies met the inclusion criteria for one or more of the three infections (Fig. 1). We identified an additional 18 studies through expert consultations and reviewing reference lists (Nguyen M et al., Hanoi Medical University, Viet Nam, personal communication, 23 March 2018; El Kettani A et al., National Institute of Hygiene, Morocco, personal communication, 2 May 2016; Galdavadze K et al., Disease Control and Public Health, Republic of Georgia; personal communication, 22 August 2017). 12 Of these 130 studies, 111 reported data for women only (Table 1; available at: http://www.who.int/bulletin/volumes/96/8/18-228486), three reported data for men only (Table 2; available at: http://www.who.int/bulletin/volumes/96/8/18-228486) and 16 reported data for both women and men (Table 1 and Table 2). Only 34 studies in women and four studies in men provided information on all three infections. The included studies contained 100 data points in women for chlamydia, 64 for gonorrhoea and 69 for trichomoniasis. In men, there were 16 data points for chlamydia, 11 for gonorrhoea and seven for trichomoniasis (Table 3).

For women, a total of 43 (21.0%) of 205 countries, territories and areas had one or more data points for chlamydia, 32 (15.6%) for gonorrhoea and 29 (14.1%) for trichomoniasis. For men, only 15 (7.3%) countries, territories and areas had one or more data points for chlamydia, 10 (4.9%) for gonorrhoea and 7 (3.4%) for trichomoniasis. For women there were sufficient data to generate summary estimates for chlamydia for the nine estimation regions, but not for gonorrhoea or trichomoniasis (Table 4).

Syphilis

As of 2 May 2018, the Spectrum-STI Database contained 1576 data points from surveys conducted since 1990, including 978 from January 2009 to December 2016. 13 In total, 181 (88.3%) of 205 countries, territories and areas had sufficient data to generate a Spectrum STI estimate for 2016. For the remaining 24 countries, territories and areas, we used the median value of the countries with data for the relevant WHO region as the 2016 estimate.

Prevalence and incidence estimates

Table 5 shows prevalence estimates for the WHO regions for 2016. Based on prevalence data from 2009 to 2016, the estimated pooled global prevalence of chlamydia in 15–49-year-old women was 3.8% (95% UI: 3.3–4.5) and in men 2.7% (95% UI: 1.9–3.7), with regional values ranging from 1.5 to 7.0% in women and 1.2 to 4.0% in men. For gonorrhoea, the global estimate was 0.9% (95% UI: 0.7–1.1) in women and 0.7% (95% UI: 0.5–1.1) in men, with regional values in women ranging from 0.3 to 1.9% and from 0.3 to 1.6% in men. The estimates for trichomoniasis were 5.3% (95% UI: 4.0–7.2) in women and 0.6% (95% UI: 0.4–0.9) in men, with regional values ranging from 1.6 to 11.7% in women and from 0.2 to 1.3% in men. For syphilis, the global estimate in both men and women was 0.5% (95% UI: 0.4–0.6) with regional values ranging from 0.1 to 1.6%. The WHO African Region had the highest prevalence for chlamydia in men, gonorrhoea in women and men, trichomoniasis in women and syphilis in men and women. The WHO Region of the Americas had the highest prevalence of chlamydia in women and of trichomoniasis in men.

These prevalence estimates correspond to the totals of 124.3 million cases of chlamydia, 30.6 million cases of gonorrhoea, 110.4 million cases of trichomoniasis and 19.9 million cases of syphilis (available from the data repository). 13 Using the World Bank classification, high-income countries, territories and areas had the lowest estimated prevalence, and low-income countries, territories and areas had the highest prevalence of gonorrhoea, trichomoniasis and syphilis. For chlamydia, estimated prevalence was highest in upper-middle income countries, territories and areas (Fig. 2). The SDG grouping showed the highest prevalence of all four sexually transmitted infections in Oceania region, that is, Pacific island nations excluding Australia and New Zealand (available from the data repository). 13 We estimated the global incidence rate for chlamydia in 2016 to be 34 cases per 1000 women (95% UI: 25–45) and 33 per 1000 men (95% UI: 21–48); for gonorrhoea 20 per 1000 women (95%
### Table 3. Number of data points that met the study inclusion criteria for the WHO 2016 prevalence estimates of chlamydia, gonorrhoea and trichomoniasis

| Estimation region                                      | No. of countries, territories and areas | Women | No. of data points | No. of countries | Men | No. of data points | No. of countries | Trichomoniasis |
|-------------------------------------------------------|----------------------------------------|-------|--------------------|------------------|-----|--------------------|------------------|----------------|
|                                                       |                                        |       |                    |                  |     |                    |                  |                |
| Central, eastern and western sub-Saharan Africa       | 41                                     | 16    | 7                  | 2                | 2   | 15                 | 7                | 2              | 2             | 21 | 9 | 1 | 1 |
| Southern sub-Saharan Africa                           | 6                                      | 7     | 4                  | 1                | 1   | 6                  | 3                | 1              | 1             | 6  | 3 | 1 | 1 |
| Andean, central, southern and tropical Latin America and Caribbean | 42                                     | 25    | 8                  | 2                | 2   | 14                 | 6                | 2              | 2             | 16 | 5 | 1 | 1 |
| High-income North America                             | 2                                      | NA    | NA                | NA               | NA  | NA                 | NA               | NA             | NA            | NA | NA | NA | NA |
| North Africa and Middle East                          | 20                                     | 11    | 4                  | 1                | 1   | 5                  | 2                | 0              | 0             | 5  | 2 | 1 | 1 |
| Australasia and high-income Asia Pacific              | 6                                      | 6     | 2                  | 2                | 1   | 4                  | 1                | 2              | 1             | 3  | 1 | 1 | 1 |
| Western, central and eastern Europe and central Asia  | 54                                     | 19    | 11                 | 6                | 6   | 9                  | 7                | 2              | 2             | 4  | 3 | 2 | 2 |
| Oceania                                               | 14                                     | 7     | 3                  | 1                | 1   | 7                  | 3                | 1              | 1             | 5  | 1 | 0 | 0 |
| South Asia                                            | 5                                      | 4     | 2                  | 0                | 0   | 2                  | 1                | 0              | 0             | 3  | 1 | 0 | 0 |
| East Asia and south-east Asia                         | 15                                     | 5     | 2                  | 1                | 1   | 2                  | 2                | 1              | 1             | 6  | 4 | 0 | 0 |
| Total                                                 | 205                                    | 100   | 43                 | 16               | 15  | 64                 | 32               | 11             | 10            | 69 | 29 | 7 | 7 |

NA: not applicable; WHO: World Health Organization.

Note: Eight of the 112 studies with data for women had two separate data points (e.g. for different population groups).
Table 4. Approach used to generate 2016 regional estimates for chlamydia, gonorrhoea and trichomoniasis

| Estimation region                      | Women                                      | Men                                      |
|----------------------------------------|--------------------------------------------|------------------------------------------|
|                                        | Chlamydia | Gonorrhoea | Trichomonias | Chlamydia | Gonorrhoea | Trichomonias |
| Central, eastern and western sub-Saharan Africa | Meta-analysis | Meta-analysis | Meta-analysis | Global male-to-female ratio | Global male-to-female ratio | Global male-to-female ratio |
| Southern sub-Saharan Africa            | Meta-analysis | Meta-analysis | Meta-analysis | Global male-to-female ratio | Global male-to-female ratio | Global male-to-female ratio |
| Andean, central, southern and tropical Latin America and Caribbean | Meta-analysis | Meta-analysis | Meta-analysis | Special case<sup>a</sup> | Global male-to-female ratio | Global male-to-female ratio |
| High-income North America<sup>b</sup> | United States estimate for 2012 | United States estimate for 2008 | United States estimate for 2008 | United States estimate for 2012 | United States estimate for 2008 | United States estimate for 2008 |
| North Africa and Middle East           | Meta-analysis | Meta-analysis | Meta-analysis | Global male-to-female ratio | Global male-to-female ratio | Global male-to-female ratio |
| Australasia and high-income Asia-Pacific | Meta-analysis | Gonorrhoea to chlamydia ratio | Trichomoniasis to chlamydia ratio | Global male-to-female ratio | Global male-to-female ratio | Global male-to-female ratio |
| Western, central and eastern Europe and central Asia | Meta-analysis | Meta-analysis | Trichomoniasis to chlamydia ratio | Meta-Analysis | Global male-to-female ratio | Global male-to-female ratio |
| Oceania                                | Meta-analysis | Meta-analysis | Meta-Analysis | Global male-to-female ratio | Global male-to-female ratio | Global male-to-female ratio |
| South Asia                             | Meta-analysis | Gonorrhoea to chlamydia ratio | Trichomoniasis to chlamydia ratio<sup>c</sup> | Global male-to-female ratio | Global male-to-female ratio | Global male-to-female ratio |
| East Asia and south-east Asia          | Meta-analysis | Gonorrhoea to chlamydia ratio<sup>d</sup> | Meta-Analysis | Global male-to-female ratio | Global male-to-female ratio | Global male-to-female ratio |

<sup>a</sup> In consultation with advisors on sexual transmitted infections for the World Health Organization (WHO) Region of the Americas, we decided to use the midpoint between the 2016 estimate generated by applying the global male-to-female ratio (7.5%) and the 2012 estimate for the region (2.1%). We deemed the former to be too high and the latter too low.

