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Gesundheit Österreich GmbH

TECHNICAL REPORT

A systematic review and meta-analysis of the prevalence of chlamydia, gonorrhoea, trichomoniasis and syphilis in Europe

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The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of this review and there is no financial interest to report.

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Abbreviations

CT	*Chlamydia trachomatis*
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
EFTA	European Free Trade Association
EU	European Union
GOEG	Gesundheit Österreich GmbH (Austrian National Public Health Institute)
GP	general practitioner
GUM	genito-urinary medicine
HIV	human immunodeficiency virus
MSM	men who have sex with men
NAAT	nucleic acid amplification test
NG	*Neisseria gonorrhoeae*
NICE	National Institute for Health and Care Excellence (UK)
NR	not reported
PE	prevalence estimate
PrEP	pre-exposure prophylaxis for HIV
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
PROSPERO	International Prospective Register of Systematic Reviews
PWID	people who inject drugs
RoB	risk of bias
SR	systematic review
STI	sexually transmitted infections
TP	*Treponema pallidum*
TV	*Trichomonas vaginalis*

Glossary

Cluster sampling	Sampling method where the population is divided into clusters, and a random sample of clusters is selected for analysis
Confidence interval	Range of values that probably contain the true population parameter, with 95% confidence
Convenience sampling	Non-probability sampling method where subjects are chosen based on their availability and accessibility
Forest plot	Graphical display of the results of multiple studies used in meta-analyses to visualise the effect sizes and confidence intervals
Funnel plot	Graphical display used in meta-analyses to assess the presence of publication bias
General population	People living in the European region aged 15 years and above, excluding specific sub-groups or populations
Heterogeneity	Degree of variability among the studies in a meta-analysis
I^2 statistic	Measure of heterogeneity in meta-analysis, indicating the proportion of total variation across studies due to heterogeneity rather than chance
Meta-analysis	Statistical technique for combining the results of multiple studies to produce a single pooled prevalence estimate
Non-random	Sampling without random selection, often convenience sampling
Pooled estimate	Combined (prevalence) estimate derived from multiple studies in a meta-analysis
Probability sampling	Sampling method where each member of the population has a known and non-zero chance of being selected for the sample
Prevalence	Proportion of individuals in a population who have an (STI) infection at a specific point in time
Proxy population	Group used as a substitute for the target population for deriving information on the prevalence, when direct access or representation is not feasible
Random sampling	Sampling method that ensures an unbiased representation of the research population
Reporting bias	Systematic errors in the dissemination of research findings, often resulting from selective publication of studies with certain results
Representative	Sample that accurately reflects the characteristics of the broader population from which it is drawn
Specimen	Biological material of an individual's tissue, fluids, or other samples used for laboratory analysis or testing
Sub-group analysis	Examination of the prevalence within specific population subsets
Targeted sampling	Sampling method that specifically targets certain groups or individuals for inclusion in the sample based on pre-defined criteria
Unweighted	Raw calculation of the proportion of individuals in a population with the STI infection of interest diagnosed, without applying any adjustment or weighting factors to the data.

Executive summary

Objectives

Sexually transmissible infections (STIs) represent some of the most prevalent infections globally, with an estimated 375 million new infections with one of the curable STIs each year [1]. About 300 000 new diagnoses of bacterial STIs are reported annually by the European Union (EU)/European Economic Area (EEA) Member States to The European Surveillance System, the main source of epidemiological data for the region. Variations in STI surveillance system characteristics and coverage, together with differences in screening policies and testing practices, hinder the routine surveillance data from providing an accurate picture of STI epidemiology. To better describe the STI epidemiology, to adequately inform primary or secondary prevention efforts, and to provide data for monitoring progress towards the elimination of STIs as a public health threat in Europe requires supplementary epidemiological information, such as prevalence estimates. This systematic review aimed to identify and collate prevalence estimates for the European general population and populations of special interest for the four curable STIs: chlamydia (etiological agent *Chlamydia trachomatis),* hereinafter CT; gonorrhoea (etiological agent *Neisseria gonorrhoeae*), hereinafter NG; trichomoniasis (etiological agent *Trichomonas vaginalis*), hereinafter TV; and syphilis (etiological agent *Treponema pallidum subspecies pallidum*), hereinafter TP.

Methods

This systematic literature review was carried out to retrieve, assess and synthesise all available data on the prevalence of CT, NG, TV, and TP in European countries (EU/European Free Trade Association (EFTA), United Kingdom (UK) and EU candidate or potential candidate countries) published between 2012 and 2023 in the general population, suitable proxy populations, and the following populations of special interest: men who have sex with men (MSM), sex workers, and people who inject drugs (PWID). The literature search was conducted in a comprehensive set of seven databases and complemented by grey literature searches. The literature was selected independently by two reviewers, and the data was extracted by one reviewer and cross-checked by another. The quality of the studies included was assessed using the Joanna Briggs Institute checklist for prevalence studies. Pooled prevalence estimates were calculated using random effects models. The review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on 23 December 2024: CRD42023492418.

Results

Of the 2 113 unique publications screened, 85 publications reporting on 78 unique studies were included. In addition, 16 studies were included from the previous systematic review commissioned by WHO (Rowley et al., 2019) and four studies were identified from sources other than the bibliographic databases.

Overall, the current burden of CT in the European region is estimated to be 2.76% (95% CI 1.65–3.87) among women, and 2.64% (95% CI 0.61–4.67) among men. The prevalence of NG is estimated to be 0.24% (95% CI 0.00–0.50) among women, and 0.10% (95% CI 0.00–0.22) among men. Prevalence of TV is estimated to be 0.69% (95% CI 0.38–0.99) among women, and 0.00% (95% CI 0.00–0.21) among men. The overall prevalence of TP is estimated to be 0.14% (95% CI 0.00–0.29) among women in antenatal care, and no estimates are available for men in the general population. In young people aged 15 to 24 years, the CT prevalence is estimated to be 5.54% in young women and 3.32% in young men. NG prevalence is estimated to be 0.51% in young women and 0.07% in young men. TV prevalence is estimated to be 0.64% in young women and 0.00% in young men. For TP in young people, only one study was identified, conducted among young women in antenatal care, reporting a prevalence of 0.00%.

The STI prevalence estimates available in the identified literature are not generalisable to the whole population of MSM. We calculated pooled estimates for various sub-groups of MSM: In MSM visiting STI clinics, the estimated prevalences are 9.72% (95% CI 8.27–11.16) for CT, 10.46% (95% CI 6.94–13.97) for NG, 0.10% (95% CI 0.00–0.22) for TV and 6.53% (95% CI 3.20–9.86) for TP. Among MSM living with HIV, the estimated prevalences are 6.08% (95% CI 0.75–11.41) for CT, 4.74% (95% CI 0.75–8.72) for NG, 0.94% (95% CI 0.00–2.78) for TV and 14.36% (95% CI 1.10–27.63) for TP. Among MSM on PrEP, the estimated prevalences are 9.57% (95% CI 7.11–12.02) for CT, 8.99% (95% CI 5.31–12.66) for NG and 6.48% (95% CI 3.95–9.02) for TP. Among MSM engaging in 'high-risk' sexual behaviour, the estimated prevalences are 15.35% (95% CI 9.62–21.08) for CT, 14.37% (95% CI 7.76–20.98) for NG, 1.54% (95% CI 0.00–4.67) for TV and 5.21% (95% CI 1.44–8.98) for TP.

In female sex workers, pooled prevalences are estimated to be 5.50% (95% CI 4.31–6.69) for CT, 2.22% (95% CI 0.63–3.80) for NG, 8.97% (95% CI 6.03–11.91) for TV, and 1.75% (95% CI 0.04–3.46) for TP. Among male and transgender (male to female) sex workers, prevalence estimates were found to be particularly high, with pooled prevalences estimated to be 6.04% for CT, 6.36% (95% CI 0.00–14.25) for NG, and 22.09% (95% CI 5.14–39.03) for TP.

Only two studies were identified for PWID, and both reported on the prevalence of TP. The pooled TP prevalence is estimated to be 1.56% (95% CI 0.45–2.76), based on the studies from Czechia and Serbia.

Conclusions and possible implications for public health practice and/or research

This literature review provides evidence-based prevalence estimates for CT, NG, TV and TP for the general population and some populations of special interest that are useful for policy actions to limit the spread of curable STIs in the European region. However, efficient prevention policies would require the availability of relatively recent prevalence estimates from most of the countries in the region and the current evidence base is insufficient, with sampling dates for national estimates ranging from 2003 to 2022. Moreover, many of the studies that are available have a considerable risk of bias, further limiting the certainty of the available evidence. Key populations, such as sex workers and PWID, are very poorly studied. There are more studies on MSM but they were almost exclusively conducted at STI clinics and are therefore of limited value for estimating the true STI prevalence in the general MSM population. No study was identified to report TP prevalence among men of the general population. The significant gaps in both, the quantity and the quality of the evidence on the prevalence of curable STIs in the European region identified in this review should be addressed in future studies.

Action that can be taken based on this evidence assessment

Against the backdrop of this study, and in line with the recommendations formulated in WHO's Regional action plans for ending AIDS and the epidemics of viral hepatitis and sexually transmitted infections 2022–2030 [2], a number of (public health) actions are advised, especially for countries with a less comprehensive description of STI epidemiology.

Strengthen capacity to describe STI epidemiology:

- conduct prevalence studies representative of the general population, by employing probability-based sampling where prevalence estimates are missing, or routine surveillance is not comprehensive, or does not offer data of acceptable quality;
- consider/collect estimates for proxy populations that may be available from specific settings (such as antenatal care programmes, routine check-ups/screenings for other conditions, or military recruits) for a more feasible and less resource-intensive alternative to representative probability-based sampling studies.

Implement evidence-based STI prevention and control measures:

- use prevalence estimates in combination with other epidemiology data to inform national prevention policies targeting the population groups most affected by STI epidemics, such as young people, specific sub-groups of MSM and sex workers.

1. Background

Sexually-transmitted infections (STIs) are some of the most prevalent infections globally, with an estimated 375 million new infections with one of the curable STIs each year [1]. About 300 000 new diagnoses of bacterial STIs are reported annually by the European Union(EU)/European Economic Area (EEA) Member States to The European Surveillance System, which is the main source of epidemiological data for the region [3]. Variations in STI surveillance systems characteristics and coverage, together with differences in screening policies and testing practices, prevent routine surveillance data from providing an accurate picture of STI epidemiology. To better describe the STI epidemiology, to adequately inform primary or secondary prevention efforts, and to provide data for monitoring progress towards the elimination of STIs as a public health threat in Europe, requires supplementary epidemiological information, such as prevalence estimates. This systematic review is centred around four of the most common curable bacterial STIs: chlamydia (etiological agent *Chlamydia trachomatis)* hereinafter CT; gonorrhoea (etiological agent *Neisseria gonorrhoeae*), hereinafter NG; trichomoniasis (etiological agent *Trichomonas vaginalis*), hereinafter TV and syphilis (etiological agent *Treponema pallidum subspecies pallidum*), hereinafter TP. These infections can evolve asymptomatically or with a variety of symptoms that can include acute conditions such as cervicitis, urethritis, and genital ulcerations. Untreated, these infections can potentially result in severe complications and long-term sequelae, such as pelvic inflammatory disease, ectopic pregnancy, infertility, chronic pelvic pain, as well as neurological and cardiovascular diseases. When transmitted vertically or during birth, some of the infections may lead to neonatal death, premature delivery, blindness, or severe disability. In addition, bacterial STIs can elevate the risk of both acquiring and transmitting HIV [4, 5]. STIs are also often associated with societal stigma, stereotyping, feelings of vulnerability and shame, and have been linked to incidents of gender-based violence [6]. Due to considerable burden and impact on health, these four infections are targeted for elimination by WHO's global health sector strategies for the period 2022–2030 [7].

1.1 Rationale

The aim of this review is to support the understanding of STI epidemiology in Europe and the monitoring of STI trends, by providing epidemiological information that is not available through routine STI surveillance of diagnosed cases reported to The European Surveillance System. The number of notified cases are dependent on national testing policies and testing practice (including availability of sensitive diagnostic techniques at large scale), which vary by country and over time, and surveillance systems coverage, and reporting practices [8, 9]. More specifically, this review aims to identify and collect/collate prevalence estimates for the European population for the four curable STIs (chlamydia, gonorrhoea, trichomoniasis, and syphilis) indicated by WHO's Regional Office for Europe in its 'Regional Action Plan for Ending AIDS and the Epidemics of Viral Hepatitis and Sexually Transmitted Infections 2022–2030' [2]. The prevalence estimates will inform monitoring of progress towards elimination of STI as public health concern at European level and where estimates are available, at national level.

1.2 Objectives

To identify and collect/collate prevalence estimates for the European population for the four curable STIs (CT, NG, TV and TP). The research question was formulated using the Condition-Context-Population (CoCoPoP) framework [10]:

Table 1. Condition-Context-Population framework

Condition	Context	Population
• Chlamydia: *Chlamydia trachomatis* infection (CT) • Gonorrhoea: *Neisseria gonorrhoea* infection (NG) • Trichomoniasis: *Trichomonas vaginalis* infection (TV) • Syphilis: primary, secondary or early latent *Treponema pallidum* subspecies *pallidum* infection (TP)	• EU/EFTA countries + UK + EU candidate and potential candidate countries.	• General population – General population 15 years and above; – Young people, aged 15-24 years; – Women attending antenatal care. • Populations of special interest – MSM; – Sex workers; – PWID.

MSM: men who have sex with men, PWID: people who inject drugs

The following 42 countries were included in the review: 27 EU Member States, four European Free Trade Association (EFTA) countries (Iceland, Liechtenstein, Norway, Switzerland), 10 candidate countries and potential candidates to the EU, and the UK (see also Annex 1).

1.3 Research questions

The following research questions were agreed upon between ECDC and the project team for the systematic literature review:

General population

Q1: What is the **prevalence** of CT, NG, TV, and TP in the general population (15 years and above) of **European countries** according to recent estimates?
Q1.1: What is the prevalence of CT, NG, TV, and TP among **young people, aged 15-24 years,** in European countries according to recent estimates?
Q1.2: What is the prevalence of CT, NG, TV, and TP in **women attending antenatal care** in European countries according to recent estimates?

Populations of special interest

Q2.1: What is the prevalence of CT, NG, TV, and TP in **MSM** in European countries according to recent estimates?
Q2.2: What is the prevalence of CT, NG, TV, and TP in **sex workers** in European countries according to recent estimates?
Q2.3: What is the prevalence of CT, NG, TV, and TP in **PWID** in European countries according to recent estimates?

Definitions for the primary outcome and populations of interest are set out in Box 1.

Box 1. Definitions

Prevalence was defined as number of people with the STI infection of interest, diagnosed using a reliable/internationally-accepted diagnostic technique in a clinical or randomised sample of the total study population, in a cross-sectional population-based or cohort study, or in a non-randomised experimental study. Prevalence estimates are reported as proportions with 95% confidence intervals (CIs).

General population was defined as people living in the European region aged 15 years and above. Some more specific study populations were defined as **suitable proxy populations** for gathering information on prevalence in the general population, including women making routine gynaecological visits, routine cancer screenings or antenatal care, patients attending community and primary care settings or hospitals for non-STI related reasons, individuals attending family planning clinics and military recruits.

Young people were defined as people aged 15–24 years.

Men who have sex with men (MSM) were defined as men who engage in sexual activity with other men, regardless of sexual identity, including bisexual men (who also have sex with women).

- **MSM using PrEP** were defined as MSM who are actively taking pre-exposure prophylaxis medication to prevent HIV infection.
- **MSM living with HIV** were defined as MSM who have been diagnosed with HIV infection.
- **MSM engaging in chemsex** were defined as MSM who use drugs, such as crystal methamphetamine, mephedrone, or GHB/GBL, specifically to enhance their sexual encounters or experiences.

Sex workers were defined as individuals who exchange sex for money, drugs, or goods, including male, female and transgender sex workers.

People who inject drugs (PWID) were defined as individuals who either currently inject or have in the past injected non-medically prescribed psychoactive substances.

2. Review methods

A systematic literature review was carried out to retrieve, assess and synthesise recent prevalence estimates for CT, NG, TV and TP in European countries (EU/EEA, Switzerland, UK and EU candidate or potential candidate countries). The search strategy was designed based on the research questions (see Section 0). The protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on 23 December 2023: CRD42023492418.

2.1 Eligibility criteria

Inclusion and exclusion criteria (Table 2) were developed in an iterative process, involving all team members from both ECDC and Gesundheit Österreich GmbH (GOEG).

Table 2. Eligibility criteria

Inclusion criteria	Exclusion criteria
• Publications reporting – primary data on prevalence estimates for CT, NG, TV, or TP in humans; – and reporting results separately for one of the infections. • Examples of included study designs: – cross-sectional population-based studies; – baseline surveys in randomised controlled trials or cohort studies.	• Publications only reporting combined STI prevalence, e.g. CT and NG. • Publications reporting prevalence data based on self-reported (i.e. unconfirmed) infections. • Publications reporting on animal or in vitro infections (e.g. diagnostics used in the laboratory only). • Publications reporting modelled data only.
• Publications from 01.01.2018 to last date of search for CT, NG, and TV. Where no representative studies were identified, older studies retrieved by the systematic review by Rowley et al. (2019) were eligible, if specimen collection started after 01.01.2009 [11]. • Publications starting from 01.01.2012 to last date of search for TP. • Specimens collected after 01.01.2009 (if specimen collection dates are provided).	• Publications falling outside the specified sampling period or publication date range.
• Publications from an EU/EFTA country, UK or an EU candidate or potential candidate country in any language.	• Publications reporting data from overseas territories of European countries.
• For prevalence estimates for the general population, sample size must be at least 100 individuals. • For prevalence estimates for populations of special interest, there is no restriction on sample size.	
• Use of appropriate testing method; pathogen-specific appropriate diagnostic principle, as described in Annex 5.	
• General population and proxy population – general population 15 years and above; – suitable proxy populations; – young people, aged 15–24 years; – women attending antenatal care. • Populations of specific interest – MSM; – sex workers; – PWID.	• Individuals aged under 15 years. • Studies conducted exclusively in populations that were not considered suitable proxies for the general population and are not one of the defined populations of specific interest (see Annex 4).

2.2 Information retrieval

Information sources

Electronic databases

Original publications were retrieved from the following bibliographic databases:

- MEDLINE (EBSCO interface)
- Embase (Elsevier interface)
- The Cochrane Library including Cochrane Database of Systematic Reviews and The Cochrane Central Register of Controlled Trials (CENTRAL) and Cochrane Clinical Answers
- CINAHL (EBSCO interface)
- Scopus
- Web of Science Core Collection
- Web of Science Preprint Citation Index.

Previous systematic review

The systematic review by Rowley et al. (2019) [11] was used to complement the literature search for studies reporting prevalences of CT, NG, or TV with studies from before our search period. The review authors conducted a systematic literature search for CT, NG, and TV for publications published until 29 July 2018.

Grey literature searches and additional sources

In addition to the bibliographic databases, we searched for additional and grey literature in Google Scholar, BASE(Bielefeld Academic Search Engine)[1] and sources listed in the Grey Matters tool[2] and GreyNet International[3]. Existing contacts with national and international experts from the Population Health Information Research Infrastructure (PHIRI[4]) and the International Network of Agencies for Health Technology Assessment (INAHTA[5]) were queried for additional published articles or grey literature providing prevalence estimates.

Search strategy

The search strategies combined the vocabulary for CT, NG, TV and TP with vocabulary for 'prevalence'. In addition, a search string was used to limit the search to studies conducted in European countries (see Annex 2). Controlled vocabulary (i.e. MeSH terms) and natural vocabulary (i.e. keywords) were used. The search strategy used only English terms, but no language restrictions were applied in the literature selection.

To focus on recent literature, a stepwise search strategy was applied (see Figure 65). The initial search was limited to publications starting from 1 January 2018. The publications identified through this search were screened and relevant studies were selected (as described below) and grouped by countries. For countries where no study was available for CT, NG, or TV reporting a prevalence estimate in the general population (representative studies), the systematic review by Rowley et al. (2019) [11] was checked for complementary studies with specimen collection after 01.01.2019. For countries where no study was available reporting a prevalence estimate for TP in the general population (representative studies or studies in proxy populations), the literature search was extended to publications starting from 1 January 2012.

The Medline (via EBSCO) search strategy was peer-reviewed by an ECDC librarian not associated with the project, using the Peer Review of Electronic Search Strategies (PRESS) standard [12]. The search was then adapted to meet the thesaurus terms and syntax of the other databases. The complete search strategies are available in Annex 2.

Selection process

References were managed using EndNote bibliographic software (Clarivate Analytics, Philadelphia, US). References were exported into EndNote, where they were de-duplicated. Both title and abstract screening and full-text screening were carried out independently by two reviewers using Rayyan[6] [13]. The abstract screening was piloted for 100 references, which were assessed by all reviewers contributing to the abstract screening. The decisions on the pilot references were compared, discussed and aligned, in case of discrepancies. Two reviewers completed abstract screening and then the full-text screening, with the requirement for two independent reviewer decisions per reference in both steps. Conflicting decisions were discussed at the end of the screening between the two reviewers who initially rated the respective references. If the conflicting decisions could not be resolved through discussion, a third reviewer was consulted to reach a majority decision. If more than one exclusion criteria was applicable, only one criterion was used to categorise the reference.

[1] https://www.base-search.net/ (accessed: 12 March 2024)

[2] https://www.cadth.ca/grey-matters-practical-tool-searching-health-related-grey-literature (accessed: 12 March 2024)

[3] https://greynet.org/greysourceindex.html (accessed: 12 March 2024)

[4] http://www.phiri.eu (accessed: 12 March 2024)

[5] https://www.inahta.org/ (accessed: 12 March 2024)

[6] https://www.rayyan.ai/ (accessed: 12 March 2024)

2.3 Data extraction

Data were extracted from included studies using a pre-specified extraction form developed in consultation with ECDC. The unit for data extraction was not the publication, but the study. A study was defined as a report of prevalence data on STI pathogen for a defined population group, in a defined country, over a discrete period of time. According to this definition, a single publication may include more than one study (e.g. comparing the same population over time; comparing different populations; reporting STI prevalence). Information on any one individual study from several distinct publications was merged in the data extraction for that study.

Study characteristics and prevalence estimates for all studies included were collected in Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia). The extraction form was piloted with five publications to ensure ease-of-use, inclusion of all relevant data items, and consistency between reviewers. Data from these studies were extracted by two reviewers independently. The extracted data were compared, and inconsistencies discussed and aligned. These pilot extraction tables were reviewed by ECDC and revised. Using the final extraction table templates, data from all included studies were extracted by one reviewer for each study and double-checked by a second reviewer. If the information provided in a publication was insufficient, the authors were contacted to request additional information.

Where prevalence estimates were reported from different anatomical sites, we extracted the higher ones. Information on the type of additional samples and anatomical sites was also extracted and is provided in the tables.

Data items

Variables extracted are provided in the data extraction template in Annex 6.

2.4 Quality assessment

The quality of the studies included was assessed using the Joanna Briggs Institute (JBI) checklist for prevalence studies [14], which was also endorsed by the National Institute for Health and Care Excellence (NICE) for quality appraisal of prevalence studies [15, 16]. The criteria in the tool assess potential risk of bias in the studies in the following nine domains: representativeness (1), recruitment (2), sample size description (3) and reporting of study subjects and setting (4), data coverage of the identified sample (5), condition measured reliably (6) and objectively (7), statistical analysis (8), and response rate (9) (see Annex 7). Each of the nine domains is addressed by answering one question with:

- 'Yes (no or minor concerns)', indicating low risk of bias;
- 'No (major concerns)', indicating high risk of bias;
- 'Unclear (not reported or contradictory)', indicating uncertain risk of bias.

We conducted the quality assessment at outcome level (i.e. studied STI) rather than study level to account for outcome-dependent assessment domains (specifically, required minimum sample sizes and testing methods). We pre-specified criteria for each question to enable a coherent assessment by the independent reviewers. Two reviewers first piloted the quality assessment by assessing the same set of five studies in parallel. The assessments were compared, and inconsistencies were discussed and aligned. Quality assessment of the remaining studies was performed by one reviewer for each study and double-checked by a second reviewer. At the end of the process, conflicting assessments were discussed by the two reviewers who initially assessed the respective studies. If the conflicting assessments could not be resolved through discussion, a third reviewer was consulted to reach a majority decision. The results of the quality assessment for all studies and populations included are provided in Annex 8.

We used an algorithm to categorise the studies into low, medium and high risk of bias (RoB). To be considered low RoB, a study had to meet the terms of questions 1 (appropriate sample frame), 2 (appropriate sampling method), 6 (appropriate testing method) and 9 (adequate response rate) and a minimum of five of the nine questions overall. To be considered medium RoB, a study had to meet the terms of questions 6 and 9 and a minimum of five of the nine questions overall.

2.5 Evidence synthesis

Calculations and meta-analyses

Data transformation and calculations

We extracted unweighted prevalence estimates from the included studies and calculated prevalence estimates from studies that only provided numbers of tested individuals and numbers of positive-testing individuals. As very few studies reported confidence intervals (CIs), we calculated all 95%-CIs ourselves using the Wald's method [17].