<sup>b</sup> Following discussions with the United States Centers for Disease Control and Prevention, we based our estimates on the latest published United States national estimates<sup>21,22</sup> and assumed they remained constant over time and that estimates for 15–39-year-old people could be extrapolated to the 15–49-year age range. We did not apply the adjustments used for other Regions in the WHO estimates process. The figures for the United States were also applied to Canada.

<sup>c</sup> The estimate based on the three available data points was over 4%, considerably higher than the 2012 estimate. Following discussions with regional experts we decided not to use this estimate, but instead to use the trichomoniasis to chlamydia ratio for low and lower-middle-income countries, territories and areas.

<sup>d</sup> This estimation region is made up of countries from East Asia and South East Asia. We used the higher and upper-middle income gonorrhoea to chlamydia ratio for East Asia and the low and lower-middle income ratio for South East Asia.<sup>19</sup>

UI: 14–28) and 26 per 1000 men (95% UI: 15–41); for trichomoniasis 40 per 1000 women (95% UI: 27–58) and 42 per 1000 men (95% UI: 23–69); and for syphilis 1.7 per 1000 women (95% UI: 1.4–2.0) and 1.6 per 1000 men (95% UI: 1.3–1.9; <sup>Fig. 3</sup>). The WHO Region of the Americas had the highest incidence rate for chlamydia and syphilis in both women and men, while the WHO African Region had the highest incidence rates for gonorrhoea and trichomoniasis in women and men. Incidence rates by income category and SDG regions are available from the data repository.<sup>11</sup>

These incidence rates translate globally into 127.2 million (95% UI: 95.1–165.9) new chlamydia cases, 86.9 million (95% UI: 58.6–123.4 million) gonorrhoea cases, 156.0 million (95% UI: 103.4–231.2 million) trichomoniasis cases and 6.3 million (95% UI: 5.5–7.1 million) syphilis cases in women and men aged 15–49 years in 2016. Together, the four infections accounted for 376.4 million new infections in 15–49-year-old people in 2016. Approximately 13.5% (50.8 million) of these infections occurred in low-income countries, territories and areas, 31.4% (118.1 million) in lower middle income, 47.1% (177.3 million) in upper-middle income and 8.0% (30.1 million) in high-income (available from the data repository).<sup>11</sup>

**Comparison of estimates**

Comparing the 2012 estimates with the estimates presented here shows that more data points were available in women for the 2016 estimates. The number increased from 69 to 100 for chlamydia, 50 to 64 for gonorrhoea and 44 to 69 for trichomoniasis. For men, the number of data points fell from 21 to 16 for chlamydia and from 12 to 11 for gonorrhoea, but increased from one to seven for trichomoniasis. The period of eligibility for both estimates was eight years with an overlap of four years (2009 to 2012); in women 27 data points were included in both estimates for chlamydia, 18 for gonorrhoea and 20 for trichomoniasis. In men, these overlaps were six, five and one, respectively.

Table 5 compares the 2012 and 2016 prevalence estimates for the four infections. For syphilis, two estimates are presented for 2012, the published estimate<sup>6</sup> and the 2012 estimate generated using Spectrum STI and the latest
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Estimates of four sexually transmitted infections, 2016

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Spectrum data set. For all infections in both women and men, the 2016 global prevalence estimate was within the 95% UI for 2012. At the regional level, the 95% UIs for prevalence overlapped for all four infections in both men and women, apart from gonorrhoea in men in the WHO African Region which was higher in 2016 than in 2012.

Discussion

We estimated a global total of 376.4 million new curable urogenital infections with chlamydia, gonorrhoea, trichomoniasis and syphilis in 15–49-year-old women and men in 2016. This estimate corresponds to an average of just over 1 million new infections each day. The number of individuals infected, however, is smaller as repeat infections and co-infections are common.

The estimates of prevalence and incidence in 2016 were similar to those in 2012, both globally and by region, showing that sexually transmitted infections are persistently endemic worldwide.

Grouping countries, territories and areas according to SDG regions revealed that the prevalence and incidence of all four sexually transmitted infections, in both women and men, were highest in the Oceania Region. The small island states in this SDG region are part of the WHO Western Pacific Region, which is dominated by China (owing to its population size). Therefore, the levels of sexually transmitted infections and need for infection control in these island states are masked when viewing the estimates only by WHO Region. When using the World Bank classification of countries, the prevalence of gonorrhoea, trichomoniasis and syphilis were highest in low-income countries, territories and areas. The prevalence of chlamydia was highest in the upper middle-income countries, territories and areas, partly due to high estimates in some Latin American countries. Further research is needed to determine whether these estimates reflect methodological factors or differences in C. trachomatis transmission.

The 2016 estimates for chlamydia, gonorrhoea and trichomoniasis were based on a systematic review of the literature complemented by outreach to experts using the same methods as in 2012. The aim was to reduce bias and insure comprehensiveness in the
search for data. For syphilis, the use of national estimates generated by a statistical model improves on the 2012 method by making use of historical trend data. The similarity between the published 2012 syphilis estimates and Spectrum STI generated estimates for 2012 provides reassurance about the validity of comparing the 2016 and 2012 estimates.

The study has limitations. First, limited prevalence data were available, despite an eight-year time window for data inclusion. Estimates for a given infection and region are therefore extrapolated from a small number of data points and ratios were used to generate estimates for some regions. For men, the lack of data was particularly striking. For syphilis, most data were from pregnant women, which might not reflect all women aged 15–49 years, or men. Second, the source studies include people in different age groups and used a range of diagnostic tests, so adjustment factors were applied to standardize measures across studies. Third, owing to the absence of empirical studies, incidence estimates were derived from the relationship between prevalence and duration of infection, and data on the average duration of infection for each infection. The processes for producing future prevalence estimates could be made timelier and more efficient through continually updated systematic reviews, as well as technological solutions that automate searching of databases and facilitate high quality updates of reviews.

The global estimates of prevalence and incidence of four curable sexually transmitted infections are important in the broader global context, highlighting a continuing public health challenge. Prevalence and incidence data play an important role in the design and evaluation of programmes and interventions for sexually transmitted infections and in interpreting changes in HIV epidemiology. The global threat of antimicrobial resistance, particularly the emergence of N. gonorrhoeae resistance to the few remaining antimicrobials recommended for treatment, further highlights the importance of investing in monitoring prevalence and incidence. Estimates of prevalence and incidence are essential for calculations of the burden of disease due to sexually transmitted infections, which are needed to advocate for funding to support sexually transmitted infection programmes. These burden estimates can also be used to promote innovation for point-of-care diagnostics, new therapeutics, vaccines and microbiicides. The WHO Global Health Sector
Strategy on Sexually Transmitted Infections sets a target of 90% reductions in the incidence of gonorrhoea and of syphilis, globally, between 2018 and 2030. Major scale-ups of prevention, testing, treatment and partner services will be required to achieve these goals. The estimates generated in this paper, despite their limitations, provide an initial baseline for monitoring progress towards these ambitious targets.

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### Competing interests
None declared.