Pooled estimates and synthesis methods

We used random effects models and present 95% confidence intervals. If there were two or more studies available, we calculated a pooled estimate by meta-analysis. Calculations were performed using the 'rma' function of the R package 'metafor' [18].

Assessment of heterogeneity and sensitivity analysis

We assessed statistical heterogeneity using the I^2 statistic. Statistical heterogeneity is typically high in meta-analyses of prevalence estimates (> 90%) and should therefore not be interpreted using the cut-off values employed in comparative meta-analysis [19, 20].

Sub-group analysis

Sub-group analyses were performed for proxy populations versus representative studies in the general population and in young people as well as based on quality assessment for all populations. Further sub-group analyses that were specified in the review protocol (accessible via PROSPERO: CRD42023492418) were not conducted, either because no reasonable groups could be established or because the respective factors were too heterogeneously reported in the included studies.

Presentation of results

General population and young people

If reported, prevalence estimates for young people were extracted separately from mixed-age studies. All analyses are separated by gender (men versus women). Therefore only studies that provided prevalence estimates separately for men and women are included in the main evidence synthesis and meta-analyses. Studies that only provided a mixed-gender prevalence estimate are only presented in the respective country profiles (see Annex 10). Studies were categorised as either 'representative' (including a representative sample of the general population) or 'proxy' (including a proxy population that was considered suitable for an approximation of the general population). Studies including women attending antenatal care were also considered as 'proxy' studies for the general population.

Men who have sex with men

Studies including MSM were categorised into four groups, based on different assumed risk for STIs:

- MSM visiting STI clinics for studies recruiting MSM in STI clinics with no other relevant inclusion criteria;
- MSM HIV for studies, including only HIV-positive MSM;
- MSM PrEP for studies, including only MSM who take PrEP;
- MSM 'high-risk' for studies, including only MSM with certain sexual behaviour classified as 'high-risk' by the study authors.

In addition, two studies were identified that investigated separate populations not categorised into any of the aforementioned groups by the study authors: MSM engaging in chemsex and MSM reporting sexual behaviour classified as 'low-risk'.

Sex workers

All analyses are separated by gender (female versus male/transgender sex workers).

Country profiles

Country profiles are provided in Annex 10, including summary tables of the studies from the respective country, and forest plots summarising the individual prevalence estimates from those studies.

2.6 Deviations from the review protocol

While the initial plan was to focus solely on the most recent prevalence estimates and to include only studies meeting a certain threshold of methodological quality in the evidence synthesis, the approach was changed early on in the project following consultation with ECDC. No specific threshold of methodological quality was applied, and all studies identified within the searched timeframes were included, rather than just the most recent ones. This approach was chosen in order to increase the likelihood of obtaining prevalence estimates for most of the individual countries and because very few studies of high methodological quality were identified. These changes are reflected in the adapted wording of the research questions.

The modified approach led to a considerably higher number of studies being included than initially planned, as well as in increased heterogeneity between the studies, due to the broader timeframe of sampling and varying methodological quality. As a result of this added complexity and due to limited time and resources, certain planned analyses and methodological steps had to be omitted. More specifically, the assessment of publication bias via funnel plots and a detailed assessment of the certainty of evidence were not conducted.

Pooled prevalence estimates for individual countries were not calculated because few countries had several studies on any population available and those that were available were largely heterogeneous. The protocol specified STI/GUM clinic attendees as a population of special interest (Q2.6). However, this population was subsequently excluded from the review. This decision was taken partly to mitigate the increased number of studies included, and partly because information on the STI prevalence in this specific population is of limited use for assessing the epidemiological situation in the general population.

3. Review results

3.1 Study selection

Of the 2 113 unique publications screened, 314 were selected based on title and abstract, and 85 were selected for extraction. These 85 publications reported on 78 unique studies. In addition, we included 17 publications (reporting on 17 studies) from the previous systematic review Rowley et al. 2019 and two publications (reporting on two studies) identified from other sources. The PRISMA flow diagram is presented in Annex 3.

The following tables and figures provide an overview of the number of prevalence estimates available per country. For simplicity, the number of prevalence estimates in these representations is not separated by gender (general population, young people, sex workers) or risk group (MSM). The number of prevalence estimates in these representations does not necessarily correspond to the numbers of individual studies, as in some instances one study provided several estimates (e.g. for men and for women).

Section 0 provides a summary of the characteristics of the included studies per STI and population. For a total of 17 countries (10 EU/EFTA and seven EU enlargement), no recent prevalence estimates were available for chlamydia, gonorrhoea, trichomoniasis, or syphilis in the general population. The list of all studies excluded after full text review, with main reason for exclusion, are provided in Annex 9.

Table 3. Number of identified prevalence estimates in the general population, including proxy populations

Country	Chlamydia			Gonorrhoea			Trichomoniasis			Syphilis			Total
	Representative	Antenatal care	Proxy (other)	Representative	Antenatal care	Proxy (other)	Representative	Antenatal care	Proxy (other)	Representative	Antenatal care	Proxy (other)	
Austria	0	0	0	0	0	0	0	1	0	0	0	0	1
Belgium	4	0	0	0	0	0	0	0	0	0	0	0	4
Croatia	0	1	0	0	0	0	0	0	0	0	0	0	1
Denmark	0	1	0	0	0	0	0	0	0	0	0	0	1
France	0	1	3	0	1	2	0	0	0	0	0	1	8
Greece	0	0	1	0	0	0	0	0	1	0	0	1	3
Hungary	0	0	0	0	0	0	0	0	0	0	1	0	1
Ireland	0	0	1	0	0	1	0	0	0	0	0	0	2
Italy	0	1	2	0	0	1	0	0	2	0	1	0	7
Netherlands	2	1	1	2	1	1	0	1	1	0	1	0	11
Poland	0	0	4	0	0	0	0	0	0	0	1	0	5
Portugal	0	0	0	0	0	1	0	0	1	0	0	0	2
Romania	0	0	0	0	0	0	0	0	0	0	1	0	1
Slovenia	2	0	0	2	0	0	2	0	0	0	0	0	6
Spain	0	1	0	0	1	0	0	0	1	0	1	0	4
Sweden	0	0	1	0	0	1	0	0	0	0	0	0	2
North Macedonia	0	0	1	0	0	1	0	0	1	0	0	0	3
Serbia	0	0	1	0	0	1	0	0	0	0	0	0	2
Türkiye	0	0	0	0	0	0	0	0	0	0	1	0	1
UK	2	0	0	2	0	0	0	0	0	0	0	0	4

For the following countries, no recent prevalence estimates in the general population (including proxy populations) were available: Bulgaria, Cyprus, Czechia, Estonia, Finland, Germany, Latvia, Lithuania, Luxembourg, Malta, Slovakia, Iceland, Liechtenstein, Norway, Switzerland, Albania, Bosnia and Herzegovina, Georgia, Kosovo, Moldova, Montenegro, and Ukraine.

Figure 1. Number of identified prevalence estimates in the general population, including proxy populations per country; combined for all four STIs

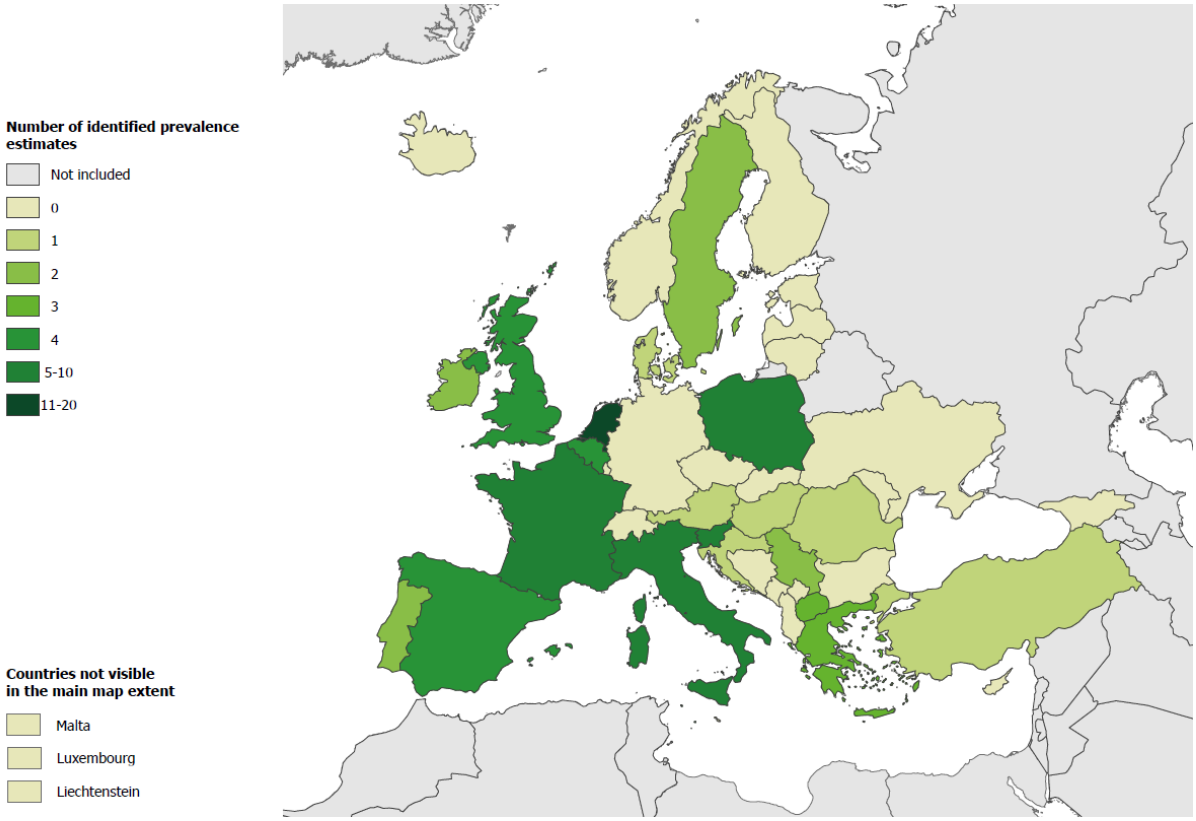


Table 4. Number of identified prevalence estimates in young people, including proxy populations

Country	Chlamydia			Gonorrhoea			Trichomoniasis			Syphilis			Total
	Representative	Antenatal care	Proxy (other)	Representative	Antenatal care	Proxy (other)	Representative	Antenatal care	Proxy (other)	Representative	Antenatal care	Proxy (other)	
Croatia	2	0	0	0	0	0	0	0	0	0	0	0	2
Finland	0	0	1	0	0	0	0	0	0	0	0	0	1
France	0	1	0	0	1	0	0	0	0	0	0	0	2
Germany	2	0	0	2	0	0	0	0	0	0	0	0	4
Ireland	0	1	0	0	0	0	0	0	0	0	0	0	1
Italy	0	0	4	0	0	2	0	0	0	0	0	0	6
Poland	2	0	0	0	0	0	0	0	0	0	0	0	2
Portugal	0	0	1	0	0	1	0	0	1	0	0	0	3
Slovenia	2	0	0	2	0	0	2	0	0	0	0	0	6
Spain	4	4	2	2	3	0	2	2	0	0	1	0	20
Norway	0	0	2	0	0	0	0	0	0	0	0	0	2
UK	2	0	2	2	0	2	0	0	0	0	0	0	8

For the following countries, no recent prevalence estimates in young people (including proxy populations) were available: Austria, Belgium, Bulgaria, Cyprus, Czechia, Denmark, Estonia, Greece, Hungary, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Romania, Slovakia, Sweden, Iceland, Liechtenstein, Switzerland, Albania, Bosnia and Herzegovina, Georgia, Kosovo, Moldova, Montenegro, North Macedonia, Serbia, Türkiye, and Ukraine.

Figure 2. Number of identified prevalence estimates in young people, including proxy populations, per country; combined for all four STIs

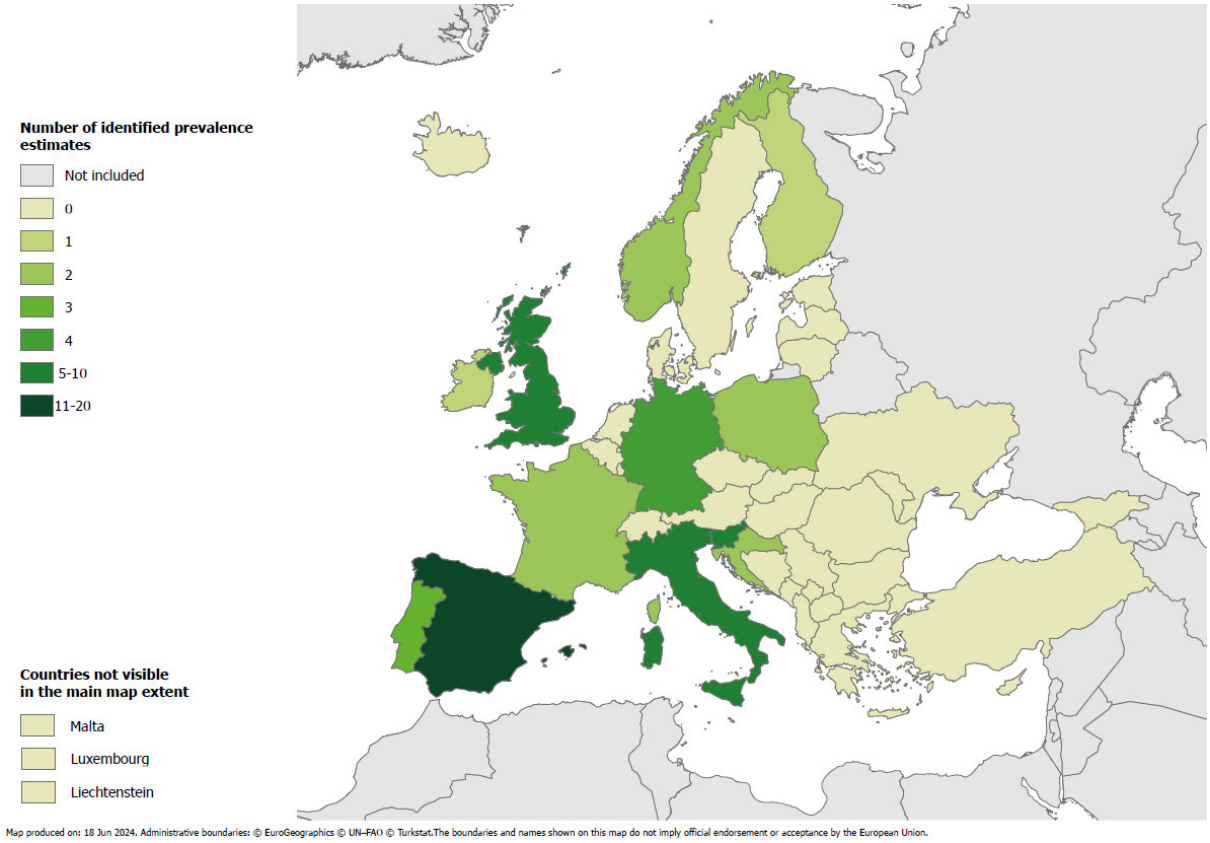
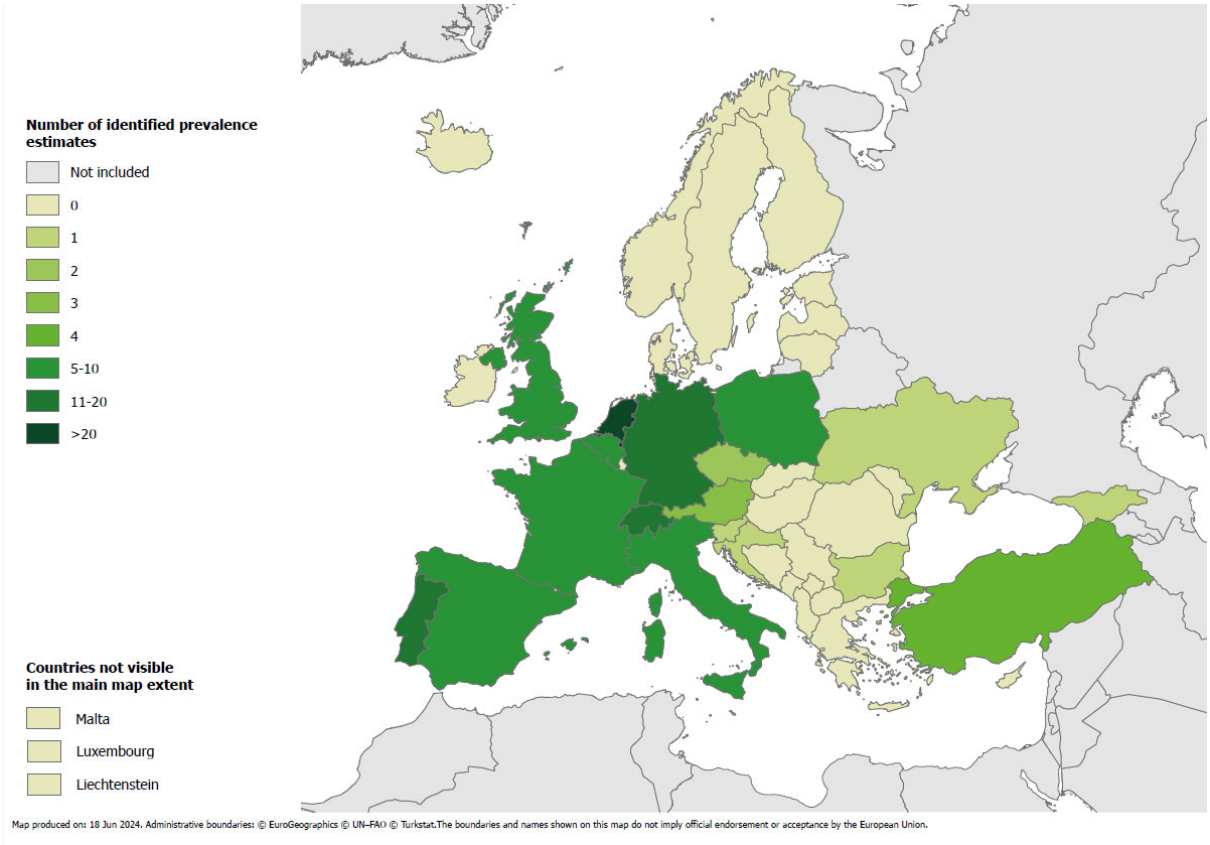


Table 5. Number of identified prevalence estimates in MSM, sex workers and PWID

Country	Chlamydia			Gonorrhoea			Trichomoniasis			Syphilis			Total
	MSM	Sex workers	PWID	MSM	Sex workers	PWID	MSM	Sex workers	PWID	MSM	Sex workers	PWID	
Austria	1	0	0	1	0	0	0	0	0	1	0	0	3
Belgium	1	2	0	1	2	0	0	1	0	1	0	0	8
Bulgaria	0	0	0	0	0	0	0	0	0	1	0	0	1
Croatia	0	0	0	0	0	0	0	0	0	1	0	0	1
Czechia	0	0	0	0	0	0	0	0	0	0	1	1	2
France	3	0	0	2	0	0	0	0	0	2	0	0	7
Germany	4	0	0	4	0	0	2	0	0	2	0	0	12
Italy	2	0	0	2	0	0	0	0	0	2	1	0	7
Netherlands	4	4	0	3	4	0	0	0	0	3	4	0	22
Poland	2	0	0	2	0	0	0	0	0	2	0	0	6
Portugal	1	3	0	1	3	0	0	0	0	0	3	1	12
Slovenia	0	0	0	0	0	0	0	0	0	1	0	0	1
Spain	3	1	0	3	1	0	0	0	0	2	0	0	10
Switzerland	2	2	0	3	2	0	1	1	0	3	2	0	16
Georgia	0	0	0	0	0	0	0	0	0	1	0	0	1
Türkiye	1	0	0	1	0	0	0	0	0	2	0	0	4
Ukraine	0	0	0	0	0	0	0	0	0	1	0	0	1
UK	2	0	0	2	0	0	0	0	0	1	0	0	5

For the following countries, no recent prevalence estimates in MSM, sex workers and PWID were available: Cyprus, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Romania, Slovakia, Sweden, Iceland, Liechtenstein, Norway, Albania, Bosnia and Herzegovina, Kosovo, Moldova, Montenegro, North Macedonia, and Serbia.

Figure 3. Number of identified prevalence estimates in MSM, sex workers and PWID per country; combined for all four STIs



3.2 Study characteristics

Chlamydia

General population

Women: for the female general population, including proxy populations, 23 studies reported CT prevalence estimates, which enrolled a total of 37 114 women. Among these 23 studies, five employed population-based probability sampling (n=4 544), and six enrolled women in antenatal care using convenience sampling (n=26 179). Thirteen studies were conducted among other female proxy populations using convenience sampling, including healthy women attending routine gynaecological check-ups, cervical and/or breast cancer screening, women attending general practitioners (GP), and female military personnel (n=6 391). Of the 23 studies, eight were conducted in central and eastern Europe, one in northern Europe, five in southern Europe, and nine in western Europe. The sampling dates ranged from 2011 to 2019.

Young women: for women aged <25 years, 21 studies reported CT prevalence estimates, enrolling a total of 17 714 young women. Among these, two studies employed population-based probability sampling, two applied random probability sampling in a panel database and in the community, and three were conducted among a representative convenience sample (n = 2 953). Six studies enrolled young women in antenatal care using convenience sampling (n = 4 264). Eight studies were conducted among other young female proxy populations using convenience, cluster or targeted sampling, including female students, HPV-vaccinated young women (randomised trial), young women attending routine gynaecological check-ups, and young female emergency room attendees (n=10 497). Of the 21 studies, three were conducted in central and eastern Europe, two in northern Europe, 11 in southern Europe, and five in western Europe. The sampling dates ranged from 2010 to 2022.

Men: for the male general population, including proxy populations, eleven studies reported CT prevalence estimates which enrolled a total of 5 343 men. Among these eleven studies, five employed population-based probability sampling (n=3 176), and six enrolled male proxy populations using convenience sampling, including male patients attending GPs, male military personnel, and male partners of women in antenatal care (n=2 167). Of the eleven studies, four were conducted in central and eastern Europe, one in northern Europe, and six in western Europe. The sampling dates ranged from 2011 to 2019.

Young men: for men aged <25 years, 11 studies reported CT prevalence estimates, enrolling a total of 3 573 young men. Among these, two studies employed population-based probability sampling, two studies applied random probability sampling in a panel database and in the community, and three studies were conducted among a representative convenience sample (n=1 969). Four studies were conducted among young male proxy populations using convenience or cluster sampling, including male students and young male emergency room attendees (n=1 604). Of the 11 studies, three were conducted in central and eastern Europe, one in northern Europe, four in southern Europe, and three in western Europe. The sampling dates ranged from 2011 to 2022.

Populations of special interest

MSM: for MSM, 28 studies reported CT prevalence estimates, enrolling a total of 367 603 individuals. Of those, three studies only included HIV-positive MSM, five only MSM taking PrEP and five only MSM engaging in sexual behaviour defined by the study authors as 'high-risk'. Almost all studies were conducted in STI clinics (25), one study recruited participants via a dating app/social media, one recruited participants via an online sexual health service and in one study participant recruitment was unclear. Of the 28 studies, three were conducted in central and eastern Europe, one in northern Europe, six in southern Europe, 17 in western Europe and one in Türkiye. The sampling dates ranged from 2015 to 2022.

Sex workers: Nine studies reported CT prevalence estimates for sex workers, with seven studies reporting estimates for female sex workers (n=3 878), five reporting estimates for male and/or transgender sex workers (n=272) and one reporting prevalence for mixed-gender sex workers (n=23). Of the nine studies, two were conducted in southern Europe, and seven in western Europe. The sampling dates ranged from 2014 to 2019.

PWID: No study was identified that reported a CT prevalence estimate for PWID.

Gonorrhoea

General population

Women: for the female general population, including proxy populations, eleven studies enrolling a total of 21 918 women, reported NG prevalence estimates. Among these eleven studies, three employed population-based probability sampling (n=3 668), and three enrolled women in antenatal care using convenience sampling (n = 13 239). Five studies were conducted among other female proxy populations using convenience sampling, including healthy women attending routine gynaecological check-ups, cervical and/or breast cancer screening, and female students (n = 5 011). Of the eleven studies, two were conducted in central and eastern Europe, three in southern Europe, and seven in western Europe. The sampling dates ranged from 2011 to 2017.

Young women: for women aged <25 years, 12 studies reported NG prevalence estimates, enrolling a total of 5 354 young women. Among these, two studies employed population-based probability sampling (n=1 099) and two were conducted among a representative convenience sample (n=578). Five studies enrolled young women in antenatal care using convenience sampling (n=1 577). Three studies were conducted among other young female proxy populations using convenience or cluster sampling, including female students. Of the twelve studies, seven were conducted in southern Europe, and three in western Europe. The sampling dates ranged from 2010 to 2021.

Men: five studies reported NG prevalence estimates for the male general population, including proxy populations, enrolling a total of 3 128 men. Among these five studies, three employed population-based probability sampling (n=2 455), and two enrolled male partners of women in antenatal care using convenience sampling (n=673). Of the five studies, one was conducted in central and eastern Europe, one in northern Europe, and three in western Europe. The sampling dates ranged from 2011 to 2017.