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**Fig. 3.** Incidence rate estimates for chlamydia, gonorrhoea, trichomoniasis and syphilis in adults, by WHO Region, 2016

| Region                  | Women (Incidence per 1000 woman) | Men (Incidence per 1000 men) |
|-------------------------|----------------------------------|-------------------------------|
| African Region          |                                   |                               |
| Region of the Americas  |                                   |                               |
| South-East Asia Region  |                                   |                               |
| European Region         |                                   |                               |
| Eastern Mediterranean Region |                             |                               |
| Western Pacific Region  |                                   |                               |

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Note: We defined adults as 15–49 years of age. UI: uncertainty interval, WHO: World Health Organization.

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| WHO Region | Chlamydia | Gonorrhoea | Trichomoniasis | Syphilis |
|------------|-----------|------------|----------------|----------|
| African Region |           |            |                |          |
| Region of the Americas |           |            |                |          |
| South-East Asia Region |           |            |                |          |
| European Region |           |            |                |          |
| Eastern Mediterranean Region |           |            |                |          |
| Western Pacific Region |           |            |                |          |

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كلاميديا، والسيلان، والزهري: تقديرات الانتشار والإصابة العالمية، 2016

الكلاميديا: 3.8% (نقطة التقدير: 95%: 3.3 إلى 4.5)، والسيلان: 0.9% (نقطة التقدير: 95%: 0.7 إلى 1.1)، وداء المشعرات: 5.3% (نقطة التقدير: 95%: 4.0 إلى 7.2)؛ والزهري لدى النساء: 0.5% (نقطة التقدير: 95%: 0.4 إلى 0.6). كانت تقديرات الانتشار في عام 2016 للكلاميديا: 2.7% (نقطة التقدير: 95%: 1.9 إلى 3.7)، والسيلان: 0.7% (نقطة التقدير: 95%: 0.5 إلى 1.1)، وداء المشعرات: 0.6% (نقطة التقدير: 95%: 0.5 إلى 0.9)؛ والإصابة في الرجال، والزهري لدى النساء: 0.0% (نقطة التقدير: 95%: 0 إلى 0.4)؛ والإصابة في الرجال، والزهري لدى الرجال: 0.0% (نقطة التقدير: 95%: 0 إلى 0.4). بلغ مجموع حالات الإصابة التقديرية 376 مليون حالة: 27.2 مليون (نقطة التقدير: 95%: 16.9 إلى 41.3 مليون) حالات الكلاميديا؛ 86.9 مليون (نقطة التقدير: 95%: 58.6 إلى 123.4 مليون) حالات السيلان؛ 156.0 مليون (نقطة التقدير: 95%: 95.1 إلى 259.7 مليون) حالات الزهري للنساء؛ و 28.4 مليون (نقطة التقدير: 95%: 12.4 إلى 47.8 مليون) حالة للرجال.

ملخص

والزهري لدى النساء والرجال، الذين تتراوح أعمارهم ب

قد تتراوح أعمارهم بين 15 و 49 سنة، من عام 2016. وفقاً لنتيجة المسح الذي تم خلال الفترة من 2009 إلى 2016، فإن هناك حاجة إلى تحسين النتائج. كما بقيت النتائج تحت تأثير قضايا أخرى، مثل نقص البيانات الأساسية.Bayesian Spectrum-STD: التقديرات الأولية النتيجة التالية استفادنا من

التقديرات أولية النتيجة التالية استفادنا من

لا يوجد نتائج أولية نموذجية لمرض الزهري globally. بالنسبة لمرض الزهري، احتوت

النتائج النموذجية لأمراض الكلاميديا، والسيلان، وداء المشعرات، شملت هناك 130 دراسة مؤيدة. بالنسبة لمرض الزهري، احتوت

نتيجة للنسبة النموذجية في عام 2016 في النساء.
截至2016年，全球共有8.25亿（95%置信区间：7.10-9.40亿）患者，其中2.31亿（95%置信区间：2.06-2.58亿）为女性患者。女性患病率估计值为：衣原体病2.7%（95%置信区间：1.9-3.7%）；淋病0.7%（95%置信区间：0.5-1.1%）；滴虫病0.6%（95%置信区间：0.4-0.9%）；梅毒0.5%（95%置信区间：0.4-0.6%）。全球男性患病率估计值为：衣原体病5.3%（95%置信区间：4.0-7.2%）；和梅毒0.5%（95%置信区间：0.4-0.6%）。

全球男性患病率估计值为：衣原体病2.7%（95%置信区间：1.9-3.7%）；淋病0.7%（95%置信区间：0.5-1.1%）；滴虫病0.6%（95%置信区间：0.4-0.9%）；梅毒0.5%（95%置信区间：0.4-0.6%）。预期病例总数为3.764亿（95%置信区间：3.322亿-4.206亿）。衣原体病病例8690万（95%置信区间：5860万-12340万）；淋病病例15600万（95%置信区间：10340万-23120万）；滴虫病病例630万（95%置信区间：550万-710万）；梅毒病例3000万（95%置信区间：2200万-4200万）。

结论

对这四种可治愈的性传播疾病的患病率和发病率的全球估计值仍然很高。该研究强调了扩大国家级数据收集工作的必要性，并为监测2016至2021年世卫组织全球卫生部门性传播疾病战略的进展提供了初始基线。
ИППП, остаются высокими. Исследование показывает, что оценивается миро́вое рас пространение этих четырёх инфекций, передаваемых половым путем (ИППП), остаются высокими. Исследование показывает оцениваемые мировые распространенность и частоты этих четырёх излечимых инфекций, передаваемых половым путем (ИППП), остаются высокими. Исследование показывает, что оцениваемые мировые распространенность и частоты этих четырёх излечимых инфекций, передаваемых половым путем (ИППП), остаются высокими.

Вывод. Оценки мировой распространенности и частоты этих четырёх излечимых инфекций, передаваемых половым путем (ИППП), остаются высокими. Исследование показывает оцениваемые мировые распространенность и частоты этих четырёх излечимых инфекций, передаваемых половым путем (ИППП), остаются высокими.

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Table 1. Included studies on chlamydia, gonorrhoea and trichomoniasis prevalence in women, 2009–2016

| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhoea | Trichomoniasis |
|----------------------|-----------------------------------|---------------|----------------------------|------------|------------|---------------|
|                      |                                   |               |                            | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
| African Region       |                                   |               |                            | Genital fluid, amplification test | 400 | 7.8 | Genital fluid, amplification test | 400 | 1.3 | Genital fluid, amplification test | 400 | 5.3 |
| Wynn et al., 2018    | Botswana, Gaborone                | Jul 2015–May 2016 | ANC clinic attendees, > 18 | Genital fluid, amplification test | 655 | 5.8 | Genital fluid, amplification test | 655 | 5.3 | Genital fluid, amplification test | 655 | 7.8 |
| Ginindza et al., 2017 | Eswatini, national                | Jun–Jul 2015 | Outpatient clinic attendees, 15–49 | Genital fluid, amplification test | 655 | 5.8 | Genital fluid, amplification test | 655 | 5.3 | Genital fluid, amplification test | 655 | 7.8 |
| Eshete et al., 2013  | Ethiopia, Jimma Town              | Dec 2011–May 2012 | ANC clinic attendees, 15–36 | NR | NR | NR | Genital fluid, culture | 361 | 5.0 |
| Mulu et al., 2015    | Ethiopia, Bahir Dar               | May–Nov 2013 | ANC clinic attendees, 15–49 | NR | NR | NR | Genital fluid, culture | 214 | 1.4 |
| Schönfeld et al., 2018 | Ethiopia, Asella               | May 2014–Sep 2015 | ANC clinic attendees, adults | NR | NR | NR | Genital fluid, amplification test | 580 | 5.3 |
| Volker et al., 2017  | Ghana, Western region             | Oct 2011–Jan 2012 | Attendees at a hospital maternity clinic, 14–48 | Genital fluid, amplification test | 177 | 1.7 | Genital fluid, culture | 180 | 0.0 | Genital fluid, culture | 180 | 0.0 |
| Jespers et al., 2014 | Kenya, Mombasa                    | 2010–2011 | Participants in a community survey, 18–35 | Genital fluid, amplification test | 110 | 3.6 | Genital fluid, culture | 110 | 2.7 |
| Kinuthia et al., 2015 | Kenya, Ahero and Bondo districts | May 2011–Jun 2013 | ANC clinic attendees, ≥ 14 | Genital fluid, amplification test | 1276 | 5.5 | Genital fluid, culture | 1278 | 6.3 | Genital fluid, culture | 1278 | 6.3 |
| Drake et al., 2013   | Kenya, Western Kenya              | Pre-2013 | ANC clinic attendees, 14–21 | Genital fluid, amplification test | 537 | 4.7 | Genital fluid, culture | 537 | 5.6 | Genital fluid, culture | 537 | 5.6 |
| Masese et al., 2017  | Kenya, Mombasa                    | Aug 2014–Mar 2015 | Students, 15–24 | Urine, amplification test | 451 | 3.5 | Urine, amplification test | 451 | 0.7 |

(continues...
| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhoea | Trichomoniasis |
|----------------------|---------------------------------|---------------|---------------------------|-----------|-----------|---------------|
|                      |                                 |               |                           | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
| Masha et al., 2017   | Kenya, Kilifi                   | Jul–Sep 2015  | ANC clinic attendees, 18–45 | Urine, amplification test | 202         | 149          | Urine, amplification test | 202         | 1.0               | Genital fluid, culture | 202         | 7.4               |
| Nkhoma et al., 2017  | Malawi, Mangochi District       | Feb 2011–Aug 2012 | ANC clinic attendees, ≥ 15 | NR         | NR         | NR            | NR         | NR         | NR                | Genital fluid, microscopy | 1210        | 10.5              |
| Olowe et al., 2014   | Nigeria, Osogba                 | Jul–Apr 2012  | ANC clinic attendees, adults | NR         | NR         | NR            | NR         | NR         | NR                | Genital fluid, microscopy | 100         | 2.0               |
| Etuketu et al., 2015 | Nigeria, Abeokutu               | Jun–Jul 2013  | ANC clinic attendees, 15–44 | NR         | NR         | NR            | NR         | NR         | NR                | Genital fluid, microscopy | 300         | 10.3              |
| Muxunyi et al., 2011 | Rwanda, Kigali                  | Nov 2007–Mar 2010 | Controls for infertility study, adults | Genital fluid, amplification test | 312         | 3.8          | NR         | NR         | NR                | NR                | NR         | NR               |
| Franceschi et al., 2014 | Rwanda, Kigali                | Apr 2013–May 2014 | Students, 18–20 | Urine, amplification test | 912         | 2.2          | NR         | NR         | NR                | NR                | NR         | NR               |
| Vieira-Baptista et al., 2017 | Sao Tome and Principe, Principe | 2015          | Attendees at a primary health-care clinic, 21–60 | Genital fluid, amplification test | 100         | 3.0          | 100         | 2.0         | 100                | 8.0              |
| Moodley et al., 2015 | South Africa, Durban           | May 2008–Jun 2010 | ANC clinic attendees, adults | Genital fluid, amplification test | 1459        | 17.8         | Genital fluid, amplification test | 1459        | 6.4              | Genital fluid, amplification test | 1459        | 15.3             |
| Jespers et al., 2014 | South Africa, Johannesburg     | 2010–2011     | ANC clinic attendees, adults | Genital fluid, amplification test | 109         | 16.5         | Genital fluid, amplification test | 109         | 0.9              | Genital fluid, culture | 109         | 4.6              |
| Peters et al., 2014  | South Africa, Mopani District   | Nov 2011–Feb 2012 | Attendees at a primary health-care clinic, 18–49 | Genital fluid, amplification test | 603         | 16.1         | Genital fluid, amplification test | 603         | 10.1             | NR                | NR         | NR               |
| de Waaij et al., 2017 | South Africa, Mopani District   | Nov 2011–Feb 2012 | Attendees at a primary health-care clinic, 18–49 | NR         | NR         | NR            | NR         | NR         | NR                | Genital fluid, amplification test | 575         | 19.7             |

(continues . . .)
| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhea | Trichomoniasis |
|----------------------|---------------------------------|---------------|---------------------------|-----------|-----------|--------------|
|                      |                                 |               |                           | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
|Francis et al., 2018 | South Africa, KwaZulu-Natal     | Oct 2016–Jan 2017 | Youth people, 15–24       | Genital, amplification test | 259         | 11.2           | Genital fluid, amplification test | 259         | 1.9           | Genital fluid, amplification test | 259         | 46           |
|Tchelougou et al., 2013 | Togo, Sokodé                  | Jun 2010–Aug 2011 | ANC clinic attendees, adults | NR         | NR         | NR           | Genital fluid, amplification test | NR         | NR         | Genital fluid, amplification test | 302         | 3.6           |
|Donders et al., 2016 | Uganda, Kampala                | Pre-2015       | Outpatient clinic attendees, adults | Genital fluid, amplification test | 360         | 1.4           | Genital fluid, amplification test | 360         | 1.7           | Genital fluid, amplification test | 360         | 6.7           |
|Rutherford et al., 2014 | Uganda, Kampala                | Sep 2008–Apr 2009 | Students, 19–25            | Genital fluid, amplification test | 280         | 2.5           | Genital fluid, amplification test | 280         | 1.1           | Genital fluid, culture | 247         | 08           |
|de Walque et al., 2012 | United Republic of Tanzania, Kilombero and Ulanga Districts | Feb–Apr 2009 | Participants in HIV prevention trial, 18–30 | Genital fluid, amplification test | 1204        | 2.7           | Genital fluid, amplification test | 1204        | 1.4           | Genital fluid, amplification test | 1204        | 16.2          |
|Chiduo et al., 2012 | United Republic of Tanzania, Tanga | May 2009–Oct 2010 | ANC clinic attendees, 18–44 | Genital fluid, amplification test | 185         | 1.6           | Genital fluid, culture and Gram stain | 185         | 1.6           | Genital fluid, microscopy | 185         | 11.4          |
|Hokororo et al., 2013 | United Republic of Tanzania, Mwanza | Apr–Dec 2012 | ANC clinic attendees, 14–20 | Urine, amplification test | 403         | 11.4          | Urine, amplification test | 403         | 6.7           | Genital fluid, microscopy | 403         | 13.4          |
|Lazenby et al., 2014 | United Republic of Tanzania, Arusha District | Pre-2014 | Participants for cervical cancer screening, 30–60 | Genital fluid, amplification test | 324         | 0.0           | Genital fluid, amplification test | 324         | 0.0           | Genital fluid, amplification test | 297         | 104           |
|Mauri et al., 2018 | United Republic of Tanzania, Mwanza | Nov 2014–Apr 2015 | ANC clinic attendees, 17–46 | NR         | NR         | NR           | Genital fluid, microscopy | 365         | 104          |
|Chaponda et al., 2016 | Zambia, Chichilenge District   | Nov 2013–Apr 2014 | ANC clinic attendees, adults | Genital fluid, amplification test | 1083        | 5.2           | Genital fluid, amplification test | 1083        | 3.1           | Genital fluid, amplification test | 1083        | 24.8          |
|Stephen et al., 2017 | Zimbabwe, Harare               | Jan 2012–Apr 2012 | ANC clinic attendees, > 18 | Genital fluid, amplification test | 242         | 5.8           | Genital fluid, amplification test | NR         | NR         | NR           | NR         | NR           |