Young men: six studies reported NG prevalence estimates for men aged <25 years, enrolling a total of 2 231 young men. Among these, two studies employed population-based probability sampling (n=916), three were conducted among a convenience sample (n=1 061), and one used cluster sampling (n=236) to include male students. Two studies were conducted in southern Europe, one in central and eastern Europe, and three in western Europe. The sampling dates ranged from 2011 to 2022.

Populations of special interest

MSM: for MSM, 27 studies reported NG prevalence estimates, enrolling a total of 324 264 individuals. Of those, three studies only included HIV-positive MSM, five only MSM taking PrEP and five only MSM engaging in sexual behaviour defined by the study authors as 'high-risk'. Almost all studies were conducted in STI clinics (24), one study recruited participants via a dating app/social media, one recruited participants via an online sexual health service and in one study participant recruitment was unclear. Of the 27 studies, three were conducted in central and eastern Europe, one in northern Europe, six in southern Europe, 16 in western Europe and one in Türkiye. The sampling dates ranged from 2015 to 2022.

Sex workers: nine studies reported NG prevalence estimates for sex workers, with seven studies reporting estimates for female sex workers (n=3 878), five reporting estimates for male and/or transgender sex workers (n=258) and one reporting prevalence for mixed-gender sex workers (n=23). Of the nine studies, two were conducted in southern Europe, and seven in western Europe. The sampling dates ranged from 2014 to 2019.

PWID: No study was identified that reported an NG prevalence estimate for PWID.

Trichomoniasis

General population

Women: nine studies reported TV prevalence estimates for the female general population, including proxy populations, which enrolled a total of 31 728 women. Among these nine studies, one employed population-based probability sampling (n=593), and two enrolled women in antenatal care using convenience sampling (n=4 179). Six studies were conducted among other female proxy populations using convenience sampling, including healthy women attending routine gynaecological check-ups, cervical and/or breast cancer screening, or an outpatient clinic, as well as female students (n=26 956). Of the nine studies, two were conducted in central and eastern Europe, five in southern Europe and two in western Europe. The sampling dates ranged from 2010 to 2017.

Young women: five studies, enrolling a total of 1 823 young women, reported a TV prevalence estimate for women aged <25 years. Among these studies, one employed population-based probability sampling (n = 107). Two studies enrolled women in antenatal care using convenience sampling (n=735) and two were conducted among other female proxy populations, such as female students using convenience sampling (n=536) and women recruited in a community setting (n = 445). Of the five studies, one was conducted in central and eastern Europe, and four in southern Europe. The sampling dates ranged from 2013 to 2022.

Men: Three studies reported a TV prevalence estimate for the male general population, including proxy populations, which enrolled a total of 1 103 men. One study employed population-based probability sampling (n=430), and two enrolled male partners of women in antenatal care as proxy populations, using convenience sampling (n=673). The studies were conducted in northern Europe, central and eastern Europe, and western Europe. The sampling dates ranged from 2011 to 2017.

Young men: two studies reported a TV prevalence estimate for men aged <25 years, enrolling a total of 242 young men. One study employed population-based probability sampling (n=76), and the other one enrolled men in community settings (n=166). The two studies were conducted in central and eastern Europe and southern Europe. The sampling dates ranged from 2017 to 2022.

Populations of special interest

MSM: four studies reported TV prevalence estimates for MSM, enrolling a total of 4 131 individuals. Of those, one study only included HIV-positive MSM, and two only included MSM engaging in sexual behaviour defined by the study authors as 'high risk'. All four studies were conducted in STI clinics. Of the four studies, three were conducted in western Europe and one in Türkiye. The sampling dates ranged from 2016 to 2020.

Sex workers: two studies reported TV prevalence estimates for sex workers, both reporting estimates for female sex workers (n=786). Both studies were conducted in western Europe. The sampling dates ranged from 2015 to 2017.

PWID: No study was identified that reported a TV prevalence estimate for PWID.

Syphilis

General population

Women: eight studies reported TP prevalence estimates for the female general population, including proxy populations, which enrolled a total of 249 945 women. Of these studies, seven were conducted among women in antenatal care using convenience sampling (n=249 600). One study was conducted among healthy women attending routine gynaecological check-ups/screening (n=345). Of the eight studies, three were conducted in central and eastern Europe, three in southern Europe, one in western Europe and one in Türkiye. The sampling dates ranged from 2010 to 2021.

Young women: one study reported a TP prevalence estimate for women aged <25 years, enrolling a total of n=596 young women. It was conducted among young women in antenatal care, using convenience sampling. The study was conducted in southern Europe and sampled between 2011 to 2014.

Men: No studies reporting TP prevalence data among men in the general population and proxy populations were identified.

Young men: No study was identified that reported a TP prevalence estimate for men aged <25 years.

Populations of special interest

MSM: for MSM, 27 studies reported TP prevalence estimates, enrolling a total of 315 257 individuals. Of those, four studies only included HIV-positive MSM, five only MSM taking PrEP and four only MSM engaging in sexual behaviour defined by the study authors as 'high-risk'. Almost all studies were conducted in STI clinics (25), one study recruited participants via a dating app/social media and in one study participant recruitment was unclear. Of the 27 studies, six were conducted in central and eastern Europe, one in northern Europe, five in southern Europe, 13 in western Europe and two in Türkiye. The sampling dates ranged from 2015 to 2022.

Sex workers: eight studies reported TP prevalence estimates for sex workers, with seven studies reporting estimates for female sex workers (n=3 422), five studies reporting estimates for male and/or transgender sex workers (n=125) and one study reporting prevalence for mixed-gender sex workers (n=23). Of the eight studies, one was conducted in central and eastern Europe, two in southern Europe, and five in western Europe. The sampling dates ranged from 2003 to 2020.

PWID: Two studies reported TP prevalence estimates for PWID, enrolling a total of 483 male and female individuals. Both studies were conducted in central and eastern Europe. The sampling dates ranged from 2003 to 2018.

3.3 Chlamydia prevalence estimates

Table 6 below summarises the pooled chlamydia prevalence estimates for all study populations. Details of the studies included and the meta-analyses are provided in the sub-chapters below.

Table 6. Prevalence estimates for chlamydia in all study populations

Population	Sub-group	No. studies	No. individuals	Pooled estimate [%]	95%-CI lower	95%-CI upper	I^2
Women	combined[1]	23	37 114	2.76	1.65	3.87	98.92
Women	representative	5	4 544	1.99	0.78	3.21	86.78
Women	proxy (ANC)	6	26 179	1.83	0.99	2.67	95.93
Women	proxy (other)	12	6 391	3.79	1.64	5.94	98.28
Men	combined[1]	11	5 343	2.64	0.61	4.67	97.23
Men	representative	5	3 176	1.11	0.49	1.72	51.34
Men	proxy (other)	6	2 167	4.05	0.00	8.19	97.56
Young women	combined[1]	21	17 714	5.54	4.59	6.50	85.68
Young women	representative	7	2 953	4.44	3.21	5.68	58.00
Young women	proxy (ANC)	6	4 264	8.19	5.40	10.98	86.42
Young women	proxy (other)	8	10 497	5.16	3.69	6.63	88.96
Young men	combined[1]	11	3 573	3.32	2.04	4.59	80.69
Young men	representative	7	1 969	2.91	1.44	4.38	73.68
Young men	proxy (other)	4	1 604	4.14	1.53	6.74	84.76
MSM	visiting STI clinics	14	362 292	9.72	8.27	11.16	99.30
MSM	"high risk"	5	2 326	15.35	9.62	21.08	92.98
MSM	HIV	3	693	6.08	0.75	11.41	91.18
MSM	PrEP	5	2 071	9.57	7.11	12.02	70.45
Sex workers	female	7	3 878	5.50	4.31	6.69	54.15
Sex workers	male+trans	5	272	6.04	1.65	10.44	38.89

ANC: antenatal care; HIV: human immunodeficiency virus; PrEP: pre-exposure prophylaxis; STI: sexually transmitted infection.
1 prevalence estimates combining both, representative studies and studies in proxy populations.

General population

Chlamydia in women

Overall, the current burden of CT among women in the European region is estimated to be 2.76% (95% CI 1.65–3.87, see Table 7 and Figure 4). Based on studies among women representative for the general population only, prevalence is estimated to be 1.99% (95% CI 0.78–3.21, see Figure 5), with the lowest prevalence reported in Belgium (1.29%; 95% CI 0.23–2.35) and the highest in the Netherlands (5.60%; 95% CI 3.37–7.83). Among women in antenatal care, CT prevalence is estimated to be 1.83% (95% CI 0.99–2.67, see Figure 6) and ranges from 0.58% (95% CI 0.15–1.01) in Denmark to 3.40% (95% CI 2.76–4.04) in Italy. In other female proxy populations, including healthy women attending routine gynaecological check-ups, cervical and/or breast cancer screening, women attending GPs and healthcare website users, and female military personnel, pooled prevalence of CT is estimated to be 3.79% (95% CI 1.64–5.94, see Figure 7).

Table 7. Prevalence estimates for chlamydia in the general female population

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95% CI	RoB
EU/EFTA													
Representative													
Netherlands	Heijne 2019 [21]	11/2016	01/2017	probability	representative	18–34[3]	register	urine or genital	NAAT	410	5.60	3.38–7.84	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18–49[3]	register	urine	NAAT	635	1.60	0.61–2.54	low
Belgium	Fischer 2021_CT1 [23]	01/2019	12/2020	probability	representative	40.0	register	urine	NAAT	422	1.32	0.29–2.55	low
Belgium	Fischer 2021_CT2 [23]	01/2019	12/2020	probability	representative	42.0	register	urine	NAAT	412	1.29	0.16–2.27	low
Proxy ANC													
Italy	Foschi 2016 [24]	01/2011	05/2014	convenience	routine gynaecological check-up and ANC	36.1[2]	clinical	genital	NAAT	3 072	3.40	2.75–4.02	high
France	Peuchant 2015 [25]	01/2011	06/2011	convenience	ANC	30.0	clinical	genital	NAAT	1 004	2.50	1.53–3.45	medium
Croatia	Ljubin-Sternak 2017 [26]	03/2014	02/2015	convenience	routine gynaecological check-up and ANC	30.9[2]	outpatient	genital	NAAT	8665	1.90	1.62–2.19	high
Netherlands	Op de Coul 2021 [27]	NR/2012	NR/2016	convenience	ANC	27.0	clinical	genital	NAAT	548	1.80	0.70–2.95	high
Spain	Piñeiro 2016 [28]	01/2011	12/2014	convenience	ANC	33.0	clinical	urine	NAAT	11 687	1.00	0.82–1.18	high
Denmark	Skafte-Holm 2023 [29]	01/2015	01/2019	convenience	ANC	30.3	clinical	genital	NAAT	1 203	0.58	0.15–1.01	medium
Proxy other													
France	Berhonde 2015 [30]	01/2013	06/2014	convenience	pre-abortion consultation	21.0	clinical	genital	NAAT	2 824	11.00	9.86–12.17	high
Poland	Frej-Madrzak 2018 [31]	NR	NR	convenience	routine gynaecological check-up	25.0	outpatient	genital	NAAT	100	4.00	0.16–7.84	high
Poland	Frej-Madrzak 2020 [32]	01/2016	NR/NR	convenience	routine gynaecological check-up	24.9[2]	clinical	genital	NAAT	315	3.20	1.24–5.11	high
Slovakia	Babinská 2017 [33]	01/2011	12/2011	convenience	GP patients	33.5[2, 4]	outpatient	urine	NAAT	172	2.90	0.40–5.42	high
Greece	Parthenis 2018 [34]	10/2015	10/2016	convenience	routine cervical screening	33.2[2]	clinical	genital	NAAT	345	1.45	0.19–2.71	high

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95% CI	RoB
Italy	Camporiondo 2016 [35]	01/2013	12/2013	convenience	breast cancer screening	49.0	clinical	genital	NAAT	309	0.00	0.00–0.61	high
Poland	Korzeniewski 2019 [36]	10/2016	11/2016	convenience	military personnel	40.5[2, 5] 38.0[2,6]	community	urine	NAAT	16	0.00	0.00–10.97	high
Italy	Seraceni 2016 [37]	01/2009	12/2014	convenience	cervical cancer screening	43.0[2]	outpatient	genital	NAAT	921	0.00	0.00–0.20	high
France	Duron 2018 [38]	NR/2014	NR/2015	probability	military personnel	18–57[3]	register	genital	NAAT	141	7.10	2.86–11.33	high
Ireland	Hassan 2016 [39]	07/2014	01/2015	convenience	cervical cancer screening	33.0	outpatient	genital	NR	236	2.40	0.53–4.55	high
Non-EU/EFTA													
Representative													
UK	Sonnenberg 2013 [40]	09/2010	08/2012	probability	representative	16–44[3]	register	urine	NAAT	2 665	1.50	1.04–1.96	low
Proxy other													
Serbia	Jadranin 2019 [41]	01/2016	06/2016	convenience	military personnel	30.9[4]	community	genital	NAAT	50	14.00	4.38–23.62	
North Macedonia	Albig 2023 [42]	NR/2014	NR/2018	convenience	gynaecology and obstetrics department	NR	clinical	NR	NAAT	962	4.90	3.52–6.25	

ANC: antenatal care; GP: general practitioner; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; RoB: risk of bias.
1 median, unless indicated otherwise
2 mean
3 range
4 comprises men and women (not reported separately)
5 positive individuals only
6 negative individuals only

Figure 4. Pooled estimates for chlamydia in women, total

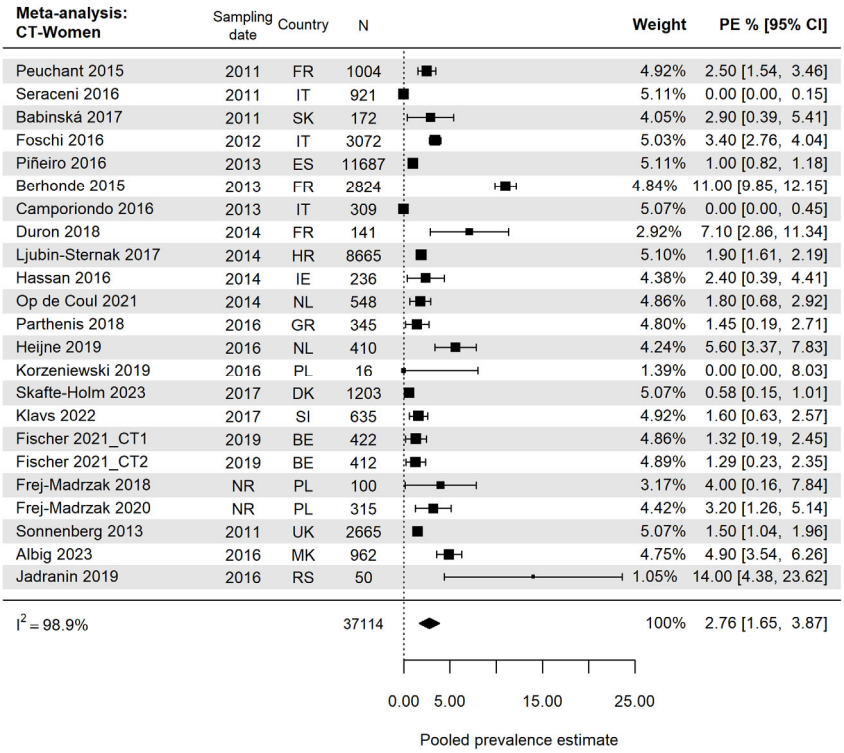


Figure 5. Pooled estimates for chlamydia in women, representative of the general population

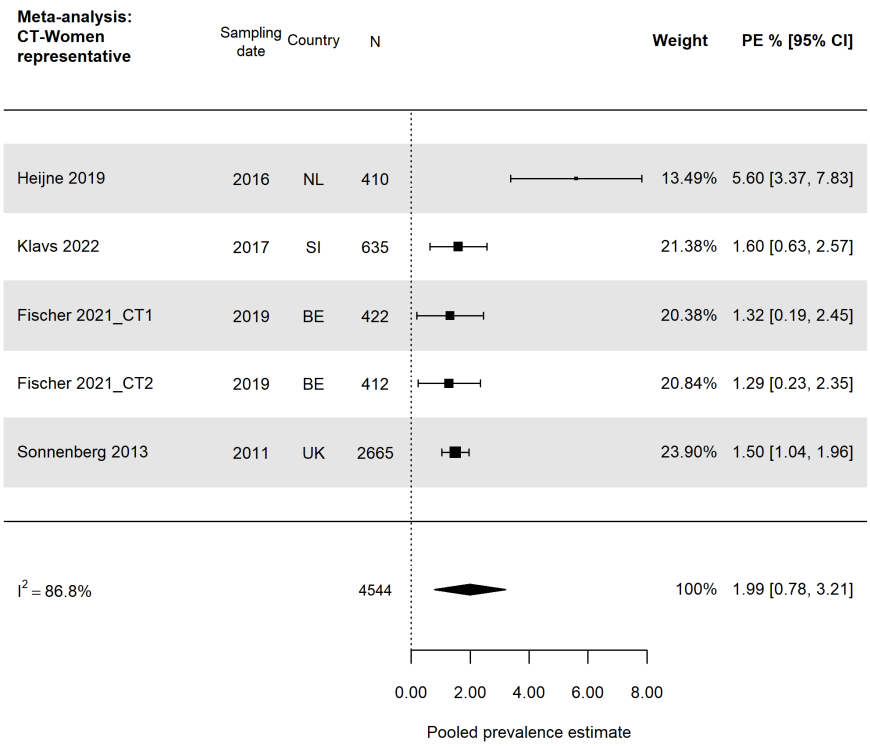


Figure 6. Pooled estimates for chlamydia in women in antenatal care (proxy population)

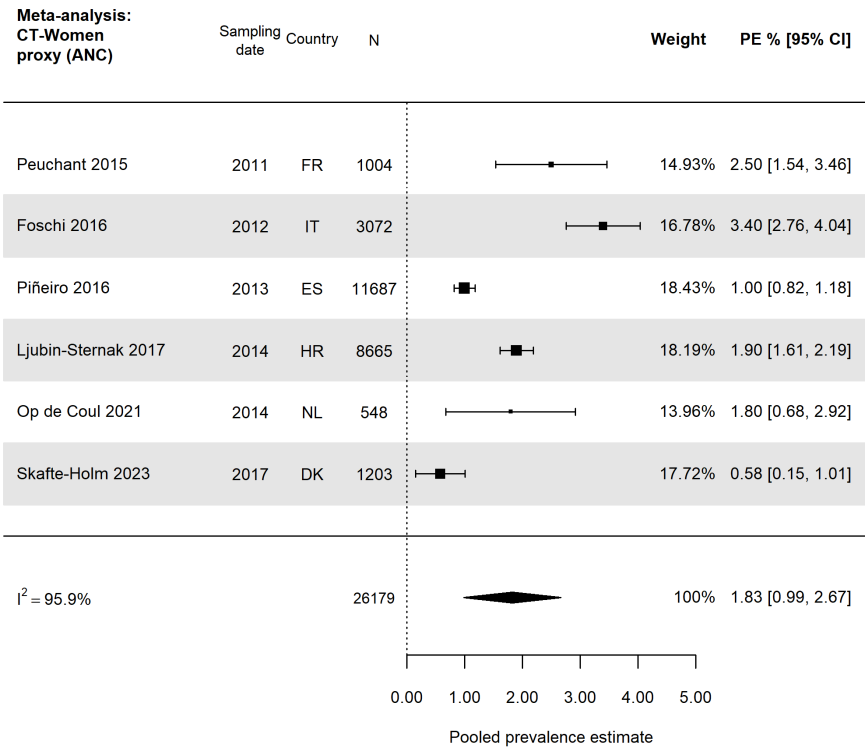
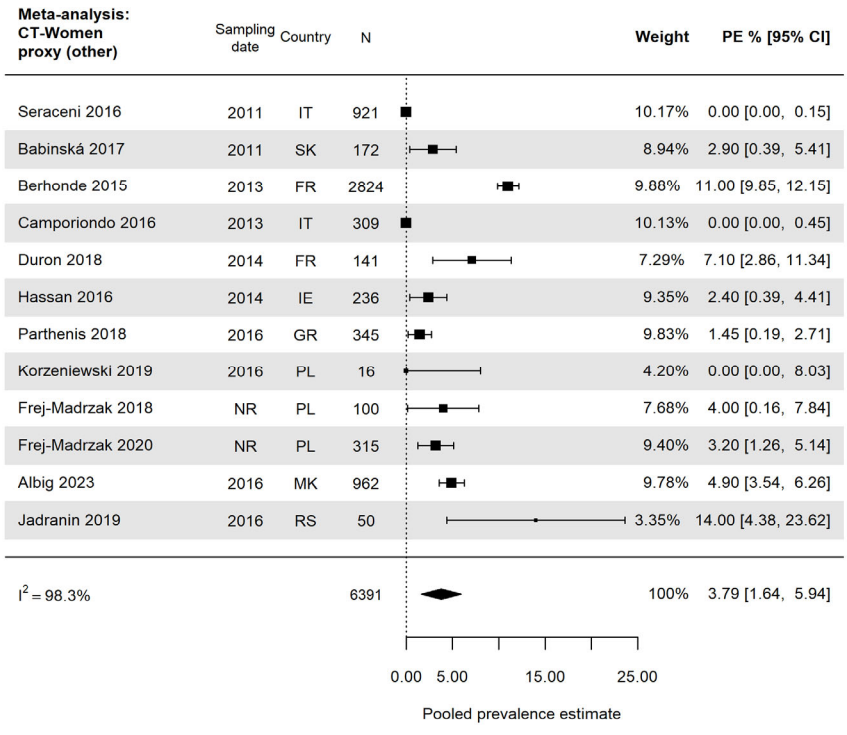


Figure 7. Pooled estimates for chlamydia in women, other proxy populations



Chlamydia in men

Overall, the current burden of CT among men in the European region is estimated to be 2.64% (95% CI 0.61–4.67, see Table 8 and Figure 8Figure). In men representative of the general population only, CT prevalence is estimated to be 1.11% (95% CI 0.49–1.72, see Figure), with the lowest prevalence reported in Slovenia (0.40%; 95% CI 0.00–1.01) and the highest in Belgium (2.25%; 95% CI 0.69–3.81). Based on studies among male proxy populations, including male patients attending GPs, military personnel, and partners of women in antenatal care, pooled CT prevalence is estimated to be 4.05% (95% CI 0.00–8.19, see Figure 10Figure).

Table 8. Prevalence estimates for chlamydia in the general male population

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	N tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Belgium	Fischer 2021_CT1 [23]	01/2019	12/2020	probability	representative	41.0	register	urine	NAAT	348	1.75	0.36–3.09	low
Belgium	Fischer 2021_CT2 [23]	01/2019	12/2020	probability	representative	44.0	register	urine	NAAT	351	2.25	0.72–3.84	low
Netherlands	Heijne 2019 [21]	11/2016	01/2017	probability	representative	18-34[3]	register	urine	NAAT	140	1.10	0.00–3.39	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18-49[3]	register	urine	NAAT	452	0.40	0.00–1.05	low
Proxy													
Slovakia	Babinská 2017 [33]	01/2011	12/2011	convenience	GP patients	33.5[2, 4]	outpatient	urine	NAAT	167	2.40	0.08–4.71	high
Netherlands	Op de Coul 2021 [27]	NR/2012	NR/2016	convenience	partners of women in ANC	29.0	clinical	urine	NAAT	425	2.20	0.75–3.49	high
Estonia	Tjagur 2021 [43]	01/2010	12/2012	convenience	partners of women in ANC	31.8	clinical	urine	NAAT	248	1.60	0.05–3.18	medium
Poland	Korzeniewski 2019 [36]	10/2016	11/2016	convenience	military personnel	40.5[2, 4, 5] 38.0[2, 4, 6]	community	urine	NAAT	237	0.84	0.00–2.01	high
France	Duron 2018 [38]	NR/2014	NR/2015	probability	military personnel	18–57[3]	register	urine	NAAT	784	3.00	1.86–4.27	high
Non-EU/EFTA													
Representative													
UK	Sonnenberg 2013 [40]	09/2010	08/2012	probability	representative	16–44[3]	register	urine	NAAT	1 885	1.10	0.64–1.59	low
Proxy													
Serbia	Jadranin 2019 [41]	01/2016	06/2016	convenience	military personnel	30.9[4]	community	genital	NAAT	306	15.70	11.61–19.76	medium

ANC: antenatal care; GP: general practitioner; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; RoB: risk of bias.
1 median, unless indicated otherwise
2 mean
3: range
4 comprises men and women (not reported separately)
5: positive individuals only
6 negative individuals only.