Region of the Americas

(continues...)
| Study, by WHO region and location | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhoea | Trichomoniasis |
|----------------------------------|----------------------------------|---------------|-----------------------------|-----------|-------------|---------------|
|                                  |                                  |               |                             | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
| Touzon et al., 2014<sup>a</sup>   | Argentina, Buenos Aires          | Jan 2010–Dec 2012 | ANC clinic attendees, adults | NR        | NR          | NR            | Genital fluid, culture | 1238       | 1.8          | Genital fluid, culture | 386         | 5.2          |
| Testardini et al., 2016<sup>a</sup> | Argentina, Buenos Aires         | Apr 2010–Aug 2011 | ANC clinic attendees, adults | NR        | NR          | NR            | Genital fluid, amplification test | 210        | 0.5          | Genital fluid, microscopy | 210         | 1.4          |
| Mucci et al., 2016<sup>a</sup>    | Argentina, Buenos Aires         | Aug 2012–Jan 2013 | ANC clinic attendees, 10–42 | NR        | NR          | NR            | Urine, amplification test | 2504       | 12.0         | Urine, amplification test | 2504        | 2.0          |
| Department of Public Health 2018<sup>a</sup> | Bahamas, national               | 2016          | ANC clinic attendees, adults | 1134      | 109         | NR            | Urine, amplification test | 299        | 7.7          | Genital fluid, culture | 299         | 7.7          |
| Magalhaes et al., 2015<sup>a</sup> | Brazil, Rio Grande do Norte State | 2008–2012     | Participants for cervical cancer screening, 25–60 | Genital fluid, amplification test | 335        | 10.7         | Urine, amplification test | 335        | 1.5          | Genital fluid, culture | 168         | 3.0          |
| Miranda et al., 2014<sup>a</sup>  | Brazil, national                | Mar–Nov 2009  | ANC clinic attendees, 15–24 | NR        | NR          | NR            | Urine, amplification test | 2071       | 9.8          | Urine, amplification test | 2071        | 1.0          |
| Pinto et al., 2011<sup>a</sup>    | Brazil, national                | Mar–Nov 2009  | ANC clinic attendees, 15–24 | Urine, amplification test | 168        | 16.7         | NR            | Genital fluid, culture | 168        | 3.0          | Genital fluid, culture | 168         | 3.0          |
| Ferreira et al., 2015<sup>a</sup> | Brazil, Belem and Para          | 2009–2011     | ANC clinic attendees, <19 | Urine, amplification test | 335        | 10.7         | NR            | Genital fluid, culture | 335        | 1.5          | Genital fluid, culture | 335         | 1.5          |
| Piazzetta et al., 2011<sup>a</sup> | Brazil, Curitiba                | Pre-2011      | Sexually active youth people, 16–23 | Genital fluid, amplification test | 562        | 12.3         | NR            | Genital fluid, culture | 562        | 12.3         | Genital fluid, culture | 562         | 12.3         |
| Silveira MF et al., 2017<sup>a</sup> | Brazil, Pelotas                 | Dec 2011–May 2013 | Attendees at a hospital maternity clinic, 18–24 | Genital fluid, amplification test | 361        | 15.0         | NR            | Genital fluid, culture | 361        | 15.0         | Genital fluid, culture | 361         | 15.0         |
| Mesenburg et al., 2013<sup>a</sup> | Brazil, Pelotas                 | Dec 2011–Jan 2013 | ANC clinic attendees, <30 | Genital fluid, amplification test | 1238       | 1.8          | Genital fluid, culture | 386        | 5.2          | Genital fluid, culture | 210         | 1.4          |

(continues . . .)
| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
|----------------------|----------------------------------|---------------|---------------------------|------------------------|-------------|---------------------|------------------------|-------------|---------------------|------------------------|-------------|---------------------|------------------------|-------------|---------------------|
| Gatti et al., 2017⁹⁶ | Brazil, Rio Grande               | Jan 2012–Jan 2015 | ANC clinic attendees, adults | Genital fluid, amplification test | 1169 | 13.1 | NR | NR | NR | NR | NR | NR | NR | NR |
| Marconi et al., 2015⁹⁶ | Brazil, Botucatu                | Sep 2012–Jan 2013 | Participants for cervical cancer screening, 14–54 | Genital fluid, amplification test | 204 | 5.9 | NR | NR | NR | NR | NR | NR | NR | NR |
| Neves et al., 2016⁶⁷ | Brazil, Manaus                  | Oct 2012–Dec 2013 | Attendees at a primary health-care clinic, 14–25 | Genital fluid, amplification test | 1519 | 1.4 | NR | NR | NR | NR | NR | NR | NR | NR |
| Zamboni et al., 2016⁶⁹ | Brazil, Santiago                | Mar 2013–Mar 2014 | Outpatient clinic attendees, 15–24 | Genital fluid, amplification test | 181 | 5.5 | NR | NR | NR | NR | NR | NR | NR | NR |
| Melo et al., 2016⁷⁰ | Brazil, Region of La Araucania  | 2013–2014 | Participants for cervical cancer screening, 18–24 | Genital fluid, amplification test | 171 | 8.8 | NR | NR | NR | NR | NR | NR | NR | NR |
| Glehn et al., 2016⁷¹ | Brazil, Federal District        | Nov 2014–Mar 2015 | Attendees at a primary health-care clinic, 18–49 | Genital fluid, culture | 193 | 15.5 | NR | NR | NR | NR | NR | NR | NR | NR |
| Ovalle et al., 2012¹ | Chile, Santiago                 | Apr 2010–Oct 2010 | ANC clinic attendees, adults | Genital fluid, amplification test | 255 | 5.9 | Genital fluid, culture | 255 | 0.0 | Genital fluid, culture | 255 | 2.4 | Genital fluid, culture | 255 | 2.4 |
| Huneeus et al., 2018¹ | Chile, Santiago                 | 2012–2014 | Sexually active youth people, < 25 | Genital fluid, amplification test | 171 | 8.8 | Genital fluid, amplification test | 171 | 0.6 | Genital fluid, amplification test | 171 | 0.0 | Genital fluid, amplification test | 171 | 0.0 |
| Villaseca et al., 2015¹ | Chile, Santiago                 | Jun 2013–Dec 2013 | Attendees at a family health clinic, 15–54 | Genital fluid, culture | 101 | 3.0 | Genital fluid, culture | 101 | 3.0 | Genital fluid, culture | 101 | 3.0 | Genital fluid, culture | 101 | 3.0 |
| Stella et al., 2011¹⁴ | Colombia, rural Medellin        | 2009–2010 | Students, 15–18 | Genital fluid, culture | 262 | 0.0 | Genital fluid, culture | 262 | 0.0 | Genital fluid, culture | 262 | 0.0 | Genital fluid, culture | 262 | 0.0 |
### Research Estimates of Four Sexually Transmitted Infections, 2016

Jane Rowley et al.

| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
|----------------------|----------------------------------|---------------|---------------------------|-------------------------|-------------|---------------------|-------------------------|-------------|---------------------|-------------------------|-------------|---------------------|
| Paredes et al., 2015 | Colombia, Sabana Centro province | Jun 2012–Aug 2013 | Students, 14–19 | Urine, amplification test | 436 | 3.2 | Urine, amplification test | 436 | 0.2 | NR | NR | NR | NR |
| Giraldo-Ospina et al., 2015 | Colombia, Dosquebradas | Aug–Dec. 2013 | ANC clinic attendees, 15–47 | Genital fluid, amplification test | 101 | 0.0 | Genital fluid, culture | 101 | 2.0 | NR | NR | NR | NR |
| Geron et al., 2014 | Colombia, Bogota | Oct 2012 | ANC clinic attendees, 15–40 | Genital fluid, amplification test | 226 | 5.3 | Genital fluid, amplification test | 199 | 4.0 | Genital fluid, amplification test | 199 | 196 | |
| Jobe et al., 2014 | Haiti, Jéème | Aug 2011 | Attendees at a primary health-care clinic, 16–75 | Genital fluid, amplification test | 104 | 1.9 | Genital fluid, amplification test | 104 | 1.0 | Genital fluid, amplification test | 104 | 13.5 | |
| Jobe et al., 2014 | Haiti, Jéème | Oct 2012 | Attendees at a primary health-care clinic, 19–78 | Genital fluid, amplification test | 104 | 1.9 | Genital fluid, amplification test | 104 | 1.0 | Genital fluid, amplification test | 104 | 13.5 | |
| Scheildell et al., 2018 | Haiti, Gressier | Aug–Oct 2013 | ANC clinic attendees, adults | Urine, amplification test | 200 | 8.0 | Urine, amplification test | 200 | 3.0 | Urine, amplification test | 200 | 205 | |
| Bristow et al., 2017 | Haiti, Port-au-Prince | Oct 2015–Jan 2016 | ANC clinic attendees, > 18 | Genital fluid, amplification test | 300 | 140 | Genital fluid, amplification test | 300 | 2.7 | Genital fluid, amplification test | 300 | 27.7 | |
| Conde-Ferráez et al., 2017 | Mexico, Merida | Aug 2010–Jan 2011 | ANC clinic attendees, adults | Genital fluid, amplification test | 121 | 8.3 | Genital fluid, amplification test | 158 | 190 | |
| López-Monteon et al., 2013 | Mexico, central Veracruz | Jun–Jul 2012 | Attendees at a primary health-care clinic, 14–50 | Genital fluid, amplification test | NR | NR | NR | NR | NR | NR |
| Magana-Contreras et al., 2015 | Mexico, Villahermosa | Jan 2013–Nov 2014 | Participants for cervical cancer screening, 16–74 | Genital fluid, amplification test | 201 | 1.5 | Genital fluid, amplification test | 201 | 1.5 | Genital fluid, amplification test | 201 | 1.5 | |
| Casillas-Vega et al., 2017 | Mexico, Jalisco | Sep 2013–Aug 2014 | ANC clinic attendees, adults | Genital fluid, amplification test | 287 | 108 | Genital fluid, amplification test | 287 | 108 | Genital fluid, amplification test | 287 | 108 | |

(continues...)
### Estimates of four sexually transmitted infections, 2016

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| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhoea | Trichomoniasis |
|----------------------|----------------------------------|---------------|---------------------------|-----------|------------|---------------|
|                      |                                  |               |                           | Clinical specimen, test¹ | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
|                      |                                  |               |                           | Genital fluid, amplification test | 600 | 100 | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 819 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 753 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 973 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 973 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 784 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 750 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 213 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 213 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 213 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 213 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 233 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
|                      |                                  |               |                           | Genital fluid, amplification test | 376 | NR | NR | NR | NR | NR | NR | NR | NR | NR |

(continues...)
| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhea | Trichomoniasis |
|----------------------|----------------------------------|---------------|---------------------------|-----------|-----------|---------------|
|                      |                                  |               |                           | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
| Banneheke et al., 2013 | Sri Lanka, Colombo district | 2007–2009 | Participants in diagnostic test study, 16–45 | NR | NR | NR | NR | NR | NR | Genital fluid, microscopy | 601 | 2.8 |
| European Region       |                                  |               |                           | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
| Farr et al., 2016     | Austria, Vienna                  | Jan 2005–Jan 2015 | ANC clinic attendees, adults | NR | NR | NR | NR | NR | NR | Genital fluid, DNA probe-based assay | 3763 | 0.8 |
| Ljubin-Sternak et al., 2017 | Croatia, Zagreb | Mar 2014–Feb 2015 | Attendees at an obstetrics and gynaecology clinic, adults | Genital fluid, amplification test | 8665 | 1.7 | NR | NR | NR | NR | NR |
| Peuchant et al., 2015 | France, Bordeaux                | Jan–Jun 2011 | ANC clinic attendees, 18–44 | Genital fluid, amplification test | 1004 | 2.5 | Genital fluid, amplification test | 1004 | 0.0 | NR | NR | NR |
| Peuchant et al., 2015 | France, Bordeaux                | Sep 2012–Feb 2013 | ANC clinic attendees, < 25 | Genital fluid, amplification test | 112 | 7.1 | Genital fluid, amplification test | 112 | 1.8 | NR | NR | NR |
| Galdavadze et al., personal communication 2012 | Georgia, Tbilisi | Jul 2011–Mar 2012 | ANC clinic attendees, 14–44 | Urine, amplification test | 300 | 5.0 | Urine, amplification test | 300 | 0.3 | NR | NR | NR |
| Ikonomidis et al., 2015 | Greece, Thessaly state | Feb 2012–Nov 2015 | Attendees at a urology and gynaecology clinic, adults | Genital fluid, amplification test | 130 | 0.8 | NR | NR | NR | NR | NR |
| O’Higgins et al., 2017 | Ireland, Dublin | Dec 2011–Dec 2013 | ANC clinic attendees, 16–25 | Genital fluid, amplification test | 2687 | 4.9 | NR | NR | NR | NR | NR |
| Hassan et al., 2016 | Ireland, Dublin                | Jul 2014–Jan 2015 | Participants for cervical cancer screening, 25–40 | Genital fluid, amplification test | 236 | 3.0 | Genital fluid, amplification test | 236 | 0.0 | NR | NR | NR |

(continues . . .)
| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhoea | Trichomoniasis |
|----------------------|----------------------------------|---------------|---------------------------|-----------|-----------|---------------|
|                       |                                  |               |                           | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
| Bianchi et al., 2016  | Italy, Milan                      | Dec 2008–Dec 2012 | HPV vaccinated young women, 18–23 | Genital fluid, amplification test | 591 | 49 | NR | NR | NR | NR | NR | NR |
| Seraceni et al., 2016 | Italy, north-eastern              | Jan 2009–Dec 2014 | Participants for cervical cancer screening, adults | Genital fluid, amplification test | 921 | 0.0 | NR | NR | NR | NR | NR | NR |
| Panatto et al., 2015  | Italy, Turin, Milan and Genoa     | Jan–Jun 2010 | Women attending gynaecologic routine check-ups, 16–26 | Genital fluid, amplification test | 566 | 5.8 | NR | NR | NR | NR | NR | NR |
| Foschi et al., 2016   | Italy, Bologna                    | Jan 2011–May 2014 | Attendees at an obstetrics and gynaecology clinic, routine, ≥ 14 | Genital fluid, amplification test | 3072 | 3.4 | NR | NR | NR | NR | NR | NR |
| Matteelli et al., 2016| Italy, Brescia                    | Nov 2012–Mar 2013 | Sexually active students, ≥ 18 | Urine, amplification test | 1297 | 1.9 | Urine, amplification test | 1297 | 0.0 | NR | NR | NR |
| Camporiondo et al., 2016| Italy, Rome                       | Mar 2013 | Healthy women attending screening, 34–60 | Genital fluid, amplification test | 309 | 0.0 | Genital fluid, amplification test | 309 | 0.0 | Genital fluid, amplification test | 309 | 1.3 |
| Leli et al., 2016     | Italy, Perugia                    | Jan–Oct 2015 | Outpatient clinic attendees, adults | Urine, amplification test | NR | NR | NR | NR | NR | Genital fluid, amplification test | 1487 | 1.3 |
| Gravningen et al., 2013| Norway, Finnmark                  | 2009         | Sexually active students, 15–20 | Urine, amplification test | 607 | 68 | NR | NR | NR | NR | NR | NR |

(continues...)
### Study, by WHO region and location

| Study, by WHO region and location | Country or territory and location | Date of study | Population and age, years | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
|---------------------------------|----------------------------------|---------------|----------------------------|------------------------|-------------|----------------------|------------------------|-------------|----------------------|------------------------|-------------|----------------------|------------------------|-------------|----------------------|
| Silva et al., 2013[10]          | Portugal, Porto                  | Pre-2013      | Students, 14–30             | Genital fluid, amplification test | 432         | 6.9                  | NR                     | NR          | NR                   | NR                     | NR          | NR                   | NR                     | NR          | NR                   |
| Babinská et al., 2017[10]       | Slovakia, eastern parts          | 2011          | Community members, adults   | Urine, amplification test | 511         | 3.5                  | NR                     | NR          | NR                   | NR                     | NR          | NR                   | NR                     | NR          | NR                   |
| Fernández-Benítez et al., 2013[11] | Spain, Laviana and Asturias     | Nov 2010–Dec 2011 | Sexually active youth people, 15–24 | Urine, amplification test | 277         | 4.0                  | NR                     | NR          | NR                   | NR                     | NR          | NR                   | NR                     | NR          | NR                   |
| Pineiro et al., 2016[12]        | Spain, Basque Autonomous Community | Jan 2011–Dec 2014 | Attendees at a hospital maternity clinic, 14–54 | Urine, amplification test | 11 687      | 1.0                  | Urine, amplification test | 11 687 | 0.0                  | Urine, amplification test | 2559 | 0.3                  | Urine, amplification test | 2559 | 0.3                  |
| Field et al., 2018[13]          | United Kingdom, national        | Sep 2010–Aug 2012 | Sexually active adults, 16–44 | Urine, amplification test | 11 687 | 1.0 | Urine, amplification test | 11 687 | 0.0 | Urine, amplification test | 2559 | 0.3 | Urine, amplification test | 2559 | 0.3 |
| Sonnenberg et al., 2013[14]     | United Kingdom, national        | Sep 2010–Aug 2012 | Sexually active adults, 16–44 | Urine, amplification test | 2665 | 2.3 | Urine, amplification test | 2665 | 0.1 | Urine, amplification test | 2559 | 0.3 | Urine, amplification test | 2559 | 0.3 |
| **Eastern Mediterranean Region** |                                    |               |                            |                        |             |                      |                        |             |                      |                        |             |                      |                        |             |                      |
| Nada et al., 2015[15]           | Egypt, Cairo                     | Jan–Nov 2014  | Controls for infertility study, adult | Genital fluid, amplification test | 100 | 2.0 | NR                     | NR          | NR                   | NR                     | NR          | NR                   | NR                     | NR          | NR                   |
| Hasansadeh et al., 2013[16]     | Iran (Islamic Republic of), Shiraz | 2009–2011    | ANC clinic attendees, adults | Genital fluid, amplification test | 11 000 | 1.2 | Genital fluid, amplification test | 11 000 | 1.2 | Genital fluid, amplification test | 11 000 | 1.2 | Genital fluid, amplification test | 11 000 | 1.2 |
| Hamid et al., 2011[17]          | Iran (Islamic Republic of), Zanjan province | Apr 2009 | Attendees at an obstetrics and gynaecology clinic, 15–45 | Genital fluid, culture | 328 | 0.9 | NR                     | NR          | NR                   | NR                     | NR          | NR                   | NR                     | NR          | NR                   |
| Nourian et al., 2015[18]        | Iran (Islamic Republic of), Zanjan | Jul 2009–Jun 2010 | ANC clinic attendees, adults | Genital fluid, culture | 1000 | 3.3 | Genital fluid, culture | 1000 | 3.3 | Genital fluid, culture | 1000 | 3.3 | Genital fluid, culture | 1000 | 3.3 |
| Rasti et al., 2011[19]          | Iran (Islamic Republic of), Kashan | Pre-2010      | ANC clinic attendees, adults | Genital fluid, culture | 450 | 0.4 | Genital fluid, culture | 450 | 0.4 | Genital fluid, culture | 450 | 0.4 | Genital fluid, culture | 450 | 0.4 |
### Estimates of four sexually transmitted infections, 2016