Figure 8. Pooled estimates for chlamydia in men, total

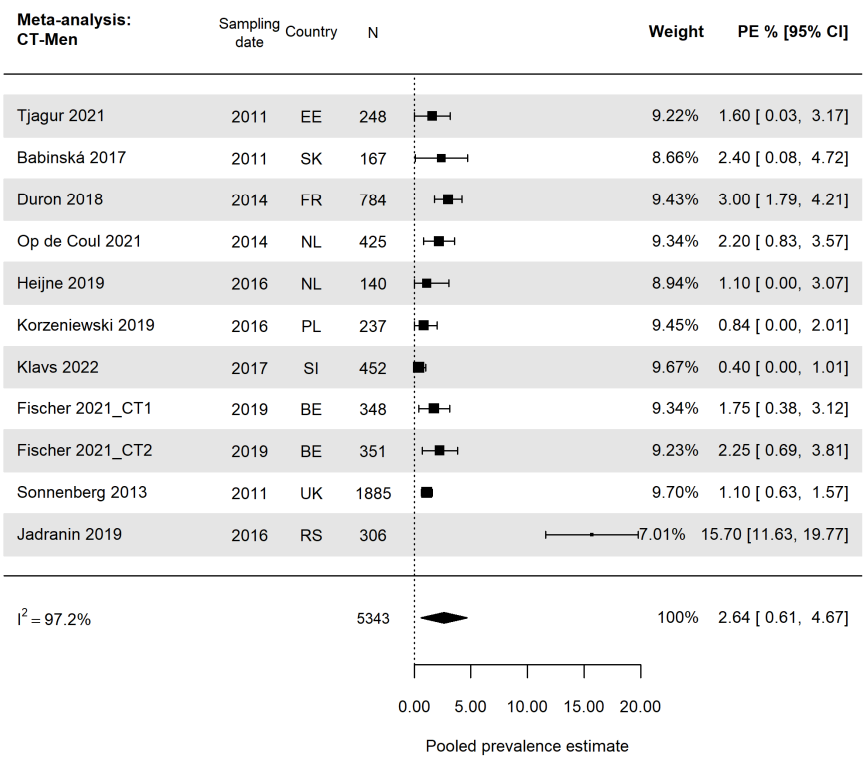


Figure 9. Pooled estimates for chlamydia in men, representative of the general population

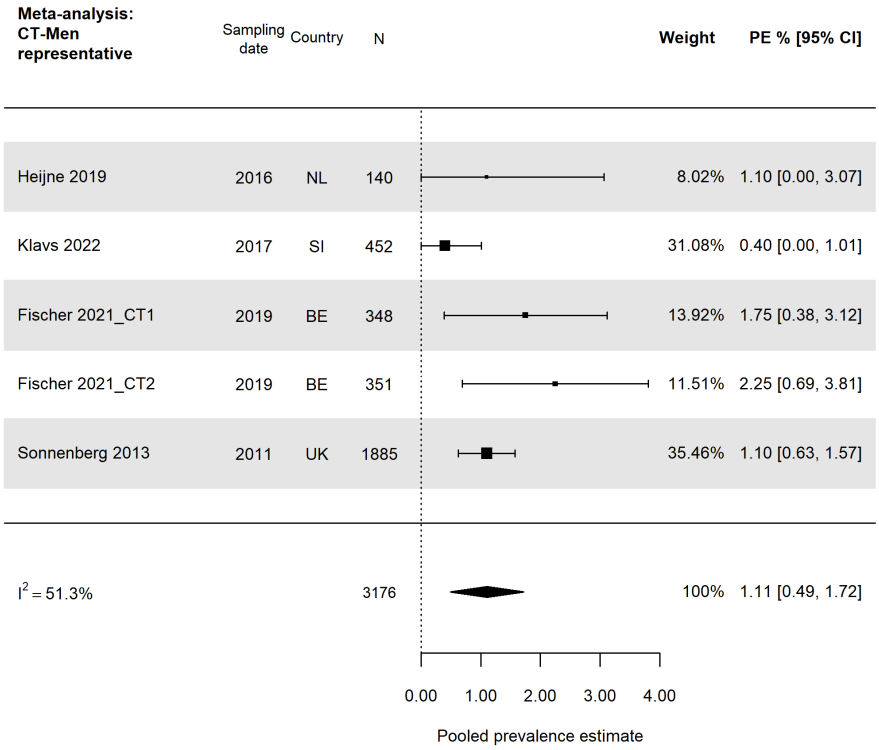
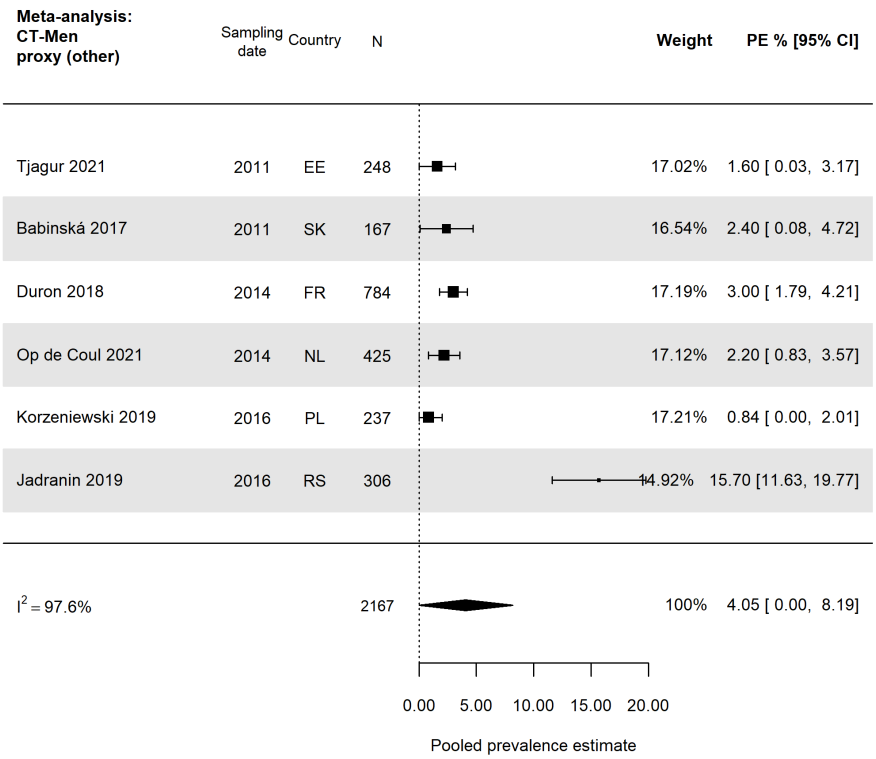


Figure 10. Pooled estimates for chlamydia in men, other proxy populations



Chlamydia in young women

In young women aged 15 to 24 years, the overall CT prevalence is estimated to be 5.54% (95% CI 4.59–6.50, see Table and Figure). When considering only studies among young women representative of the general population of young people, pooled prevalence is estimated to be 4.44% (95% CI 3.21–5.68, see Figure 12), with the lowest prevalence reported in Croatia (2.90%; 95% CI 0.81–4.99) and the highest in Germany (7.50%; 95% CI 3.02–11.98). Among young women in antenatal care, pooled prevalence is estimated to be 8.19% (95% CI 5.40–10.98, see Figure), and among other young female proxy populations, 5.16% (95% CI 3.69–6.63, see Figure Figure).

Chlamydia in young men

Among young men, overall CT prevalence is estimated to be 3.32% (95% CI 2.04–4.59, see Table and Figure). When considering only studies among young men representative of the general population of young people, pooled prevalence is estimated to be 2.91% (95% CI 1.44–4.38, see Figure), with the lowest prevalence reported in Croatia (1.00%; 95% CI 0.00–2.36) and the highest in Germany (8.20%; 95% CI 3.52–12.88). Among other young male proxy populations, pooled prevalence is estimated to be 4.14% (95% CI 1.53–6.74, see Figure 17Figure 1).

Table 9. Prevalence estimates for chlamydia in young women

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Germany	Skaletz-Rorowski 2021 [44]	12/2016	07/2018	convenience	representative	23.0[4]	community	any-site (AR/UG/PH)	NAAT	133	7.50	3.04–12.00	high
Spain	Reyes-Lacalle 2022 [45]	01/2018	11/2019	convenience	representative	21.1[5] 20.1[2]	community	genital	NAAT	391	5.60	3.34–7.91	high
Spain	Espies 2023 [46]	09/2021	05/2022	convenience	representative	20.0[2, 4]	community	urine	NAAT	445	6.90	4.60–9.33	high
Poland	Czerwinski 2018 [47]	09/2012	06/2015	probability	representative	18.7[2, 4]	community	urine	NAAT	635	4.10	2.55–5.64	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18-24[3]	register	urine	NAAT	112	3.60	0.13–7.01	low
Croatia	Bozicevic 2023 [48]	11/2021	01/2022	probability, internet-based	representative	21.7[2, 4]	panel database	urine	NAAT	245	2.90	0.77–4.94	medium
Proxy ANC													
Spain	Dorado Criado 2021 [49]	11/2018	06/2019	convenience	ANC	22.0	clinical	urine	NAAT	136	18.40	11.87–24.89	high
France	Peuchant 2015 [25]	01/2011	06/2011	convenience	ANC	18-24[3]	clinical	genital	NAAT	165	7.90	3.77–11.99	high
Spain	Muñoz Santa 2022 [50]	01/2019	10/2020	convenience	ANC	< 25.0	NR	genital	NAAT	599	7.20	5.11–9.25	high
Spain	Piñeiro 2016 [28]	01/2011	12/2014	convenience	ANC	< 25.0	clinical	urine	NAAT	596	6.40	4.41–8.34	high
Ireland	O'Higgins 2017 [51]	12/2011	12/2013	convenience	ANC	21.8[2]	clinical	genital	NAAT	2 687	5.60	4.71–6.45	high
Spain	Lopez-Corbeto 2021 [52]	01/2016	06/2016	NR	ANC	< 25.0	clinical	urine	NAAT	81	9.80	3.38–16.37	high
Proxy other													
Spain	Yuguero 2021 [53]	12/2017	12/2018	convenience	emergency room	22.0[4]	clinical	urine	NAAT	162	8.00	3.84–12.21	high
Norway	Gravningen 2013 [54]	NR/2009	NR/NR	convenience	students	17.0[4]	community	urine	NAAT	564	7.30	5.13–9.41	medium
Portugal	Silva 2013 [55]	NR	NR	convenience	students	18.0[2]	community	genital	NAAT	432	6.90	4.55–9.34	high
Italy	Panatto 2015 [56]	01/2010	06/2010	convenience	routine gynaecological check-up	16-26[3]	outpatient	genital	NAAT	566	5.80	3.90–7.76	high

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
Italy	Matteelli 2016 [57]	11/2012	03/2013	convenience	students	18.4[2]	community	urine	NAAT	1 297	1.90	1.18–2.68	high
Italy	Bianchi 2016 [58]	12/2008	12/2012	targeted	HPV vaccinated	18.8	trial	genital	NAAT	591	4.90	3.17–6.65	high
Finland	Adhikari 2022 [59]	NR/2010	NR/2014	targeted	HPV vaccinated	18.5-22[3]	trial	genital	NAAT	6 618	3.70	3.25–4.16	medium
Non-EU/EFTA													
Representative													
UK	Sonnenberg 2013 [40]	09/2010	08/2012	probability	representative	16-24[3]	register	urine	NAAT	992	3.10	2.04–4.21	low
Proxy other													
United Kingdom	Oakeshott 2019 [60]	09/2016	10/2016	cluster	students	17.9[4]	community	genital	NAAT	267	5.60	2.86–8.38	high

ANC: antenatal care; AR: ano-rectal; GP: general practitioner; HPV: human papillomaviruses; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; PH: pharyngeal; RoB: risk of bias; UG: uro-genital.

1 median, unless indicated otherwise
2 mean
3 range
4 comprises men and women (not reported separately)
5 positive individuals only.

Figure 11. Pooled estimates for chlamydia in young women, total

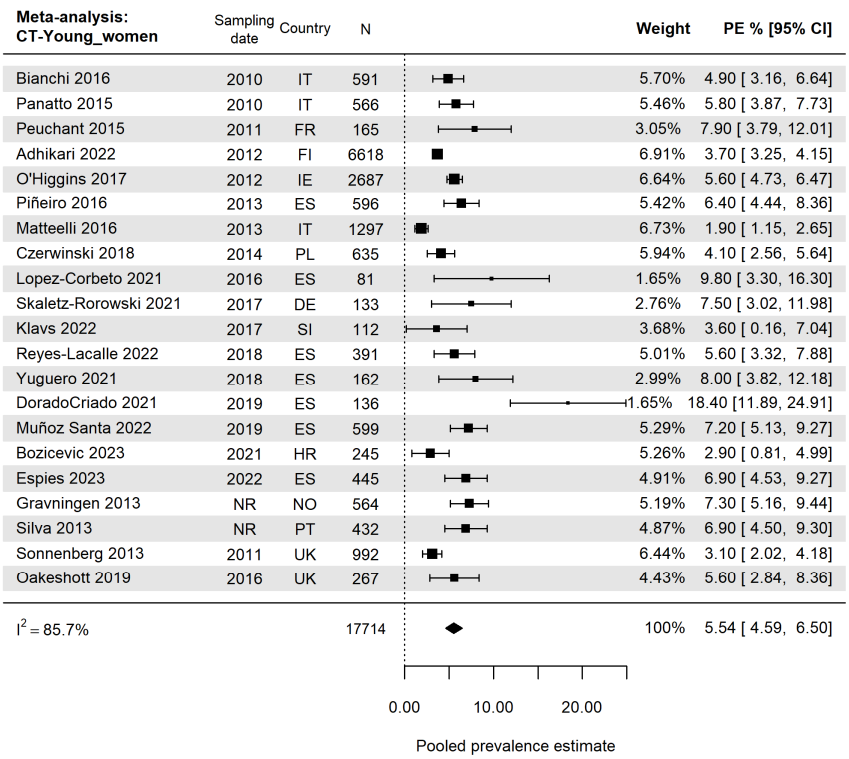


Figure 12. Pooled estimates for chlamydia in young women, representative of the general population

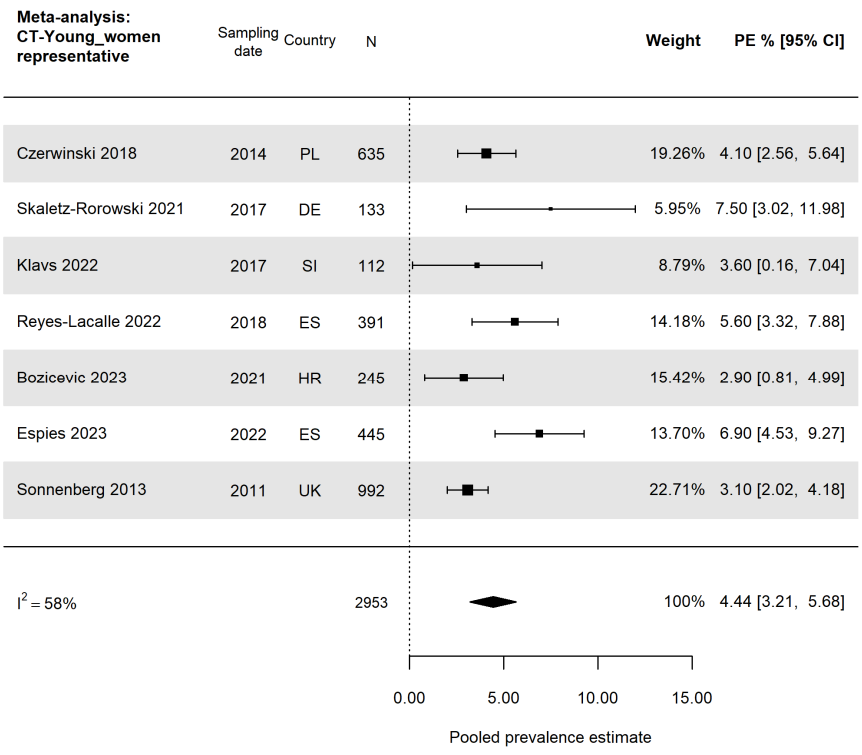


Figure 13. Pooled estimates for chlamydia in young women in antenatal care (proxy population)

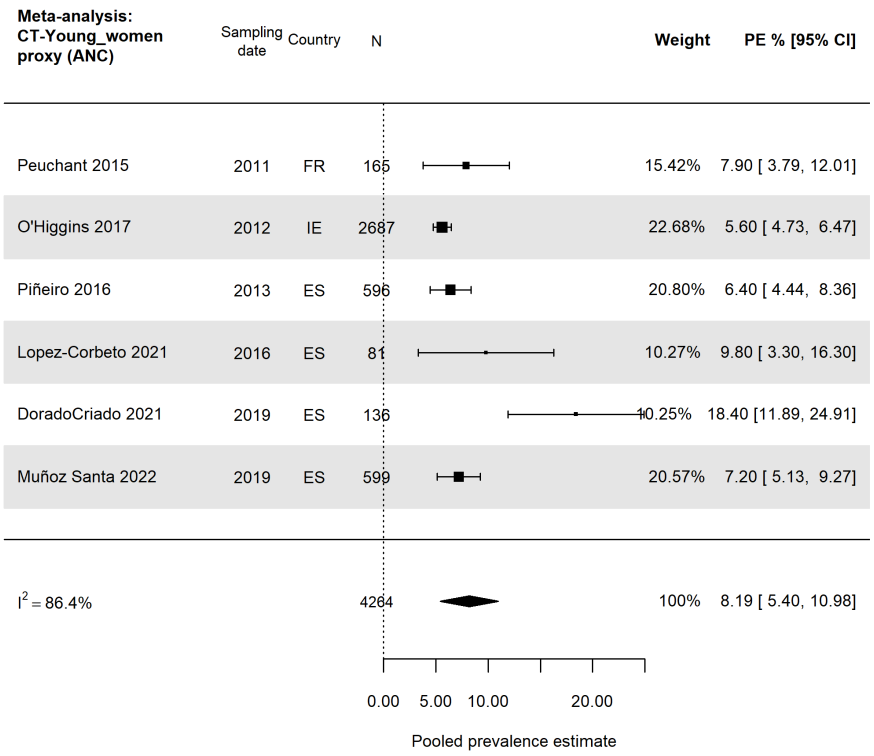


Figure 14. Pooled estimates for chlamydia in young women, other proxy populations

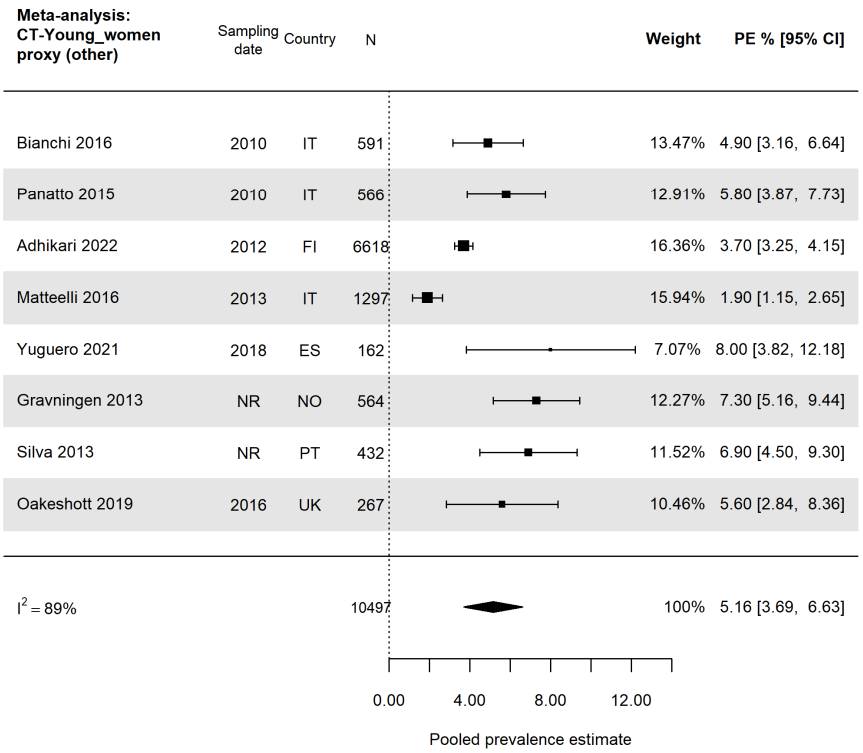


Table 10. Prevalence estimates for chlamydia in young men

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Germany	Skaletz-Rorowski 2021 [44]	12/2016	07/2018	convenience	representative	23.0[4]	community	any-site (AR/UR/PH)	NAAT	133	8.20	3.59–12.95	high
Spain	Reyes-Lacalle 2022 [45]	01/2018	11/2019	convenience	representative	21.1[4, 5] 20.1[2]	community	urine	NAAT	232	5.20	2.32–8.02	high
Spain	Espies 2023 [46]	09/2021	05/2022	convenience	representative	20.0[2, 4]	community	urine	NAAT	166	1.20	0.00–2.86	high
Poland	Czerwinski 2018 [47]	09/2012	06/2015	probability	representative	18.7[2, 4]	community	urine	NAAT	315	4.10	1.93–6.32	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18-49[3]	register	urine	NAAT	80	2.50	0.00–5.92	low
Croatia	Bozicevic 2023 [48]	11/2021	01/2022	probability, internet-based	representative	21.7[2, 4]	panel database	urine	NAAT	203	1.00	0.00–2.34	medium
Proxy other													
Spain	Yuguero 2021 [53]	12/2017	12/2018	convenience	emergency room	22.0[4]	clinical	urine	NAAT	136	6.60	2.44–10.80	high
Norway	Gravningen 2013 [54]	NR/2009	NR/NR	convenience	students	17.0[4]	community	urine	NAAT	470	3.60	1.93–5.31	medium
Italy	Matteelli 2016 [57]	11/2012	03/2013	convenience	students	18.5[2]	community	urine	NAAT	762	1.40	0.60–2.29	high
Non-EU/EFTA													
Representative													
UK	Sonnenberg 2013 [40]	09/2010	08/2012	probability	representative	16-24[3]	register	urine	NAAT	840	2.30	1.26-3.27	low
Proxy other													
United Kingdom	Oakeshott 2019 [60]	09/2016	10/2016	cluster	students	17.9[4]	community	urine	NAAT	236	6.80	3.57-9.99	high

AR: ano-rectal; GP: general practitioner; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; PH: pharyngeal; RoB: risk of bias; UG: uro-genital.

1 median, unless indicated otherwise
2 mean
3 range
4 comprises men and women (not reported separately)
5 positive individuals only.

Figure 15. Pooled estimates for chlamydia in young men, total

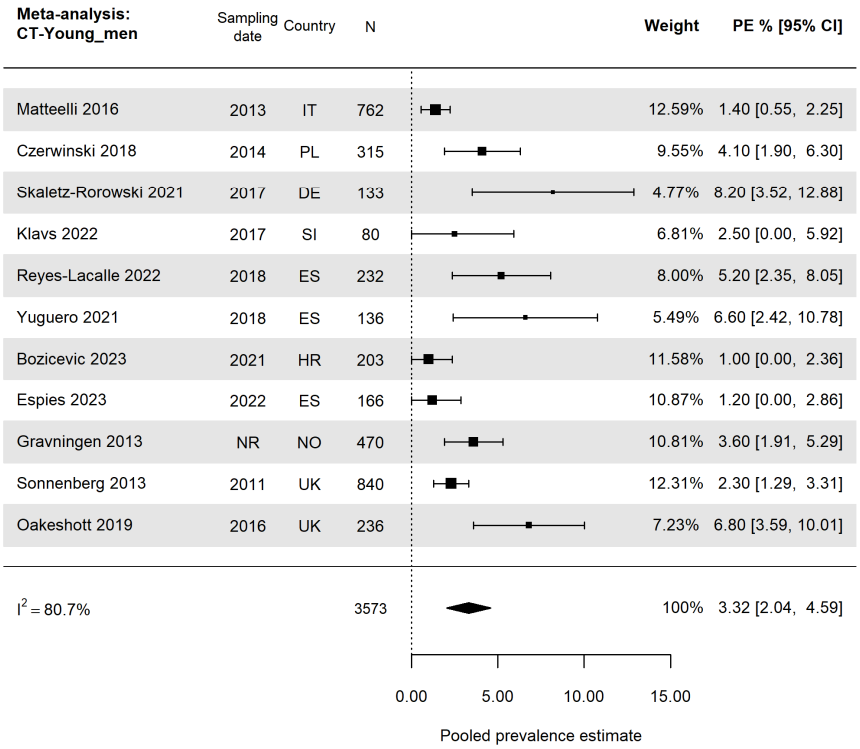


Figure 16. Pooled estimates for chlamydia in young men, representative of the general population

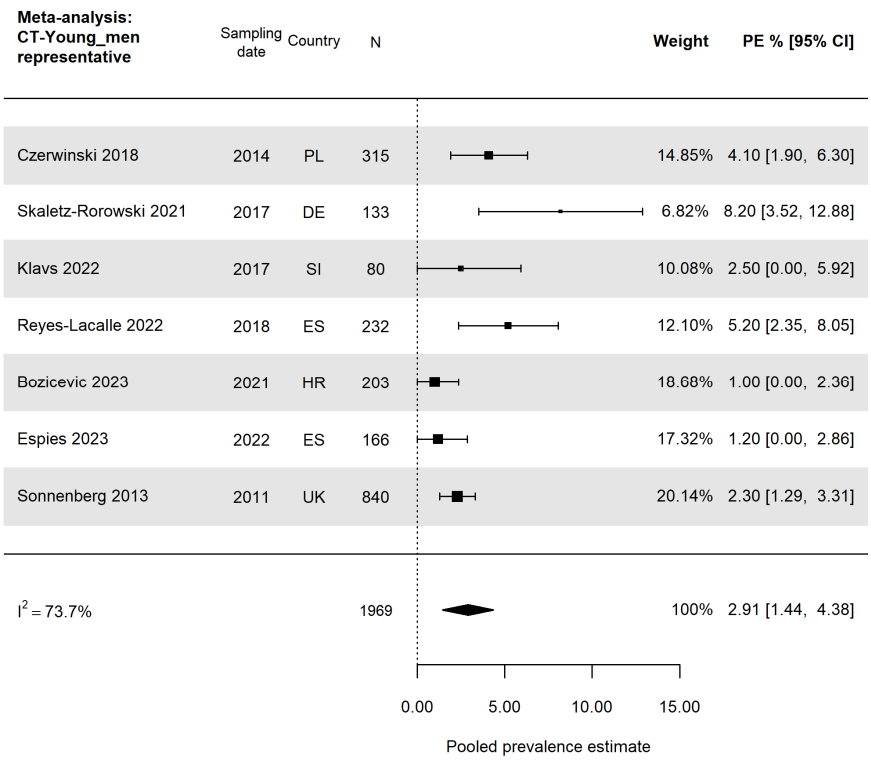
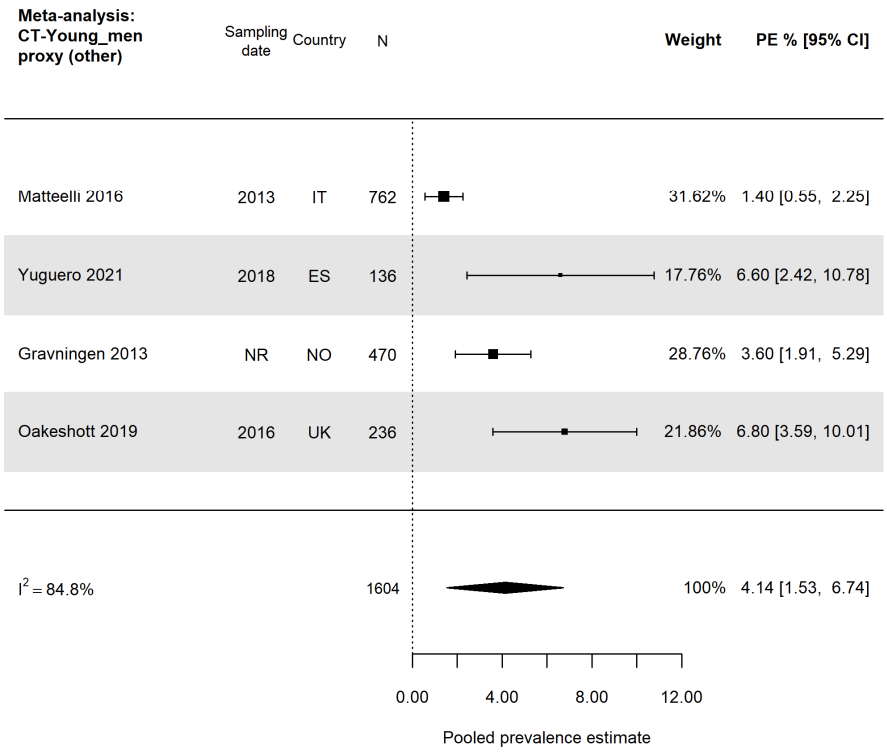


Figure 117. Pooled estimates for chlamydia in young men, other proxy populations



Populations of special interest

Chlamydia in men who have sex with men

The prevalence of CT is estimated to be 9.72% (95% CI 8.27–11.16) in MSM visiting STI clinics (see Figure 18), 6.08% (95% CI 0.75–11.41) in MSM living with HIV (see Figure 19), 9.57% (95% CI 7.11–12.02) in MSM on PrEP (see Figure 20) and 15.35% (95% CI 9.62–21.08) in MSM engaging in 'high-risk' sexual behaviour, see Figure 41).

Table 11. Prevalence estimates for chlamydia in MSM

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
MSM visiting STI clinics													
Netherlands	Druckler 2018 [61]	07/2016	12/2016	convenience	35.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	4 925	9.90	9.07–10.74	medium
Netherlands	Evers 2022 [62]	NR/2016	NR/2017	convenience	37.0	STI/GUM clinic	ano-rectal	UG, PH, any-site	NAAT	16 1275	8.00	7.87–8.13	medium
France	Rondeau 2019 [63]	04/2016	12/2016	convenience	NR	STI/GUM clinic	ano-rectal	UR	NAAT	111	17.10	10.11–24.12	medium
Spain	Ayerdi Aguirrebengoa 2020 [64]	01/2016	12/2018	convenience	18.1[2]	STI/GUM clinic	any-site (AR/UG/PH)	UG, PH, AR	NAAT	149	10.10	5.24–14.90	medium
Portugal	Ribeiro 2019 [65]	01/2016	05/2018	convenience	31.0	STI/GUM clinic	any-site (AR/UG/PH)	UG, PH, AR	NR	1 489	7.59	6.24–8.93	high
Netherlands	Achterbergh 2020 [66]	09/2017	12/2017	convenience	35.0	STI/GUM clinic	any-site (AR/UG/PH)	UG, PH, AR	NAAT	4 460	9.70	8.84–10.58	medium
Netherlands	Van Aar 2020 [67]	01/2017	12/2017	convenience	36.0	STI/GUM clinic	ano-rectal	none	NAAT	43 873	7.10	6.86–7.34	medium
Iceland	Hilmarsdottir 2021 [68]	10/2018	01/2019	convenience	NR	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	52	11.50	2.85–20.22	high
Spain	Hoyos-Mallecot 2022 [69]	11/2016	11/2019	convenience	34.0	STI/GUM clinic	any-site (AR/UR/PH)	none	NAAT	6 304	9.00	8.29–9.70	medium
Germany	Jansen 2020 [70]	02/2018	07/2018	convenience	39.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	2 203	9.90	8.65–11.14	medium
France	Rahib 2022 [71]	04/2018	06/2018	convenience	30.0	dating app/social media	any-site (AR/UR/PH)	UR, PH, AR	NAAT	1 930	9.30	7.98–10.57	high
MSM HIV													
Germany	Spinner 2018 [72]	02/2016	08/2016	convenience	43.2	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT	296	8.80	5.56–12.01	high
France	Farfour 2021 [73]	09/2017	12/2017	convenience	47.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	291	8.96	5.66–12.21	high
MSM PrEP													
Belgium	Reyniers 2018 [74]	09/2015	06/2016	convenience	38.0	unclear	any-site (AR/UR/PH)	UR, PH, AR	NAAT	196	11.70	7.23–16.24	medium
Italy	Nozza 2022 [75]	05/2017	05/2022	convenience	34.5	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT	624	10.30	7.88–12.64	medium
Switzerland	Hovaguimian 2022 [76]	04/2019	01/2020	convenience	40.0	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT	710	11.30	8.94–13.59	medium

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method	No. tested	PE (%)	95%-CI	RoB
Bulgaria	Pakov 2022 [77]	10/2020	08/2022	convenience	33.0	STI/GUM clinic	urine or urogenital	none	NAAT	410	5.60	3.38–7.84	high
Austria	Chromy 2023 [78]	07/2020	12/2021	convenience	33.8	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	131	10.00	4.80–15.04	high
MSM 'high-risk'													
Switzerland	Schmidt 2020 [79]	01/2016	06/2017	convenience	33.0	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT	779	8.70	6.75–10.71	high
Italy	Foschi 2018 [80]	01/2017	11/2017	convenience	35.5[2]	STI/GUM clinic	ano-rectal	UR, PH	NAAT	165	25.40	18.81–32.10	high
Germany	Streeck 2022 [81]	06/2018	03/2019	convenience	33.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	1 043	12.80	10.82–14.88	medium
Poland	Szetela 2023_hr [82]	12/2019	12/2020	convenience	NR	STI/GUM clinic	any-site (AR/UG/PH)	UG, PH, AR	NAAT	103	20.58	12.61–28.17	high
Germany	Weidlich 2023 [83]	04/2021	07/2022	convenience	37.0	STI/GUM clinic	any-site (AR/UR/UG/ PH)	UR/UG, PH, AR	NAAT	236	12.70	8.46–16.96	high
MSM other													
Poland	Szetela 2023_lr[4] [82]	12/2019	12/2020	convenience	NR	STI/GUM clinic	any-site (AR/UG/PH)	UG, PH, AR	NAAT	64	7.93	1.24–14.39	high
Spain	De La Mora 2022[5] [84]	03/2018	05/2019	convenience	39.0[2]	STI/GUM clinic	any-site or pooled (AR/UR/PH)	none	NAAT	157	10.00	5.46–14.92	high
Non-EU/EFTA													
MSM visiting STI clinics													
UK	Charin 2023 [85]	12/2016	01/2020	convenience	27.0	online sexual health service	any-site (AR/UR/PH)	UR, PH, AR	NAAT	5 051	5.90	5.25–6.55	high
UK	Ogaz 2019 [86]	01/2017	12/2017	convenience	NR	STI/GUM clinic	any-site	AR	NAAT	128 772	12.10	11.92–12.28	medium
Georgia	Kevlishvili 2023 [87]	NR/2019	NR/2019	convenience	18-65[3]	STI/GUM clinic	any-site or pooled (AR/UG)	none	IF+NAAT	1 698	15.70	13.99–17.46	medium
MSM HIV													
Türkiye	Taspinar Sen 2023 [88]	08/2018	02/2020	convenience	38.4[2]	STI/GUM clinic	urine	none	NAAT	106	0.94	0.00–2.78	high

AR: ano-rectal swab; GUM: genitourinary medicine; NAAT: nucleic acid amplification test; NR: not reported; PH: pharyngeal swab; RoB: risk of bias; STI: sexually transmitted infection; UG: urogenital swab; UR: urine.
1 median, unless indicated otherwise; 2 mean; 3 range; 4 MSM reporting sexual behaviour that was classified as 'low-risk' by the study authors; 5 MSM engaging in chemsex.

Figure 18. Pooled estimates for chlamydia in MSM visiting STI clinics

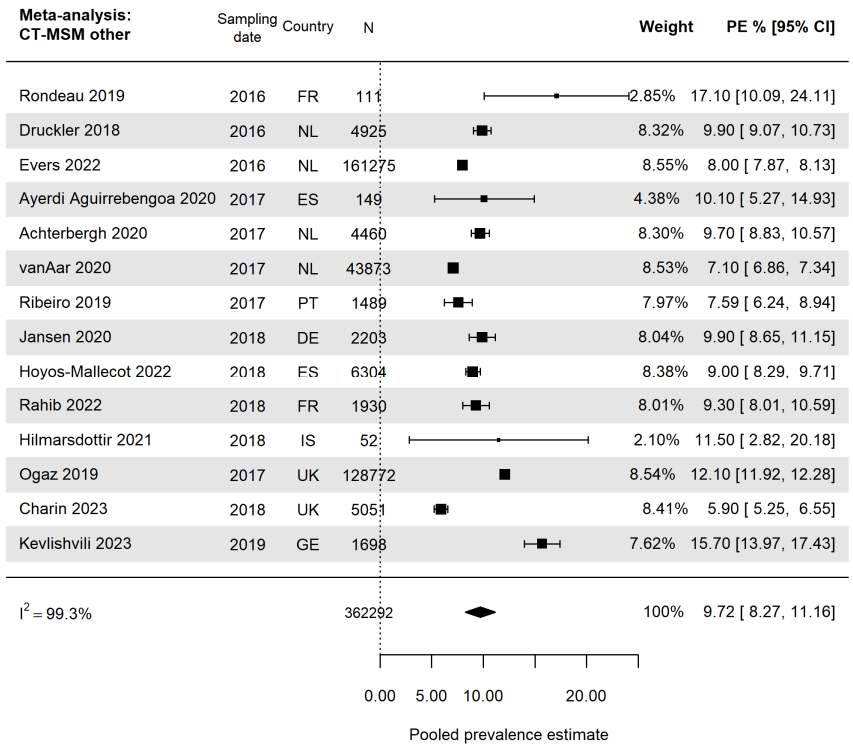


Figure 19. Pooled estimates for chlamydia in MSM living with HIV

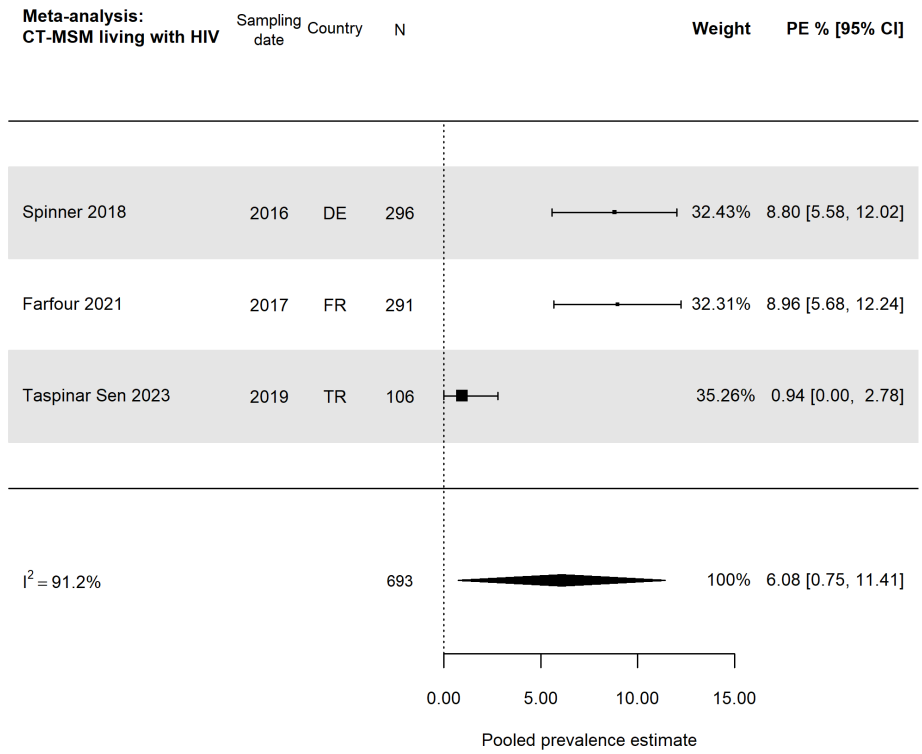


Figure 20. Pooled estimates for chlamydia in MSM on PrEP

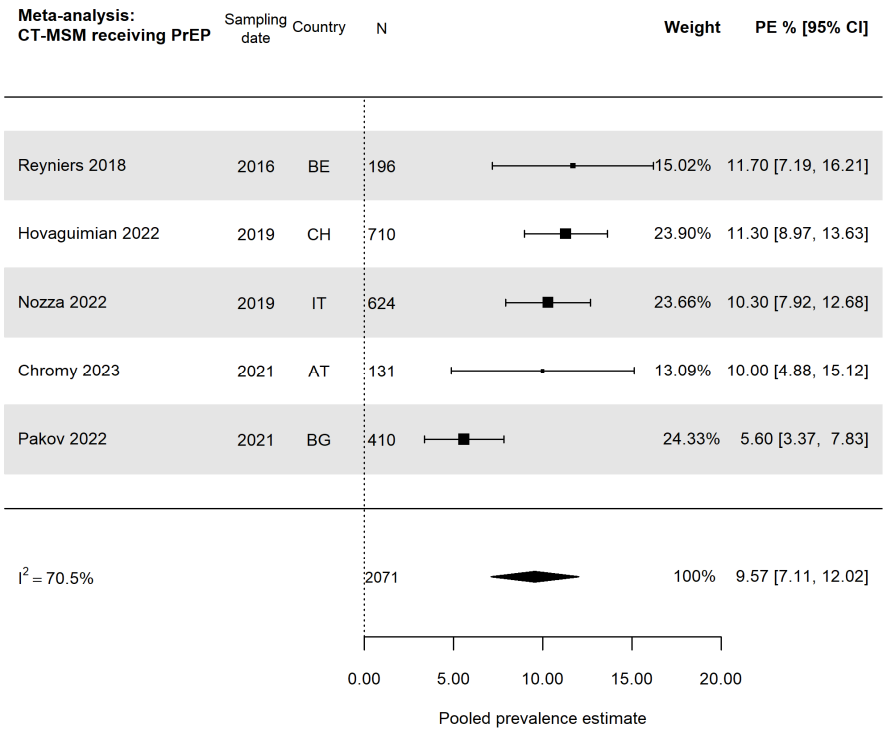
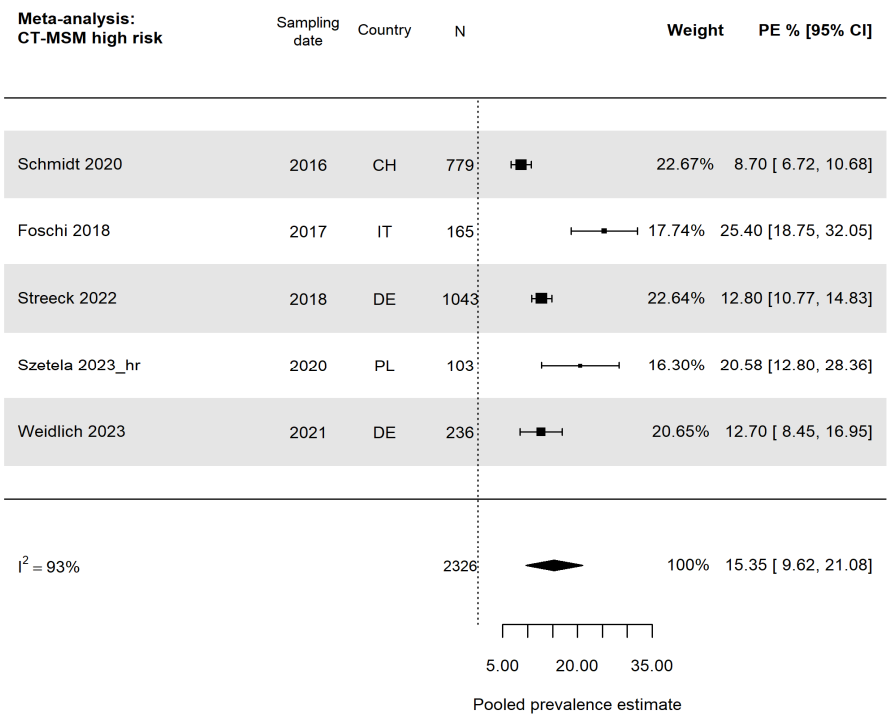


Figure 21. Pooled estimates for chlamydia in MSM high risk



Chlamydia in sex workers

Among female sex workers, pooled CT prevalence is estimated to be 5.50% (95% CI 4.31–6.69) and 6.04% (95% CI 1.65–10.44) among male and transgender sex workers (see Table 12, Figure 62 and Figure 63). One conference abstract was identified reporting a CT prevalence of 82.60% (95% CI 67.12–98.10) among mixed gender sex workers in the UK.

Chlamydia in people who inject drugs

No studies reporting CT prevalence data for PWID were identified.

Table 12. Prevalence estimates for chlamydia in sex workers

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Female sex workers													
Portugal	Almeida 2020_f [89]	09/2015	09/2016	convenience	36.2[2, 4]	outreach	any-site (AR/UR/PH)	UR, PH, AR	NAAT	74	2.70	0.00–6.40	high
Belgium	Coorevits 2018 [90]	06/2015	06/2016	convenience	33.0[2]	outreach	urine or genital	none	NAAT	299	9.00	5.78–12.28	high
Netherlands	Druckler 2020_f [91]	01/2014	12/2015	convenience	28.0	health centre	ano-rectal	UG, PH, AR	NAAT	1 217	6.10	4.74–7.42	medium
Netherlands	van Dulm 2020 [92]	01/2016	09/2016	convenience	28.0	community	genital	UG, PH, AR	NAAT	1 213	4.10	3.00–5.24	medium
Switzerland	Vernazza 2020 [93]	01/2016	06/2017	convenience	31.0	STI clinic	pooled (AR/UG/PH)	none	NAAT	490	6.30	4.17–8.48	medium
Belgium	Verougstraete 2020 [94]	02/2018	07/2019	convenience	NR	community	any-site (AR/UG/PH)	UG, PH, AR	NAAT	489	5.10	3.16–7.06	high
Switzerland	Vu 2020 [95]	04/2015	12/2016	convenience	18-60[3]	community	urine	none	NAAT	96	6.25	1.41–11.09	high
Male and transgender sex workers													
Portugal	Almeida 2020_m [89]	09/2015	09/2016	convenience	36.2[2, 4]	outreach	any-site (AR/UR/PH)	UR, PH, AR	NAAT	12	0.00	0.00–14.30	high
Portugal	Almeida 2020_t [89]	09/2015	09/2016	convenience	36.2[2, 4]	outreach	any-site (AR/UR/PH)	UR, PH, AR	NAAT	14	0.00	0.00–12.42	high
Spain	Ferrer 2022 [96]	10/2017	12/2018	convenience	33.0[2]	community	any-site (AR/UR/PH)	UR, PH, AR	NAAT	147	10.30	5.31–15.10	high
Netherlands	Druckler 2020_m [91]	01/2014	12/2015	convenience	28.0	health centre	urine	UG, PH, AR	NAAT	84	6.00	0.89–11.01	medium
Netherlands	Druckler 2020_t [91]	01/2014	12/2015	convenience	39.0	health centre	ano-rectal	UG, PH, AR	NAAT	15	13.30	0.00–30.54	medium
Non-EU/EFTA													
Mixed gender sex workers													
UK	Sultan 2021 [97]	NR	NR	convenience	NR	outreach	any-site (AR/UG/PH)	UG, PH, AR	NAAT	23	82.60	67.12–98.10	high

AR: ano-rectal; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; PH: pharyngeal; RoB: risk of bias; UG: uro-genital; UR: urine.

1 median, unless indicated otherwise; 2 mean; 3 range; 4 comprises male, female, and transgender sex workers (not reported separately).

Figure 22. Pooled estimates for chlamydia in female sex workers

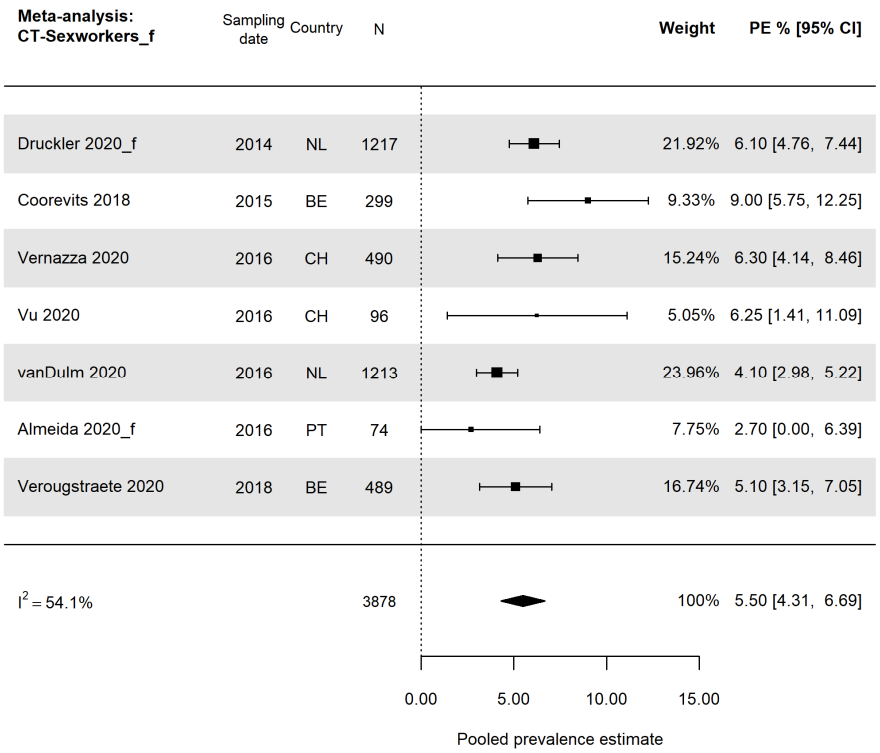
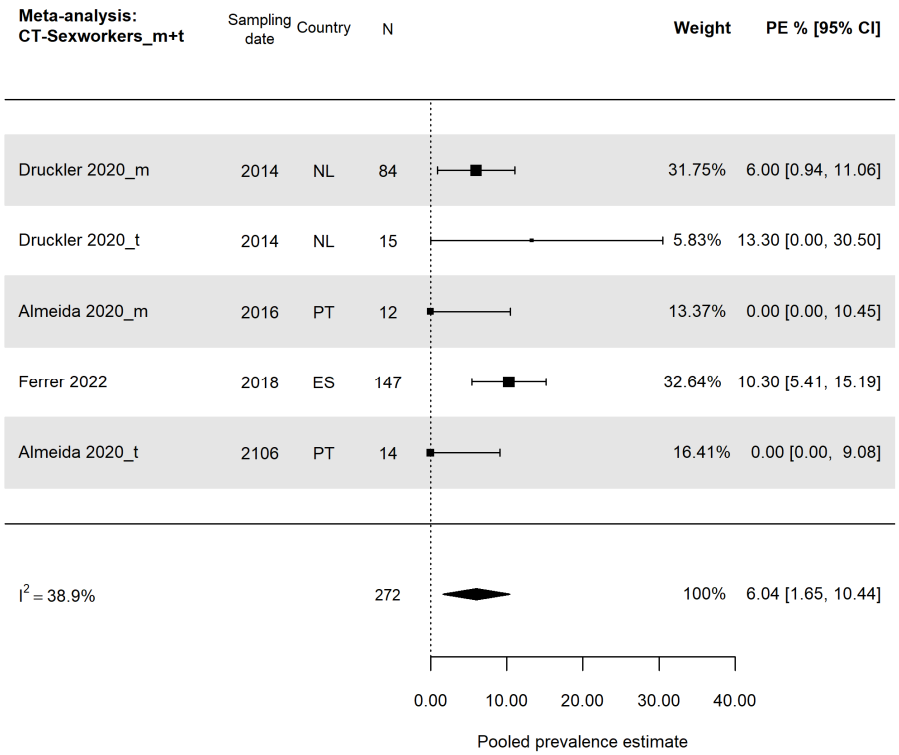


Figure 23. Pooled estimates for chlamydia in male and transgender sex workers



3.4 Gonorrhoea prevalence estimates

The following table summarises the pooled gonorrhoea prevalence estimates for all study populations. Details of the studies included and the meta-analyses are provided in the sub-chapters below.