Jane Rowley et al.

| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhea | Trichomoniasis |
|----------------------|-----------------------------------|---------------|---------------------------|------------|-----------|---------------|
|                      |                                   |               |                           | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
| Dehgan Marvast et al., 2017 | Iran (Islamic Republic of), Yazd | May–Sep 2010 | ANC clinic attendees, 16–39 | Urine, amplification test | 250 | 0.0 | NR | NR | NR | NR | NR | NR |
| Ahmadi et al., 2016 | Iran (Islamic Republic of), Sanandaj | Aug 2012–Jan 2013 | Controls for spontaneous abortion study, 19–42 | Genital fluid, amplification test | 109 | 11.9 | NR | NR | NR | NR | NR | NR |
| Arabi et al., 2014 | Iran (Islamic Republic of), Kashan | Oct 2012–Aug 2013 | Attendees at a public health unit, 16–60 | NR | NR | NR | NR | NR | NR | Genital fluid, culture | 970 | 23 |
| Hasanabad et al., 2013 | Iran (Islamic Republic of), Sabzevar | Pre-2013 | ANC clinic attendees, adolescents | Urine, amplification test | 399 | 12.3 | Urine, amplification test | 399 | 1.3 | NR | NR | NR | NR |
| Mousavi et al., 2014 | Iran (Islamic Republic of), Sanandaj | Feb–May 2013 | Controls for infertility study, 14–40 | Genital fluid, amplification test | 104 | 5.8 | NR | NR | NR | NR | NR | NR |
| Nateghi Rostami et al., 2015 | Iran (Islamic Republic of), Qom | May 2013–Apr 2014 | Attendees at an obstetrics and gynaecology clinic, 18–50 | Genital fluid, amplification test | 518 | 7.1 | NR | NR | NR | NR | NR | NR |
| Marashi et al., 2014 | Iran (Islamic Republic of), not specified | Pre-2014 | Controls for infertility study, 20–40 | Genital fluid, amplification test | 200 | 6.5 | NR | NR | NR | NR | NR | NR |
| Joolayi et al., 2017 | Iran (Islamic Republic of), Ahvaz | Aug 2016–Jan 2017 | Controls for infertility study, 18–49 | Genital fluid, amplification test | 125 | 1.6 | NR | NR | NR | NR | NR | NR |
| El Kettani et al., personal communication, 2016 | Morocco, Rabat, Salé, Agadir and Fes | Oct 2011–Dec 2011 | Attendees at a family planning clinic, 18–49 | Genital fluid, amplification test | 537 | 3.0 | Genital fluid, amplification test | 537 | 0.4 | Genital fluid, culture | 537 | 5.6 |
| El Kettani et al., personal communication, 2016 | Morocco, Rabat, Salé, Agadir and Fes | Dec 2011–Jan 2012 | ANC clinic attendees, 18–49 | Genital fluid, amplification test | 252 | 3.6 | Genital fluid, amplification test | 252 | 0.8 | Genital fluid, culture | 252 | 5.2 |

(continues . . )
| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhoea | Trichomoniasis |
|----------------------|----------------------------------|---------------|---------------------------|-----------|------------|--------------|
|                      |                                  |               |                           | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
| Kamel 2013[128]      | Saudi Arabia, Jazan              | Jul 2011–Jun 2012 | Controls for infertility study, 18–40 | Genital fluid, culture | 100 | 40 | NR | NR | NR | NR | NR |
| Western Pacific Region | Wen 2013[129]                  | China, Wuhu   | 2010 | Sexually active adults, adults | Genital fluid, amplification test | 7892 | 5.4 | NR | NR | NR | Genital fluid, microscopy | 2010 | 6.6 |
|                      | Lu et al., 2013[130]            | China, Shenzhen | 2011–2012 | Attendees at an obstetrics and gynaecology clinic, adults | Genital fluid, culture | 108 268 | 1.5 | NR | NR | NR | NR | NR |
|                      | Xia et al., 2015[131]           | China, east, 16 cities | Jan–Dec 2011 | Attendees at an hospital maternity clinic, adults | Genital fluid, culture | 1183 | 3.7 | NR | NR | NR | NR | NR |
|                      | Zhang et al., 2017[132]         | China, Shaanxi province | Jun 2012–Jan 2013 | Attendees at an obstetrics and gynaecology clinic, adults | Genital fluid, amplification test | 500 | 3.4 | NR | NR | NR | NR | NR |
|                      | Zhang et al., 2017[133]         | China, Beijing | Mar–Oct 2014 | Attendees at an obstetrics and gynaecology clinic, 20–70 | Genital fluid, amplification test | 953 | 2.2 | NR | NR | NR | Genital fluid, microscopy | 953 | 1.7 |
|                      | Imai et al., 2015[134]          | Japan, Miyazaki | Oct 2011–Feb 2012 | Students, > 18 | Urine, amplification test | 1183 | 3.7 | NR | NR | NR | NR | NR |
|                      | Suzuki et al., 2015[135]        | Japan, national | Oct 2013–Mar 2014 | Attendees at an obstetrics and gynaecology clinic, adults | Genital fluid, amplification test | 250571 | 2.3 | NR | NR | NR | NR | NR |
|                      | Ministry of Health 2017[136]    | Mongolia, national | 2016 | Attendees at an obstetrics and gynaecology clinic, adults | Genital fluid, culture | 69278 | 0.5 | NR | NR | NR | NR | NR |
|                      | Corsenac et al., 2015[137]      | New Caledonia, national | Aug–Dec 2012 | Attendees at a primary health-care clinic, 18–49 | Urine, amplification test | 376 | 10.1 | NR | NR | NR | NR | NR |

(continues . . .)
| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Chlamydia | Gonorrhoea | Trichomoniasis |
|----------------------|----------------------------------|---------------|---------------------------|------------|------------|---------------|
|                      |                                  |               |                           | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
| Unger et al., 2015  | Papua New Guinea, Madang         | Nov 2009–Aug 2012 | ANC clinic attendees, ≥ 16 | Genital fluid, amplification test | 674 | 4.5 | Genital fluid, amplification test | 674 | 8.2 | Genital fluid, amplification test | 674 | 21.8 |
| Wangnapi et al., 2015| Papua New Guinea, Madang         | Feb 2011–Apr 2012 | ANC clinic attendees, 16–39 | Genital fluid, amplification test | 362 | 11.0 | Genital fluid, amplification test | 362 | 9.7 | Genital fluid, amplification test | 362 | 21.3 |
| Valley et al., 2017 | Papua New Guinea, four provinces | Dec 2011–Jan 2015 | ANC clinic attendees, 18–59 | Genital fluid, amplification test | 765 | 22.9 | Genital fluid, amplification test | 765 | 14.2 | Genital fluid, amplification test | 765 | 22.4 |
| Valley et al., 2017 | Papua New Guinea, four provinces | Dec 2011–Jan 2015 | Participants for cervical cancer screening, 18–59 | Genital fluid, amplification test | 614 | 7.5 | Genital fluid, amplification test | 614 | 8.0 | Genital fluid, amplification test | 614 | 15.0 |
| Badman et al., 2016 | Papua New Guinea, Milne Bay      | Aug–Dec 2014   | ANC clinic attendees, > 18 | Genital fluid, amplification test | 125 | 200 | Genital fluid, amplification test | 125 | 11.2 | Genital fluid, amplification test | 125 | 376 |
| Hahn et al., 2014   | Republic of Korea, Seoul         | Mar 2010–Apr 2011 | ANC clinic attendees, adults | Genital fluid, amplification test | 455 | 2.2 | Genital fluid, amplification test | 455 | 0.4 | Genital fluid, amplification test | 455 | 0.0 |
| Choe et al., 2012   | Republic of Korea, Seoul         | Mar–Dec 2010   | Attendees at a health examination clinic, 20–59 | Urine, amplification test | 805 | 3.2 | Urine, amplification test | 805 | 0.2 | NR | NR | NR |
| Kim et al., 2011    | Republic of Korea, Uijeongbu     | Jul–Dec 2010   | Attendees at a check-up clinic, 20–60 | Genital fluid, amplification test | 279 | 3.9 | Genital fluid, amplification test | 279 | 0.4 | Genital fluid, amplification test | 279 | 2.5 |
| Kim et al., 2014    | Republic of Korea, Seoul         | Jan–Oct 2012   | Attendees at a health examination clinic, 25–81 | Genital fluid, amplification test | 405 | 1.2 | Genital fluid, amplification test | 405 | 0.0 | Genital fluid, amplification test | 405 | 0.2 |
| Marks et al., 2015  | Solomon Islands, Honiara         | Aug 2014       | Attendees at a primary health-care clinic, 16–49 | Genital fluid, amplification test | 296 | 203 | Genital fluid, amplification test | 296 | 5.1 | NR | NR | NR |

(continues . . .)
### Study, by WHO region

| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
|----------------------|----------------------------------|---------------|---------------------------|-------------------------|-------------|----------------------|-------------------------|-------------|----------------------|-------------------------|-------------|----------------------|
| Ton Nu et al., 2015 | Viet Nam, Hue                     | Sep 2010–Jun 2012 | Attendees at a family planning clinic, adults | NR                      | NR          | NR                   | NR                      | NR          | NR                   | Genital fluid, microscopy | 534         | 0.7                  |
| Nguyen et al., personal communication, 2017 | Viet Nam, Hanoi                   | 2016–2017 | ANC clinic attendees, > 18 | Genital fluid, amplification test | 490         | 0.8                  | Genital fluid, amplification test | 490         | 0.0                  | Genital fluid, amplification test | 490         | 0.8                  |

ANC: antenatal care; DNA: deoxyribonucleic acid; HIV: human immunodeficiency virus; NR: not reported; WHO: World Health Organization.

1. Studies that reported using both culture and Gram stain were assumed to have the same sensitivity and specificity values as culture.
2. The study used an immunochromatographic capillary-flow enzyme immunoassay and we assumed a sensitivity of 50% and specificity of 99%.
3. The study used a nonamplified, nucleic acid probe-based test system and we assumed the same specific and sensitivity values as for a nucleic acid amplification test.
Table 2. Included studies on chlamydia, gonorrhoea and trichomoniasis prevalence in men, 2009–2016

| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Study prevalence, % | Population and age, years | Study prevalence, % | Population and age, years | Study prevalence, % |
|----------------------|----------------------------------|---------------|---------------------------|---------------------|---------------------------|---------------------|---------------------------|---------------------|
| **African Region**   |                                  |               |                           |                     |                           |                     |                           |                     |
| Francis et al., 2018 | South Africa, KwaZulu-Natal      | Oct 2016–Jan 2017 | Community members, 15–24 | 188                 | 5.3                       |                     |                           |                     |
| Rutherford et al., 2014 | Uganda, Kampala              | Sep 2008–Apr 2009 | Students, 19–25 | 360                 | 0.8                       |                     |                           |                     |
| de Walque et al., 2012 | United Republic of Tanzania, Kilombero and Ulugha districts | Feb–April 2009 | Participants in HIV prevention trial, 18–30 | 1195              | 1.7                       |                     |                           |                     |
| **Region of the Americas** |                              |               |                           |                     |                           |                     |                           |                     |
| Huneeus et al., 2018 | Chile, Santiago                 | 2012–2014    | Sexually active students, ≤ 24 | 115                | 8.7                       |                     |                           |                     |
| Paredes et al., 2015 | Colombia, Sabana Centro province | 2011      | Students, 14–19 | 536                | 1.1                       |                     |                           |                     |
| **South-East Asia Region** |                               |               |                           |                     |                           |                     |                           |                     |
| Jatapai et al., 2013 | Thailand, national              | Nov 2008–May 2009 | Military recruits, 17–29 | 2123              | 7.9                       |                     |                           |                     |
| **European Region**  |                                  |               |                           |                     |                           |                     |                           |                     |
| Sviben et al., 2015 | Croatia, Zagreb                 | Pre-2014     | Controls in case-control study, 18–66 | NR                | NR                       | NR                  | NR                       | NR                  |
| Ikonomidis et al., 2015 | Greece, Thessaly State         | Feb 2012–Nov 2015 | Attendees at urology and gynaecology clinic, adult | 171                | 0.6                       | NR                  | NR                       | NR                  |
| Matteelli et al., 2016 | Italy, Brescia                   | Nov 2012–Mar 2013 | Sexually active students, > 18 | 762                | 1.4                       |                     |                           |                     |
| Ikonomidis et al., 2015 | Greece, Thessaly State         | Feb 2012–Nov 2015 | Attendees at urology and gynaecology clinic, adult | 171                | 0.6                       | NR                  | NR                       | NR                  |
| Matteelli et al., 2016 | Italy, Brescia                   | Nov 2012–Mar 2013 | Sexually active students, > 18 | 762                | 1.4                       |                     |                           |                     |

(continues . . .)
## Estimates of four sexually transmitted infections, 2016

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| Study, by WHO region | Country or territory and location | Date of study | Population and age, years | Population and age, years | Study prevalence, % | Study prevalence, % | Study prevalence, % |
|----------------------|----------------------------------|---------------|---------------------------|---------------------------|---------------------|---------------------|---------------------|
|                      |                                   |               | Chlamydia                 | Gonorrhoea                | Trichomoniasis      |                     |                     |
|                      |                                   |               | Clinical specimen, test   | Sample size               | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % | Clinical specimen, test | Sample size | Study prevalence, % |
|                      |                                   |               | Urine, amplification test | 505                       | 3.4                 | NR                  | NR                  | NR                  | NR                  | NR                  |
|                      |                                   |               | Sexually active youth, 15–20 | Community members, adult | 344                  | 2.0                 | NR                  | NR                  | NR                  | NR                  |
|                      |                                   |               | Urine, amplification test | 210                       | 4.3                 | NR                  | NR                  | NR                  | NR                  | NR                  |
|                      |                                   |               | Urine, amplification test | 1885                      | 1.9                 | Urine, amplification test | 1885 | 0.1                 | NR                  | NR                  |
|                      |                                   |               | Attendees at a public health unit, 16–60 | Urine, amplification test | 233                  | 0.9                 | Attendees at a check-up clinic, 18–50 | Urine, amplification test | 430                  | 6.7                 |                   |                     |
|                      |                                   |               | Attendees at a health examination clinic, 20–59 | Urine, amplification test | 807                  | 7.9                 | Urine, amplification test | 807 | 0.6                 | NR                  | NR                  |
|                      |                                   |               | Attendees at a check-up clinic, 20–60 | Urine, amplification test | 430                  | 0.5                 | Urine, amplification test | 430 | 0.2                 |                     |                     |

HIV: human immunodeficiency virus; NR: not reported; WHO: World Health Organization.

* Tests were either nucleic acid amplification test or culture.