Table 13. Prevalence estimates for gonorrhoea in all study populations

Population	Sub-group	No. studies	No. individuals	Pooled estimate [%]	95%-CI lower	95%-CI upper	I^2
Women	combined[1]	11	21 918	0.24	0.00	0.50	95.34
Women	representative	3	3 668	0.07	0.00	0.18	0.00
Women	proxy (ANC)	3	13 239	0.02	0.00	0.15	61.99
Women	proxy (other)	5	5 011	0.53	0.00	1.11	87.09
Men	combined[1]	5	3 128	0.10	0.00	0.22	0.00
Men	representative	3	2 455	0.08	0.00	0.21	0.00
Men	proxy (other)	2	673	0.91	0.00	2.86	87.12
Young women	combined[1]	12	5 354	0.51	0.04	0.99	92.60
Young women	representative	4	1 677	0.20	0.00	0.51	17.10
Young women	proxy (ANC)	5	1 577	1.42	0.00	2.97	89.71
Young women	proxy (other)	3	2 100	0.26	0.00	0.88	80.90
Young men	combined[1]	6	2 213	0.07	0.00	0.21	0.00
Young men	representative	4	1 215	2.00	0.00	5.78	97.22
Young men	proxy (other)	2	998	0.45	0.00	1.66	68.03
MSM	visiting STI clinics	13	318 954	10.46	6.94	13.97	99.86
MSM	"high risk"	5	2 326	14.37	7.76	20.98	95.27
MSM	HIV	3	693	4.74	0.75	8.72	86.78
MSM	PrEP	5	2 071	8.99	5.31	12.66	89.01
Sex workers	female	7	3 878	2.22	0.63	3.80	93.59
Sex workers	male+trans	5	258	6.36	0.00	14.25	78.97

ANC: antenatal care; HIV: human immunodeficiency virus; PrEP: pre-exposure prophylaxis; STI: sexually transmissible infection.

1 prevalence estimates combining both, representative studies and studies in proxy populations.

General population

Gonorrhoea in women

Overall prevalence of NG was estimated to be 0.24% (95% CI 0.00–0.50) among women (see Table 14 and Figure 24). Based on studies among women representative of the general population only, NG prevalence is estimated to be 0.07% (95% CI 0.00–0.18, see Figure 25), with the lowest prevalence reported in Slovenia (0.00%; 95% CI 0.00–0.23) and the highest in the UK (0.10%; 95% CI 0.00–0.23). Among women in antenatal care, prevalence of NG is estimated to be 0.02% (95% CI 0.00–0.15, see Figure 26), with the highest prevalence reported in the Netherlands (0.40%; 95% CI 0.00–0.90). In female proxy populations, including healthy women attending routine gynaecological check-ups, cervical and/or breast cancer screening, women attending GPs and healthcare website users, and female military personnel, pooled prevalences for NG is estimated to be 0.53% (95% CI 0.00–1.11, see Figure 27).

Table 14. Prevalence estimates for gonorrhoea in the general female population

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Netherlands	Heijne 2019 [21]	11/2016	01/2017	probability	representative	18-34[3]	register	urine or genital	NAAT	410	0.00	0.00–0.46	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18-49[3]	register	urine	NAAT	593	0.00	0.00–0.32	low
Proxy ANC													
Netherlands	Op de Coul 2021 [27]	NR/2012	NR/2016	convenience	ANC	27.0	clinical	genital	NAAT	548	0.40	0.00–0.87	high
France	Peuchant 2015 [25]	01/2011	06/2011	convenience	ANC	30.0	clinical	genital	NAAT	1 004	0.00	0.00–0.19	medium
Spain	Piñeiro 2016 [28]	01/2011	12/2014	convenience	ANC	33.0	clinical	urine	NAAT	11 687	0.00	0.00–0.02	high
Proxy other													
France	Berhonde 2015 [30]	01/2013	06/2014	convenience	pre-abortion consultation	21.0	clinical	genital	NAAT	2 824	1.30	0.89–1.73	high
Italy	Camporiondo 2016 [35]	01/2013	12/2013	convenience	breast cancer screening	49.0	clinical	genital	NAAT	309	0.00	0.00–0.61	high
Portugal	Silva 2021 [98]	01/2010	12/2016	convenience	students	22.0[2]	community	genital	NAAT	680	1.30	0.46–2.18	high
Ireland	Hassan 2016 [39]	07/2014	01/2015	convenience	cervical cancer screening	33.0	outpatient	genital	NR	236	0.00	0.00–0.80	high
Non-EU/EFTA													
Representative													
UK	Sonnenberg 2013 [40]	09/2010	08/2012	probability	representative	16-44[3]	register	urine	NAAT	2 665	0.10	0.00–0.24	low
Proxy other													
North Macedonia	Albig 2023 [42]	NR/2014	NR/2018	convenience	gynaecology and obstetrics department	NR	clinical	NR	NAAT	962	0.20	0.00–0.50	high

ANC: antenatal care; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; RoB: risk of bias

1 median, unless indicated otherwise
2 mean
3 range.

Figure 24. Pooled estimates for gonorrhoea in women, total

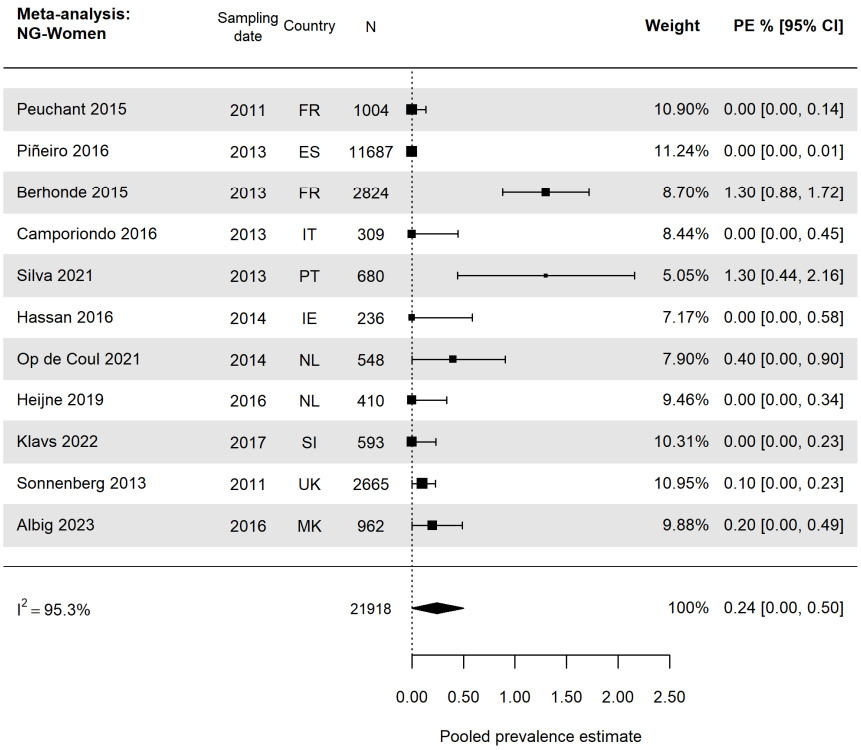


Figure 25. Pooled estimates for gonorrhoea in women, representative of the general population

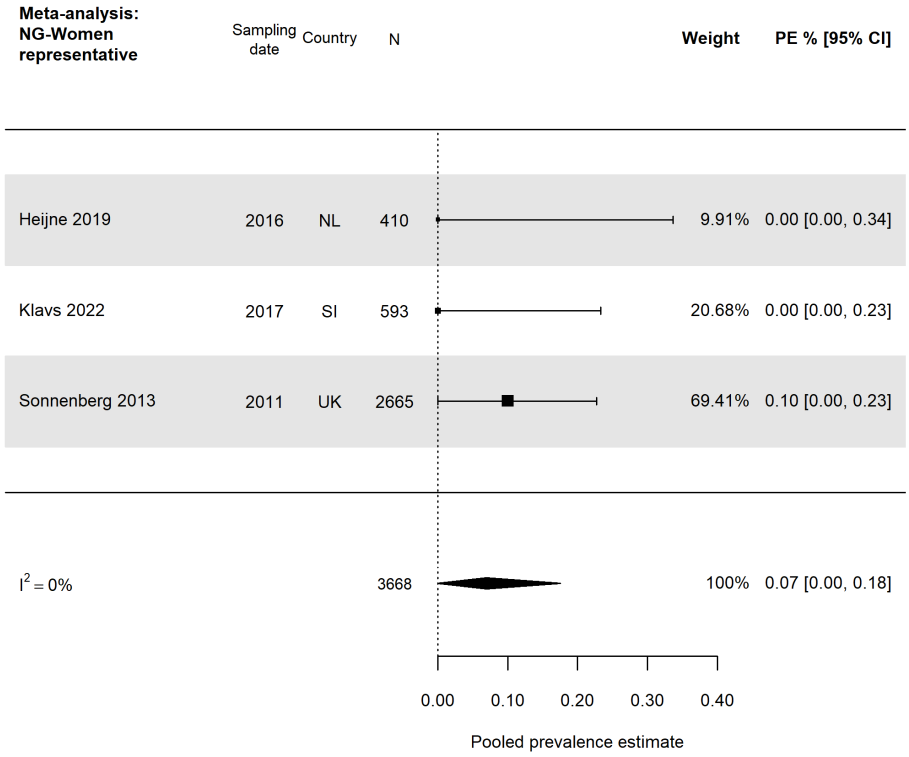


Figure 26. Pooled estimates for gonorrhoea in women in antenatal care (proxy population)

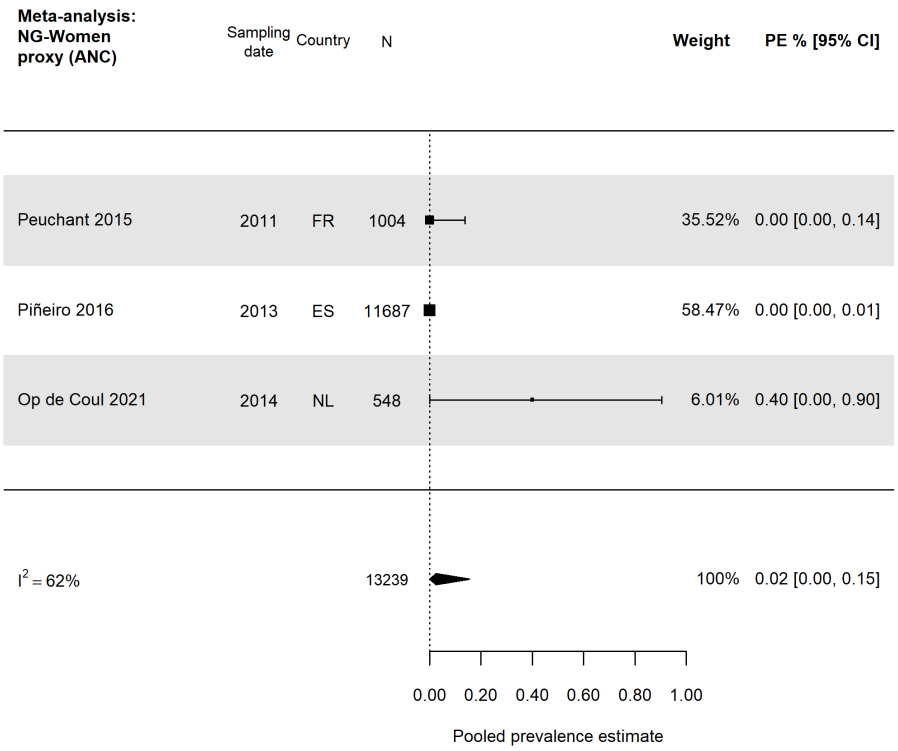
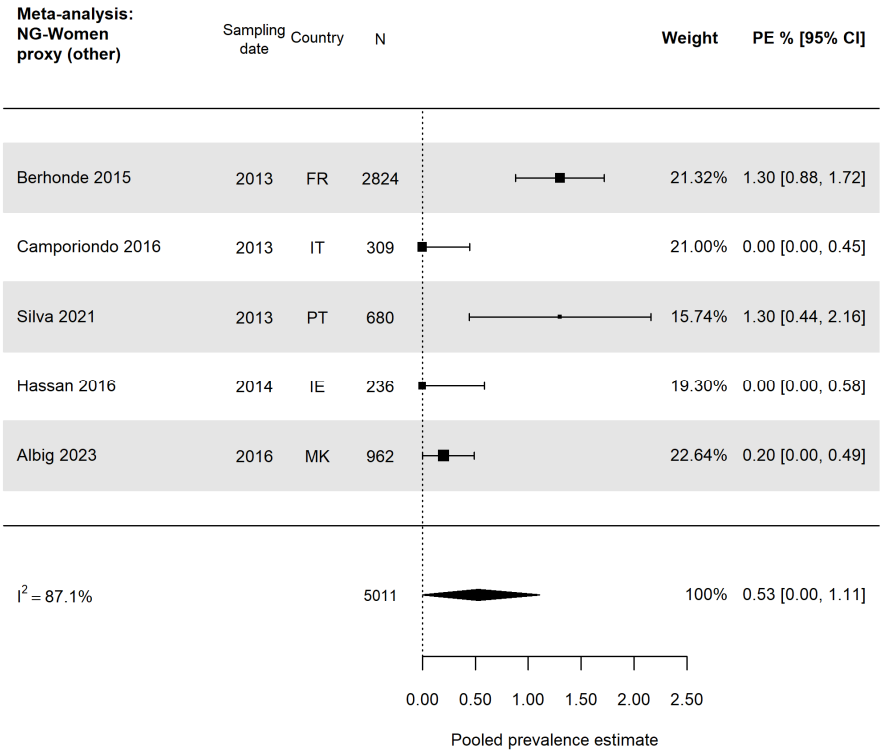


Figure 27. Pooled estimates for gonorrhoea in women, other proxy populations



Gonorrhoea in men

Overall prevalence of NG was estimated to be 0.10% (95% CI 0.00–0.22) among men (see Table 15 and Figure 28Figure). In men representative of the general population only, NG prevalence is estimated to be 0.08% (95% CI 0.00–0.21, see Figure 29), with the highest prevalence in the UK (0.10%; 95% CI 0.00–0.25). Based on two studies among male proxy populations, including male partners of women in ANC, pooled NG prevalence is estimated to be 0.91 (95% CI 0.00–2.86, see Figure 30).

Table 15. Prevalence estimates for gonorrhoea in the general male population

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Netherlands	Heijne 2019 [21]	11/2016	01/2017	probability	representative	18–34[3]	register	urine	NAAT	140	0.00	0.00–1.34	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18–49[3]	register	urine	NAAT	430	0.00	0.00–0.44	low
Proxy other													
Netherlands	Op de Coul 2021 [27]	NR/2012	NR/2016	convenience	partners of women in ANC	29.0	clinical	urine	NAAT	425	2.00	0.59–3.17	high
Estonia	Tjagur 2021 [43]	01/2010	12/2012	convenience	partners of women in ANC	31.8	clinical	urine	NAAT	248	0.00	0.00–0.76	medium
Non-EU/EFTA													
Representative													
UK	Sonnenberg 2013 [40]	09/2010	08/2012	probability	representative	16–44[3]	register	urine	NAAT	1 885	0.10	0.00–0.25	low

ANC: antenatal care; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; RoB: risk of bias.

1 median, unless indicated otherwise
2 mean
3 range.

Figure 28. Pooled estimates for gonorrhoea in men, total

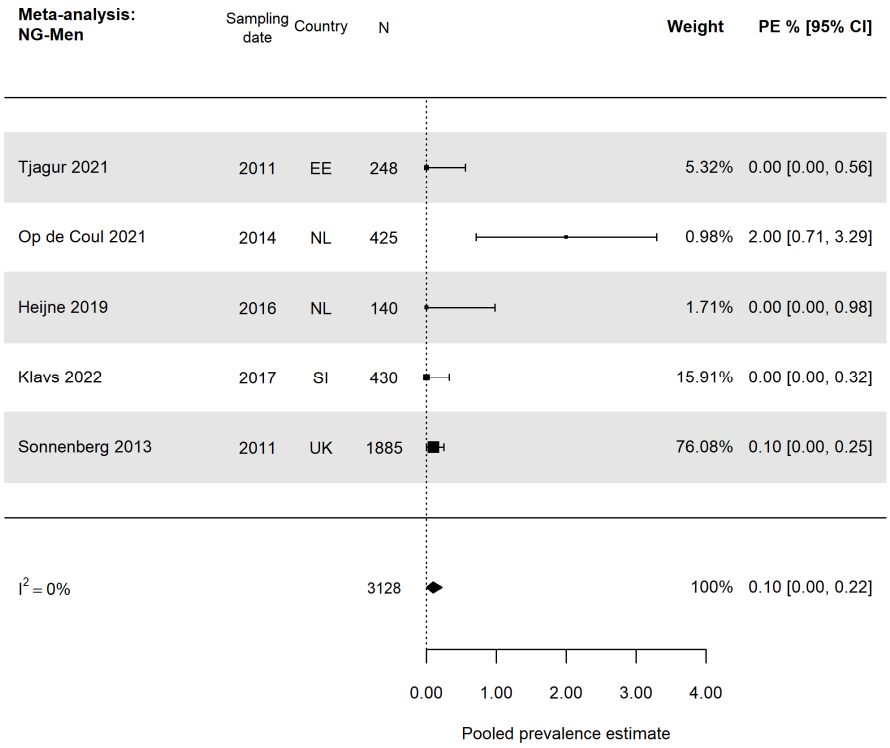


Figure 29. Pooled estimates for gonorrhoea in men, representative of the general population

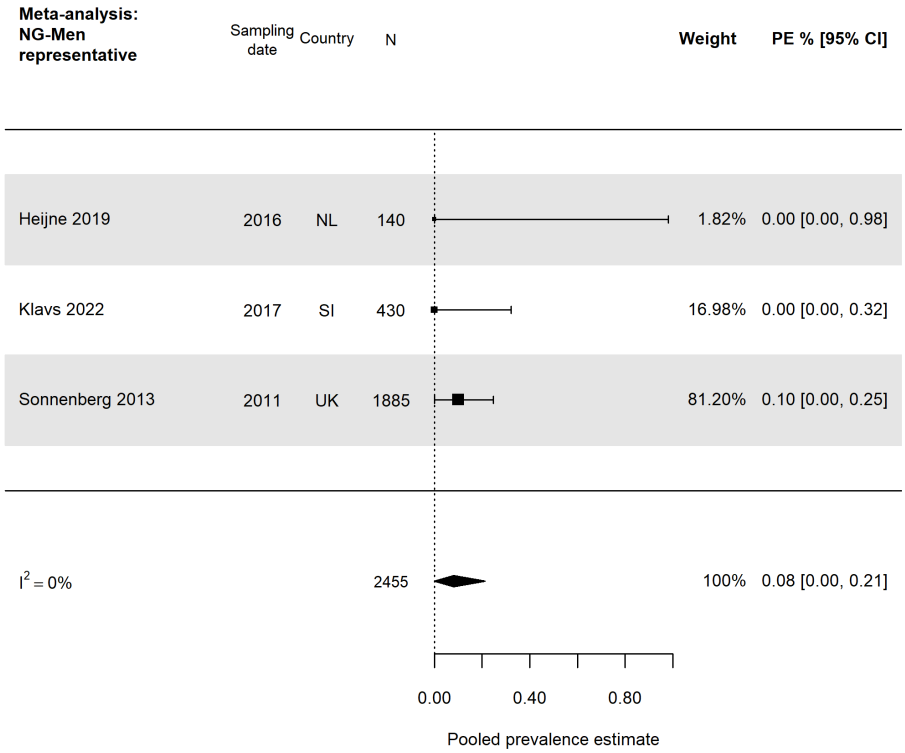
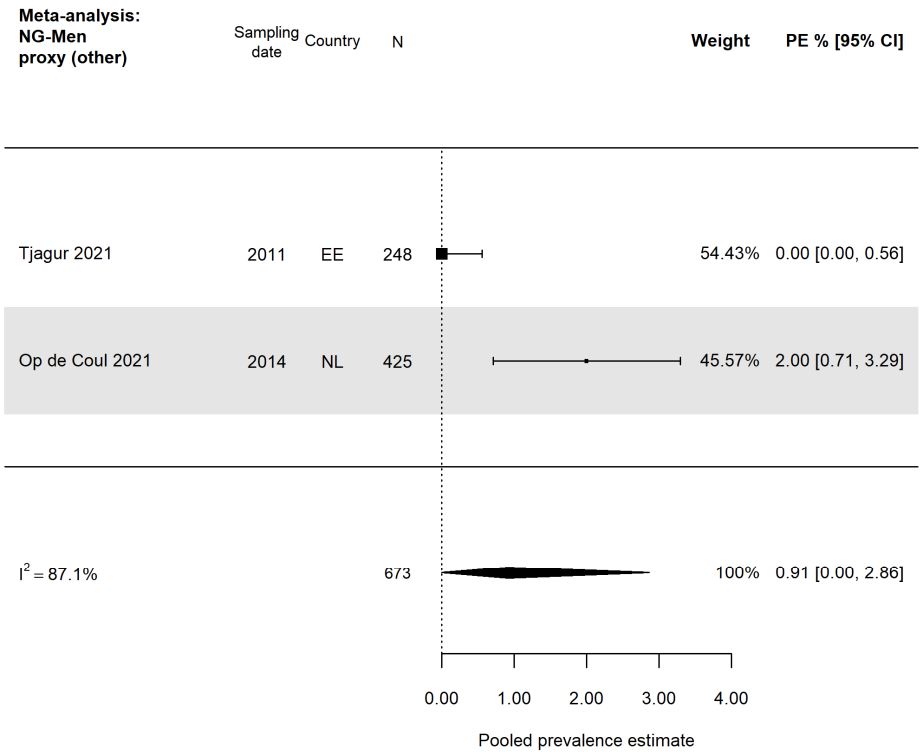


Figure 30. Pooled estimates for gonorrhoea in men, other proxy populations



Gonorrhoea in young women

Overall NG prevalence, based on studies among young women, is estimated to be 0.51% (95% CI 0.04–0.99, see Table 16 and Figure 31). When considering only studies among young women representative of the general population of young people, pooled prevalence is estimated to be 0.20% (95% CI 0.00–0.51, see Figure 32), with the lowest prevalence reported Slovenia (0.00%; 95% CI 0.00–1.28) and the highest in Germany (1.50%; 95% CI 0.00–3.57). Among young women in antenatal care, pooled NG prevalence is estimated to be 1.42% (95% CI 0.00–2.97, see Figure 33), and among other young female proxy populations, 0.26% (95% CI 0.00–0.88, see Figure 34Figure).

Table 16. Prevalence estimates for gonorrhoea in young women

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Spain	Espies 2023 [46]	09/2021	05/2022	convenience	representative	20.0[2, 4]	community	urine	NAAT	445	0.45	0.00–1.07	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18–24[3]	register	urine	NAAT	107	0.00	0.00–1.74	low
Germany	Skaletz-Rorowski 2021 [44]	12/2016	07/2018	convenience	representative	23.0[2, 4]	community	any-site (AR/UG/PH)	NAAT	133	1.50	0.00–3.57	high
Proxy ANC													
Spain	Dorado Criado 2021 [49]	11/2018	06/2019	convenience	ANC	22	clinical	urine	NAAT	136	3.00	0.10–5.78	high
Spain	Lopez-Corbeto 2021 [52]	01/2016	06/2016	NR	ANC	<25.0	clinical	urine	NAAT	81	3.70	0.00–7.82	high
Spain	Muñoz Santa 2022 [50]	01/2019	10/2020	convenience	ANC	<25.0	NR	genital	NAAT	599	2.80	1.51–4.17	high
France	Peuchant 2015 [25]	01/2011	06/2011	convenience	ANC	18-24[3]	clinical	genital	NAAT	165	0.00	0.00–1.13	medium
Spain	Piñeiro 2016 [28]	01/2011	12/2014	convenience	ANC	<25.0	clinical	urine	NAAT	596	0.00	0.00–0.32	high
Proxy other													
Italy	Matteelli 2016 [57]	11/2012	03/2013	convenience	students	18.4[2]	community	urine	NAAT	1 297	0.00	0.00–0.15	high
Portugal	Silva 2021 [98]	01/2010	12/2016	convenience	students	15-25[3]	community	genital	NAAT	536	1.12	0.23–2.01	high
Non-EU/EFTA													
Representative													
UK	Sonnenberg 2013 [40]	09/2010	08/2012	probability	representative	16-24[3]	register	urine	NAAT	992	0.10	0.00–0.30	low
Proxy other													
UK	Oakeshott 2019 [60]	09/2016	10/2016	cluster	students	17.9[4]	community	genital	NAAT	267	0.00	0.00–0.70	high

ANC: antenatal care; AR: ano-rectal; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; PH: pharyngeal; RoB: risk of bias; UG: uro-genital.

1 median, unless indicated otherwise; 2 mean; 3 range; 4 comprises men and women (not reported separately).

Figure 31. Pooled estimates for gonorrhoea in young women, total

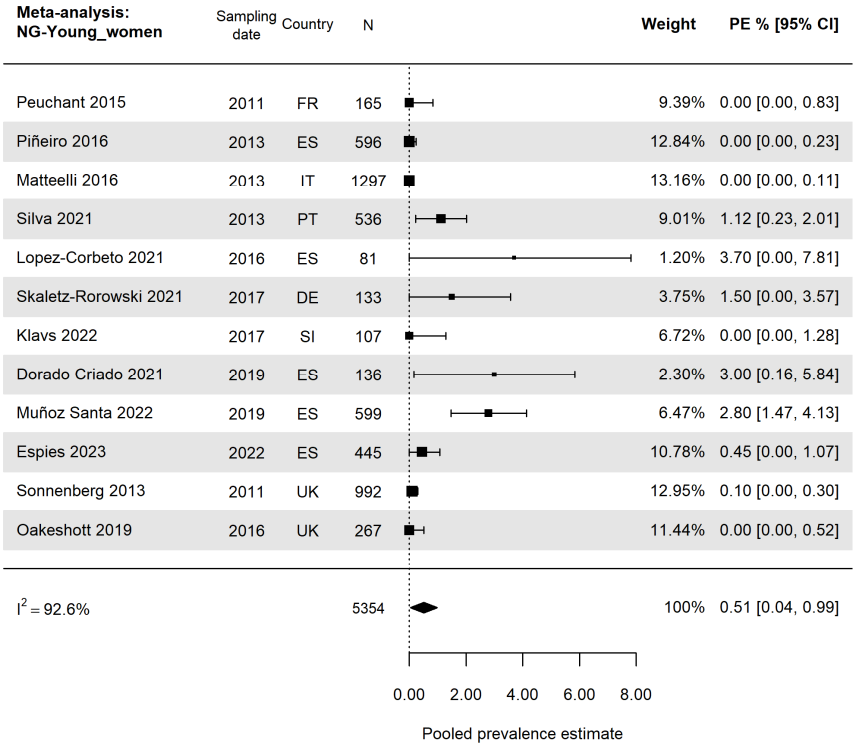


Figure 32. Pooled estimates for gonorrhoea in young women, representative of the general population

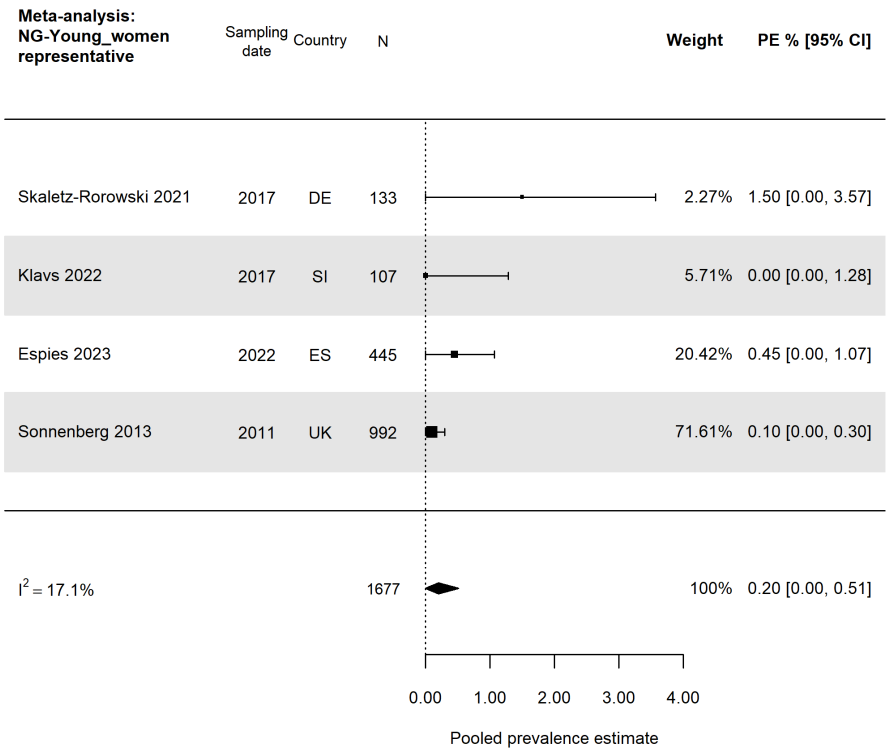


Figure 33. Pooled estimates for gonorrhoea in young women in antenatal care (proxy population)

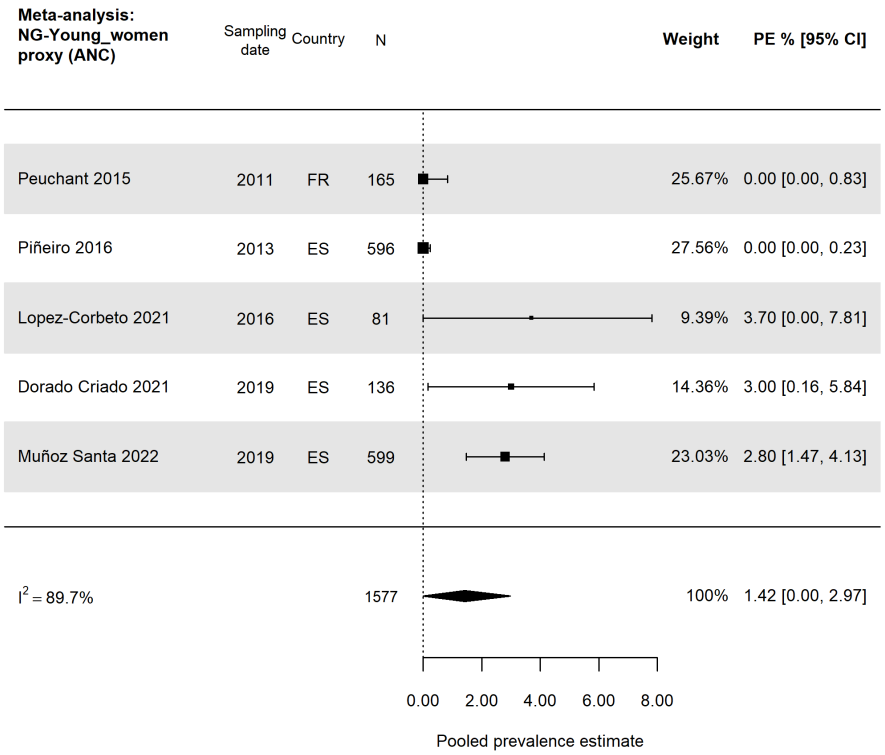
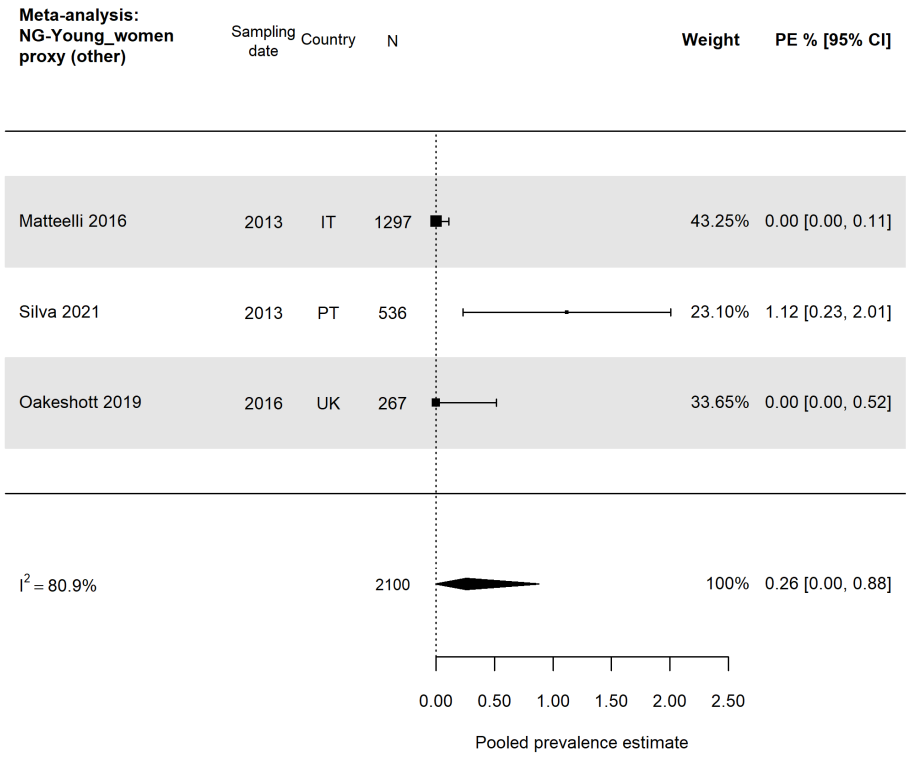


Figure 34. Pooled estimates for gonorrhoea in young women, other proxy populations



Gonorrhoea in young men

Overall NG prevalence among young men is estimated to be 0.07% (95% CI 0.00–0.21) (see Table and Figure 35). Among young men representative of the young general population only, pooled prevalence is estimated to be 2.00% (95% CI 0.00–5.78, see Figure 36), with the lowest prevalence reported in Slovenia (0.00%; 95% CI 0.00–1.79) and the highest in Germany (9.70%; 95% CI 4.65–14.75). Among other young male proxy populations, pooled prevalence is estimated to be 0.45% (95% CI 0.00–1.66, see Figure 37).

Table 17. Prevalence estimates for gonorrhoea in young men

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Spain	Espies 2023 [46]	09/2021	05/2022	convenience	representative	20.0[2, 4]	community	urine	NAAT	166	0.60	0.00–1.78	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18–24[3]	register	urine	NAAT	76	0.00	0.00–2.44	low
Germany	Skaletz-Rorowski 2021 [44]	12/2016	07/2018	convenience	representative	23.0[4]	community	any-site (AR/UR/PH)	NAAT	133	9.70	4.73–14.82	high
Proxy other													
Italy	Matteelli 2016 [57]	11/2012	03/2013	convenience	students	18.5[2]	community	urine	NAAT	762	0.00	0.00–0.25	high
Non-EU/EFTA													
Representative													
UK	Sonnenberg 2013 [40]	09/2010	08/2012	probability	representative	16-24[3]	register	urine	NAAT	840	0.10	0.00–0.35	low
Proxy other													
UK	Oakeshott 2019 [60]	09/2016	10/2016	cluster	students	17.9[4]	community	urine	NAAT	236	1.30	0.00–2.70	high

AR: ano-rectal; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; PH: pharyngeal; RoB: risk of bias; UG: uro-genital.

1 median, unless indicated otherwise
2 mean
3 range
4 comprises men and women (not reported separately).

Figure 35. Pooled estimates for gonorrhoea in young men, total

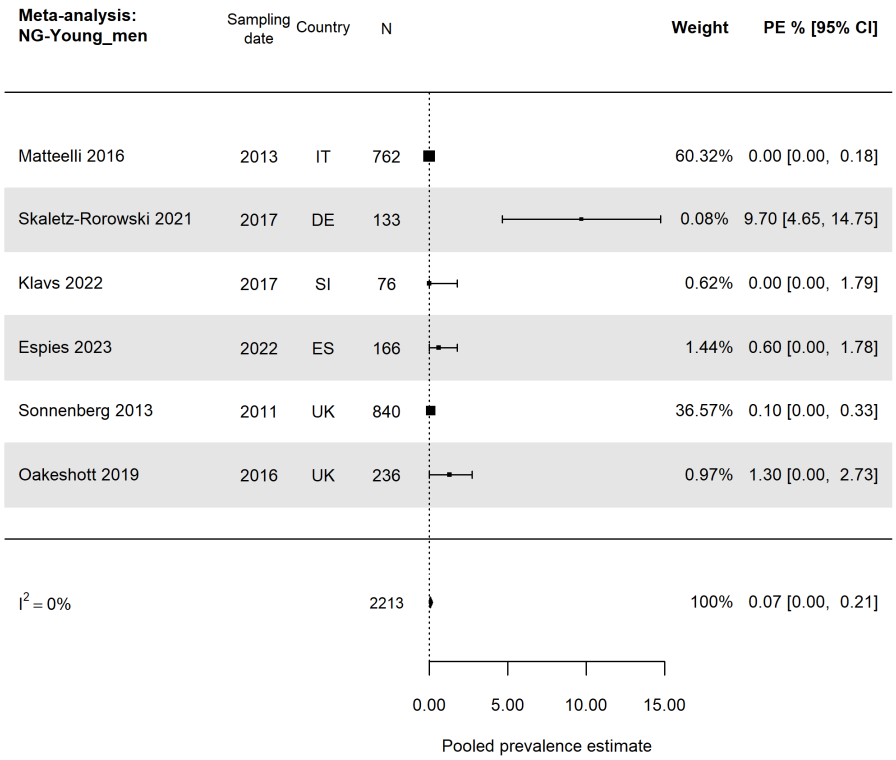


Figure 36. Pooled estimates for gonorrhoea in young men, representative of the general population

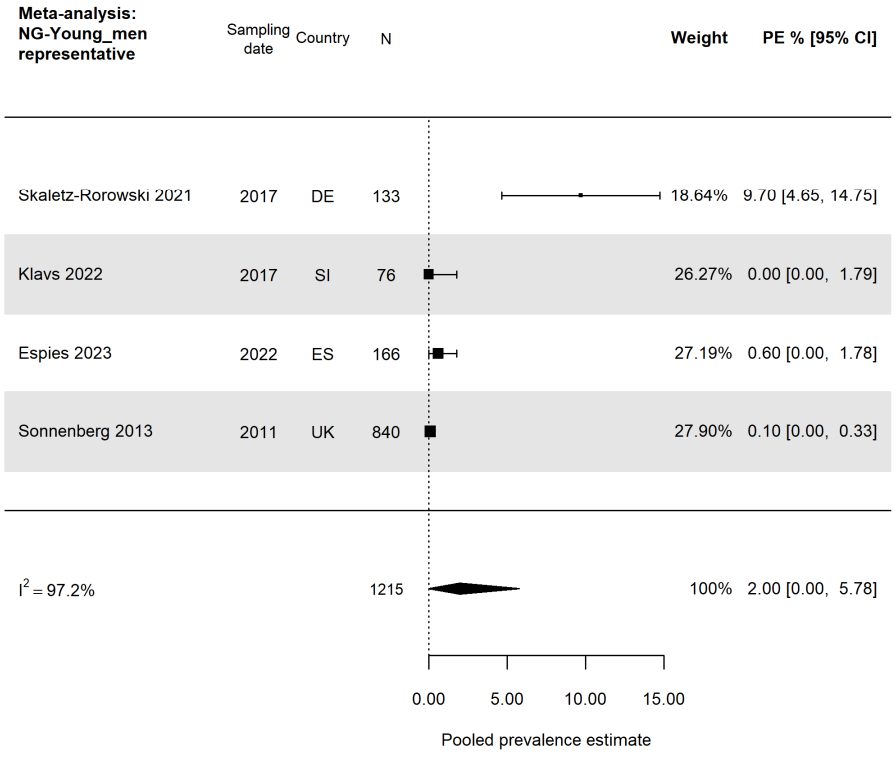
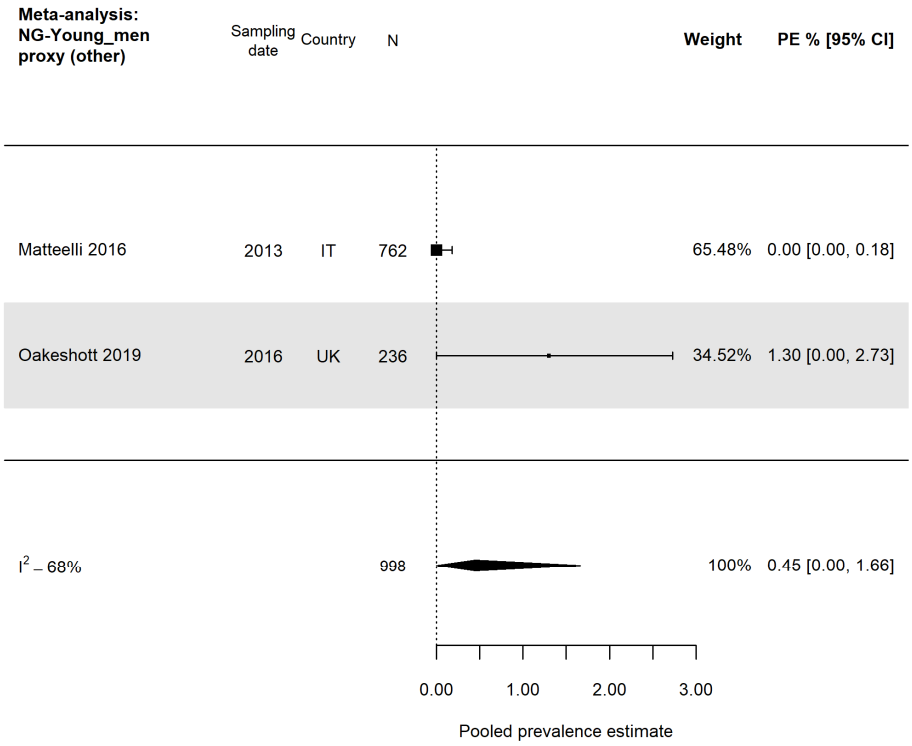


Figure 37. Pooled estimates for gonorrhoea in young men, other proxy populations



Populations of special interest

Gonorrhoea in men who have sex with men

The prevalence of NG is estimated to be 10.46% (95% CI 6.94–13.97) in MSM visiting STI clinics, 4.74% (95% CI 0.75–8.72) in MSM living with HIV, 8.99% (95% CI 5.31–12.66) in MSM on PrEP and 14.37% (95% CI 7.76–20.98) in MSM engaging in 'high-risk' sexual behaviour.

Table 18. Prevalence estimates for gonorrhoea in MSM

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
MSM visiting STI clinics													
Netherlands	Druckler 2018 [61]	07/2016	12/2016	convenience	35.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	4 925	12.40	11.49–13.33	medium
Netherlands	Evers 2022 [62]	NR/2016	NR/2017	convenience	37.0	STI/GUM clinic	any-site	none	NAAT	161 275	10.80	10.65–10.95	medium
Portugal	Ribeiro 2019 [65]	01/2016	05/2018	convenience	31.0	STI/GUM clinic	any-site (AR/UG/PH)	UG, PH, AR	NAAT	1 489	10.75	9.17–12.32	high
Spain	Ayerdi Aguirrebengoa 2020 [64]	01/2016	12/2018	convenience	18.1[2]	STI/GUM clinic	any-site (AR/UR/PH)	UG, PH, AR	unclear	149	30.20	22.83–37.57	high
Netherlands	Achterbergh 2020 [66]	09/2017	12/2017	convenience	35.0	STI/GUM clinic	any-site (AR/UG/PH)	UG, PH, AR	NAAT	4 465	11.90	10.94–12.84	medium
Iceland	Hilmarsdottir 2021 [68]	10/2018	01/2019	convenience	NR	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	57	0.00	0.00–3.24	high
Spain	Hoyos-Mallecot 2022 [69]	11/2016	11/2019	convenience	34.0	STI/GUM clinic	any-site (AR/UR/PH)	none	NAAT	6 304	10.90	10.13–11.67	medium
Switzerland	Bigler 2023 [99]	01/2017	12/2019	convenience	NR	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT	647	3.40	2.00–4.80	medium
Germany	Jansen 2020 [70]	02/2018	07/2018	convenience	39.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	2 203	8.90	7.71–10.09	medium
France	Rahib 2022 [71]	04/2018	06/2018	convenience	30.0	dating app / social media	any-site (AR/UR/PH)	UR, PH, AR	NAAT	1 930	9.60	8.27–10.90	high
MSM HIV													
Germany	Spinner 2018 [72]	02/2016	08/2016	convenience	43.2	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT	296	6.80	3.90–9.62	high
France	Farfour 2021 [73]	09/2017	12/2017	convenience	47.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	291	6.89	3.97–9.78	high
MSM PrEP													
Belgium	Reyniers 2018 [74]	09/2015	06/2016	convenience	38.0	unclear	any-site (AR/UR/PH)	UR, PH, AR	NAAT	196	12.20	7.66–16.83	medium
Italy	Nozza 2022 [75]	05/2017	05/2022	convenience	34.5	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT/culture	624	5.20	3.40–6.86	medium
Switzerland	Hovaguimian 2022 [76]	04/2019	01/2020	convenience	40.0	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT	710	9.60	7.41–11.74	medium
Bulgaria	Pakov 2022 [77]	10/2020	08/2022	convenience	33.0	STI/GUM clinic	ano-rectal	none	NR	410	5.30	3.18–7.55	high

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method	No. tested	PE (%)	95%-CI	RoB
Austria	Chromy 2023 [78]	07/2020	12/2021	convenience	33.8	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	131	16.00	9.75–22.31	high
MSM "high risk"													
Switzerland	Schmidt 2020 [79]	01/2016	06/2017	convenience	33.0	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT	779	10.30	8.14–12.40	high
Italy	Foschi 2018 [80]	01/2017	11/2017	convenience	35.5[2]	STI/GUM clinic	ano-rectal	UR, PH	NAAT	165	27.20	20.48–34.07	high
Germany	Streeck 2022 [81]	06/2018	03/2019	convenience	33.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	1 043	10.10	8.24–11.89	medium
Poland	Szetela 2023_hr [82]	12/2019	12/2020	convenience	NR	STI/GUM clinic	any-site (AR/UR/PH)	UG, PH, AR	NAAT	103	18.62	10.96–25.94	high
Germany	Weidlich 2023 [83]	04/2021	07/2022	convenience	37.0	STI/GUM clinic	any-site (AR/UR/UG/ PH)	UR/UG, PH, AR	NAAT	236	8.50	4.92–12.03	high
MSM other													
Poland	Szetela 2023_lr[4] [82]	12/2019	12/2020	convenience	NR	STI/GUM clinic	any-site (AR/UR/PH)	UG, PH, AR	NAAT	64	17.46	7.94–26.43	high
Spain	De La Mora 2022[5] [84]	03/2018	05/2019	convenience	39.0[2]	STI/GUM clinic	any-site or pooled (AR/UR/PH)	none	NAAT	156	23.00	16.47–29.69	high
Non-EU/EFTA													
MSM visiting STI clinics													
UK	Charin 2023 [85]	12/2016	01/2020	convenience	27.0	online sexual health service	any-site (AR/UR/PH)	UR, PH, AR	NAAT	5 040	4.50	3.93–5.08	high
UK	Ogaz 2019 [86]	01/2017	12/2017	convenience	NR	STI/GUM clinic	any-site	AR	NAAT or culture	128 772	9.00	8.84–9.16	medium
Georgia	Kevlishvili 2023 [87]	NR/2019	NR/2019	convenience	18-65[3]	STI/GUM clinic	any-site or pooled (AR/UG)	none	gram stain+ NAAT	1 698	18.40	16.53–20.22	medium
MSM HIV													
Türkiye	Taspinar Sen 2023 [88]	08/2018	02/2020	convenience	38.4[2]	STI/GUM clinic	urine	none	NAAT	106	0.94	0.00–2.78	high

AR: ano-rectal swab; GUM: genitourinary medicine; NAAT: nucleic acid amplification test; NR: not reported; PH: pharyngeal swab; RoB: risk of bias; STI: sexually transmitted infection; UG: urogenital swab; UR: urine.
1 median, unless indicated otherwise; 2 mean; 3 range; 4 MSM reporting sexual behaviour classified as 'low risk' by the study authors; 5 MSM engaging in chemsex.

Figure 38. Pooled estimates for gonorrhoea in MSM visiting STI clinics

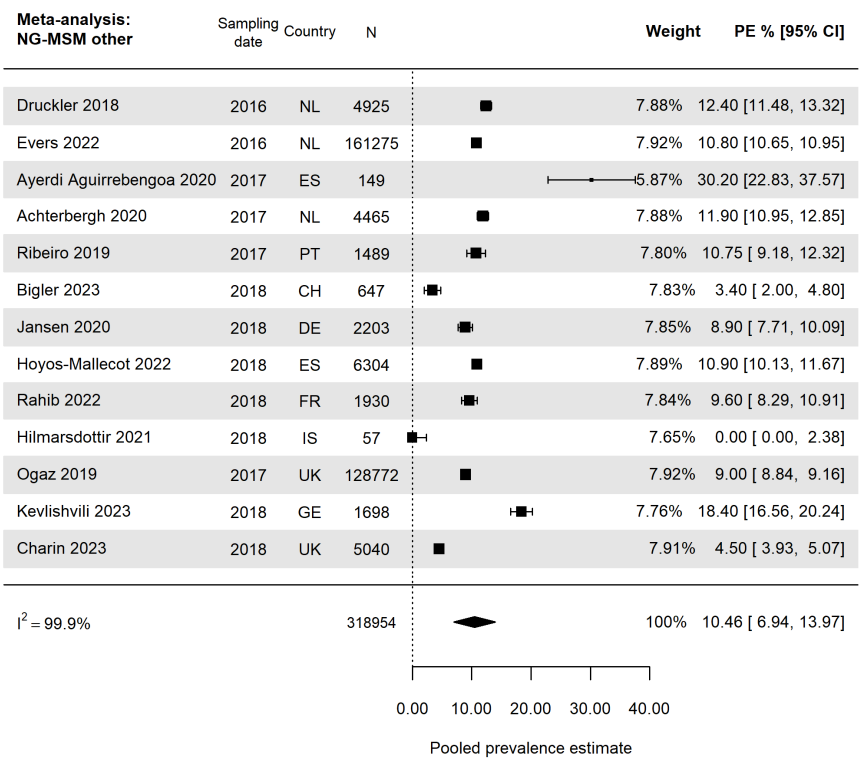


Figure 39. Pooled estimates for gonorrhoea in MSM living with HIV

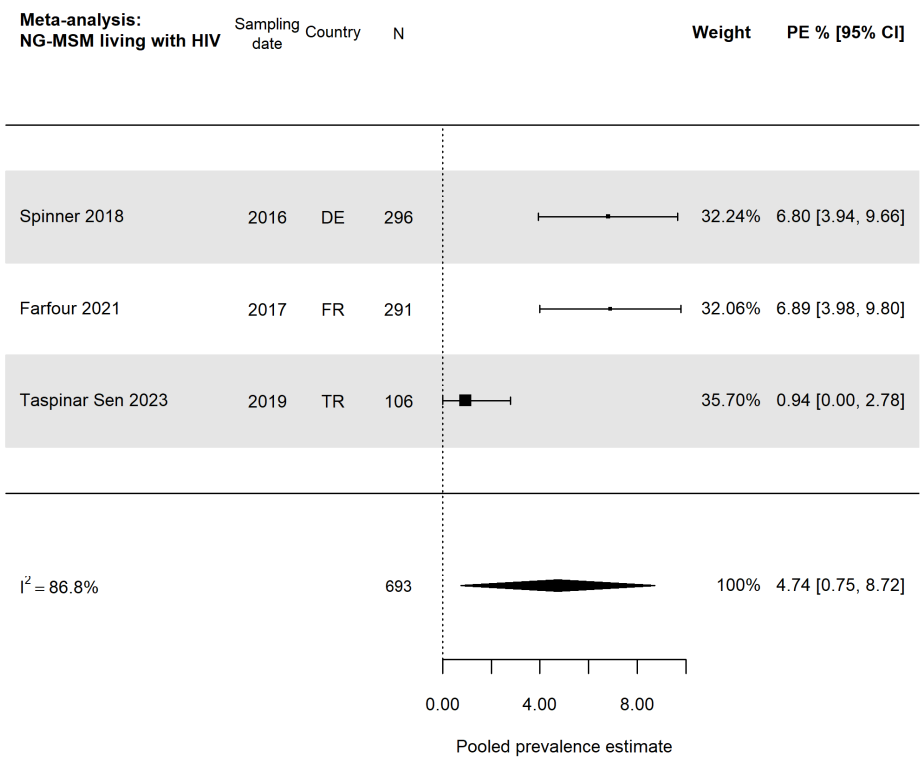


Figure 40. Pooled estimates for gonorrhoea in MSM on PrEP

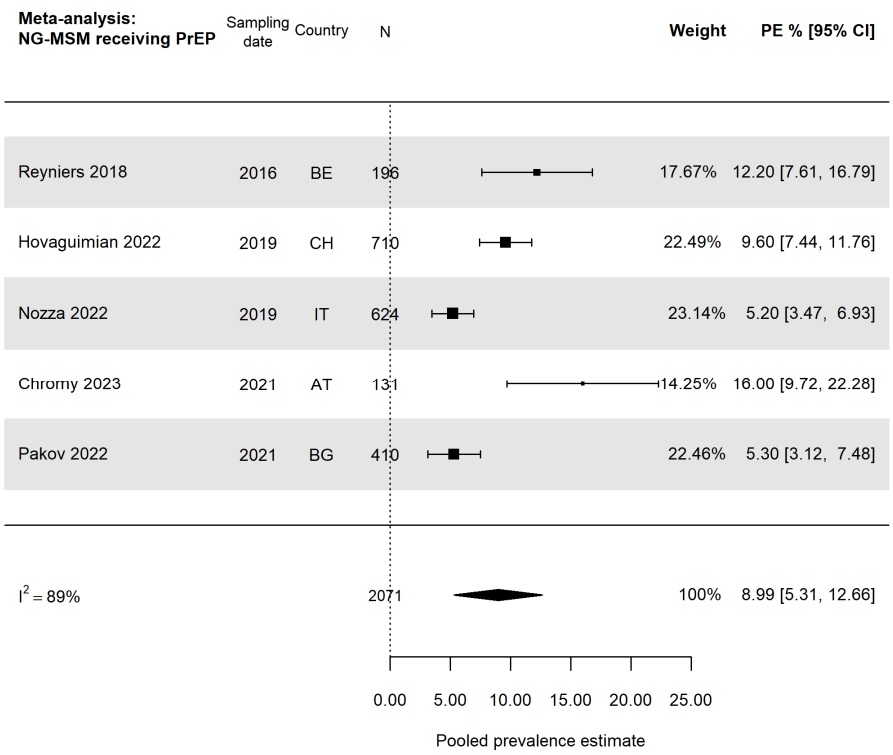
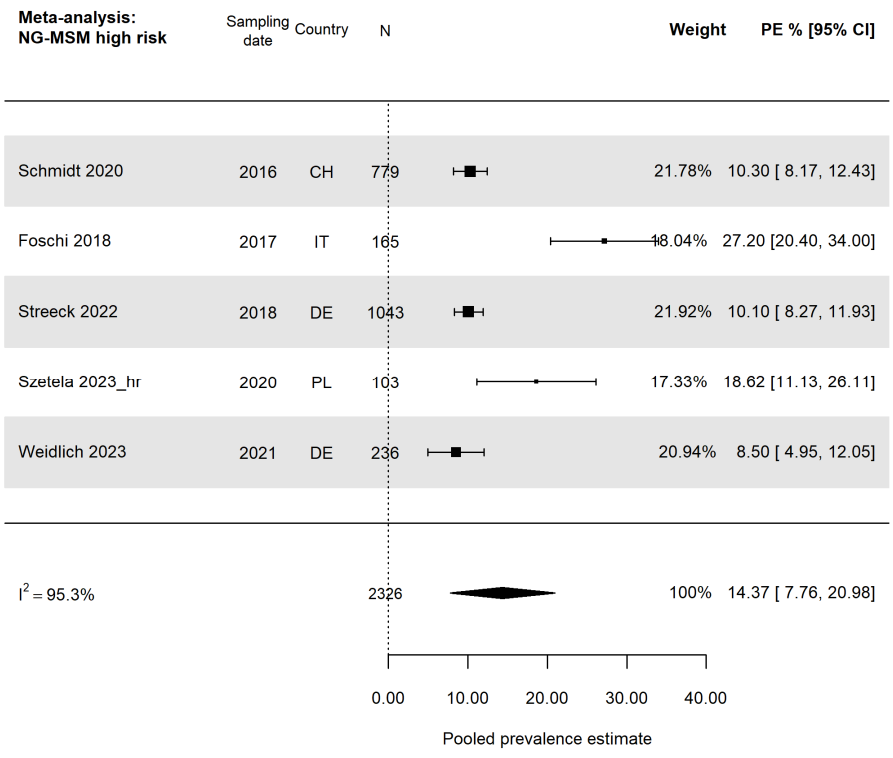


Figure 41. Pooled estimates for gonorrhoea in MSM high risk



Gonorrhoea in sex workers

Among female sex workers, pooled NG prevalence is estimated to be 2.22% (95% CI 0.63–3.80) and 6.36% (95% CI 0.00–14.25) among male and transgender sex workers, see Table. One conference abstract was identified reporting a NG prevalence of 69.60% (95% CI 50.76–88.37) among mixed gender sex workers in the UK.

Table 19. Prevalence estimates for gonorrhoea in sex workers

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Female sex workers													
Portugal	Almeida 2020_f [89]	09/2015	09/2016	convenience	36.2[2, 4]	outreach	any-site (AR/UR/PH)	UR, PH, AR	NAAT	74	10.80	3.74–17.89	high
Belgium	Coorevits 2018 [90]	06/2015	06/2016	convenience	33.0[2]	outreach	urine or genital	none	NAAT	299	3.30	1.31–5.38	medium
Netherlands	Druckler 2020_f [91]	01/2014	12/2015	convenience	28.0	health centre	rectal	UG, PH, AR	NAAT	1 217	1.40	0.74–2.06	medium
Netherlands	van Dulm 2020 [92]	01/2016	09/2016	convenience	28.0	community	genital	UG, PH, AR	NAAT	1 213	0.30	0.01–0.65	medium
Switzerland	Vernazza 2020 [93]	01/2016	06/2017	convenience	31.0	STI clinic	pooled (AR/UG/PH)	none	NAAT	490	4.90	2.99–6.81	medium
Belgium	Verougstraete 2020 [94]	02/2018	07/2019	convenience	NR	community	any-site (AR/UG/PH)	UG, PH, AR	NAAT	489	2.00	0.79–3.30	high
Switzerland	Vu 2020 [95]	04/2015	12/2016	convenience	18–60[3]	community	urine	none	NAAT	96	0.00	0.00–1.94	high
Male and transgender sex workers													
Portugal	Almeida 2020_m [89]	09/2015	09/2016	convenience	36.2[2, 4]	outreach	any-site (AR/UR/PH)	UR, PH, AR	NAAT	12	0.00	0.00–14.30	high
Portugal	Almeida 2020_t [89]	09/2015	09/2016	convenience	36.2[2, 4]	outreach	any-site (AR/UR/PH)	UR, PH, AR	NAAT	14	0.00	0.00–12.42	high
Netherlands	Druckler 2020_m [91]	01/2014	12/2015	convenience	28.0	health centre	rectal	UG, PH, AR	NAAT	70	10.00	2.97–17.03	medium
Netherlands	Druckler 2020_t [91]	01/2014	12/2015	convenience	39.0	health centre	rectal	UG, PH, AR	NAAT	15	0.00	0.00–11.65	medium
Spain	Ferrer 2022 [96]	10/2017	12/2018	convenience	33.0	community	any-site (AR/UR/PH)	UR, PH, AR	NAAT	147	19.20	12.70–25.40	high
Non-EU/EFTA													
Mixed gender sex workers													
UK	Sultan 2021 [97]	NR	NR	convenience	NR	outreach	any-site (AR/UG/PH)	UG, PH, AR	NAAT	23	69.60	50.76–88.37	high

AR: ano-rectal; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; PH: pharyngeal; RoB: risk of bias; STI: sexually transmissible infections; UG: uro-genital; UR: urine

1 median, unless indicated otherwise
2 mean
3 range
4 comprises male, female, and transgender sex workers (not reported separately).

Figure 42. Pooled estimates for gonorrhoea in female sex workers

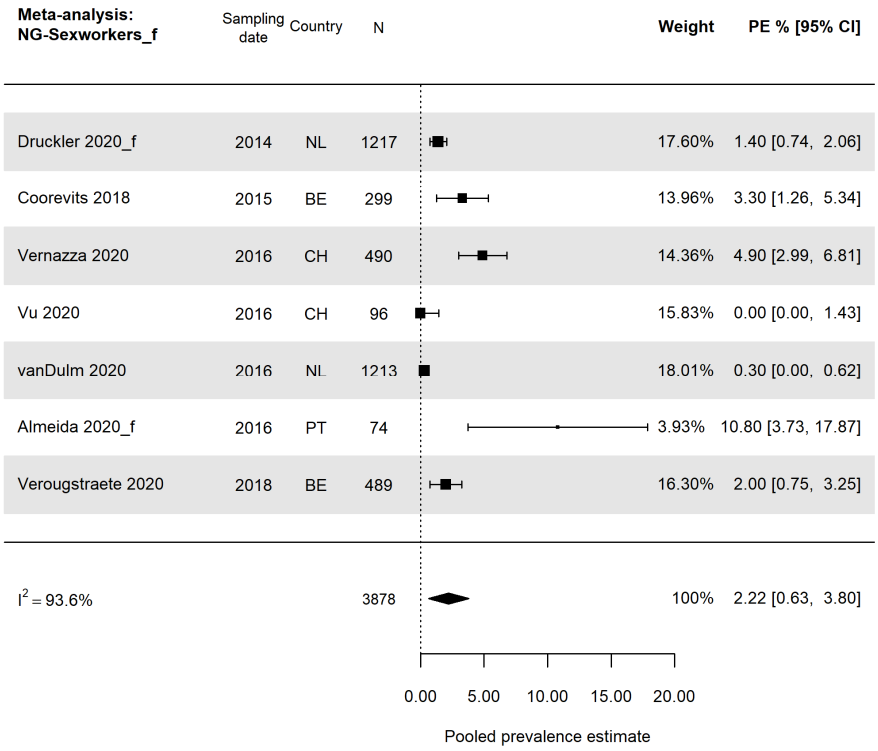
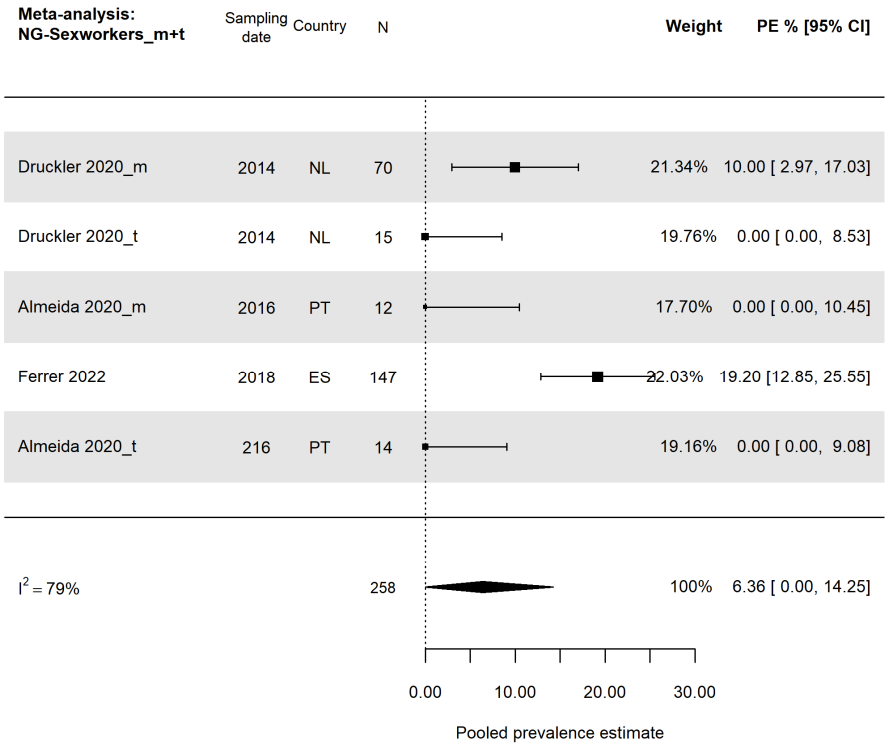


Figure 43. Pooled estimates for gonorrhoea in male and transgender sex workers



Gonorrhoea in people who inject drugs

No studies were identified reporting NG prevalence data for PWID.

3.5 Trichomoniasis prevalence estimates

The following table summarises the pooled trichomoniasis prevalence estimates for all study populations (prevalence estimates from individual studies are presented for populations or sub-groups where only one study was available). Details of the studies included and the meta-analyses are provided in the sub-chapters below.

Table 20. Prevalence estimates for trichomoniasis in all study populations

Population	Sub-group	No. studies	No. individuals	Pooled estimate [%]	95%-CI lower	95%-CI upper	I^2
Women	combined[1]	9	31 728	0.69	0.38	0.99	81.34
Women	representative	1	593	0.17	0.00	0.50	N/A
Women	proxy (ANC)	2	4 179	0.64	0.33	0.94	25.01
Women	proxy (other)	6	26 956	0.85	0.41	1.29	79.47
Men	combined[1]	3	1 103	0.00	0.00	0.21	0.00
Men	representative	1	430	0.00	0.00	0.40	N/A
Men	proxy (other)	2	673	0.00	0.00	0.28	0.00
Young women	combined[1]	5	1 823	0.64	0.00	1.40	79.57
Young women	representative	2	552	0.20	0.00	0.62	0.00
Young women	proxy (ANC)	2	735	2.04	0.61	3.46	20.28
Young women	proxy (other)	1	536	0.20	0.00	0.55	N/A
Young men	representative	2	242	0.00	0.00	0.75	0.00
MSM	visiting STI clinics	1	2 203	0.10	0.00	0.22	N/A
MSM	'high-risk'	2	1 822	1.54	0.00	4.67	96.06
MSM	HIV	1	106	0.94	0.00	2.78	N/A
Sex workers	female	2	786	8.97	6.03	11.91	53.03

ANC: antenatal care; HIV: human immunodeficiency virus; STI: sexually transmissible infection.
1 prevalence estimates combining both, representative studies and studies in proxy populations.

General population

Trichomoniasis in women

Overall prevalence of TV was estimated to be 0.69% (95% CI 0.38–0.99) among women (see Table 21 and Figure 44). No studies were identified reporting on prevalence data for women representative of the general population only. Among women in antenatal care, pooled prevalence of TV is based on two studies and is estimated to be 0.64 (95% CI 0.33–0.94, see Figure 45), with the lowest prevalence reported in the Netherlands (0.40%; 95% CI 0.00–0.90) and the highest in Austria (0.74%; 95% CI 0.46–1.02). In female proxy populations, including healthy women attending routine gynaecological check-ups, cervical and/or breast cancer screening, women attending GPs and healthcare website users, and female military personnel, pooled prevalence of TV is estimated to be 0.85% (95% CI 0.41–1.29), see Figure 46.

Table 21. Prevalence estimates for trichomoniasis in the general female population

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18-49[3]	register	urine	NAAT	593	0.20	0.00–0.50	medium
Proxy ANC													
Netherlands	Op de Coul 2021 [27]	NR/2012	NR/2016	convenience	ANC	27.0	clinical	genital	NAAT	548	0.40	0.00–0.87	high
Austria	Farr 2016 [100]	01/2005	01/2015	convenience	ANC	30.4[2]	clinical	genital	NR	3 631	0.74	0.46–1.02	high
Proxy other													
Spain	Bolumburu 2020 [101]	01/2013	12/2017	convenience	medical centres and gynaecologists	38.8[2]	clinical	genital	NAAT	23 173	0.80	0.68–0.91	high
Italy	Camporiondo 2016 [35]	01/2013	12/2013	convenience	breast cancer screening	49.0	clinical	genital	NAAT	309	1.30	0.03–2.55	high
Italy	Leli 2016 [102]	01/2015	10/2015	convenience	outpatient clinic	32.0	outpatient	genital	NAAT	1 487	1.30	0.71–1.85	high
Greece	Parthenis 2018 [34]	10/2015	10/2016	convenience	routine cervical screening	33.2[2]	clinical	genital	NAAT	345	0.00	0.00–0.54	high
Portugal	Silva 2021 [98]	01/2010	12/2016	convenience	students	22.0[2]	community	genital	NAAT	680	1.00	0.27–1.79	high
Non-EU/EFTA													
Proxy other													
North Macedonia	Albig 2023 [42]	NR/2014	NR/2018	convenience	gynaecology and obstetrics department	NR	clinical	NR	NAAT	962	1.20	0.55–1.95	high

ANC: antenatal care; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; RoB: risk of bias.

1 median, unless indicated otherwise
2 mean
3 range.

Figure 44. Pooled estimates for trichomoniasis in women, total

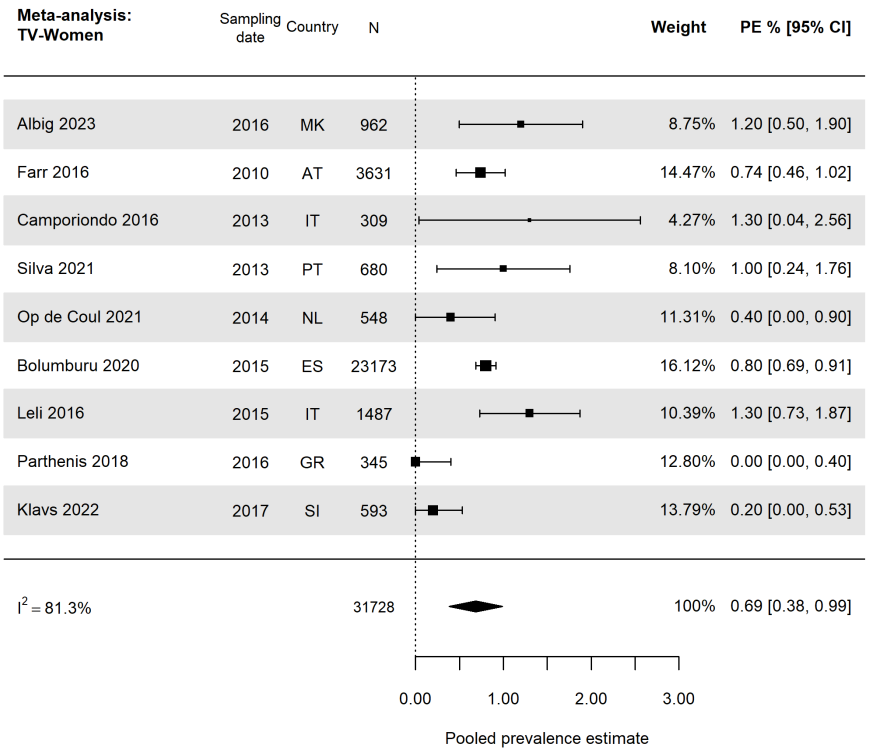


Figure 45. Pooled estimates for trichomoniasis in women in antenatal care (proxy population)

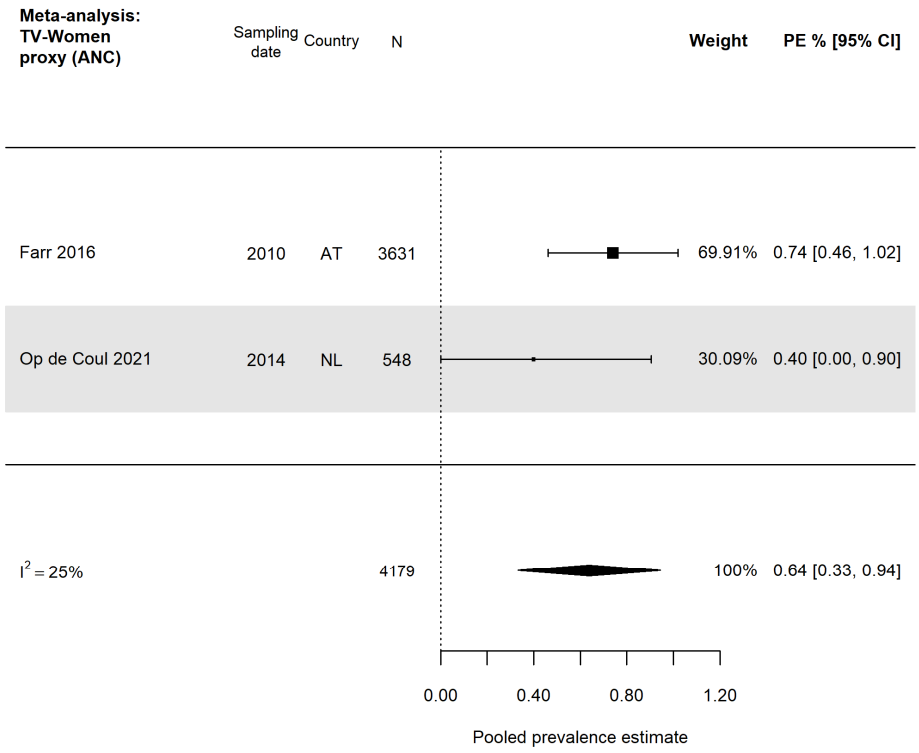
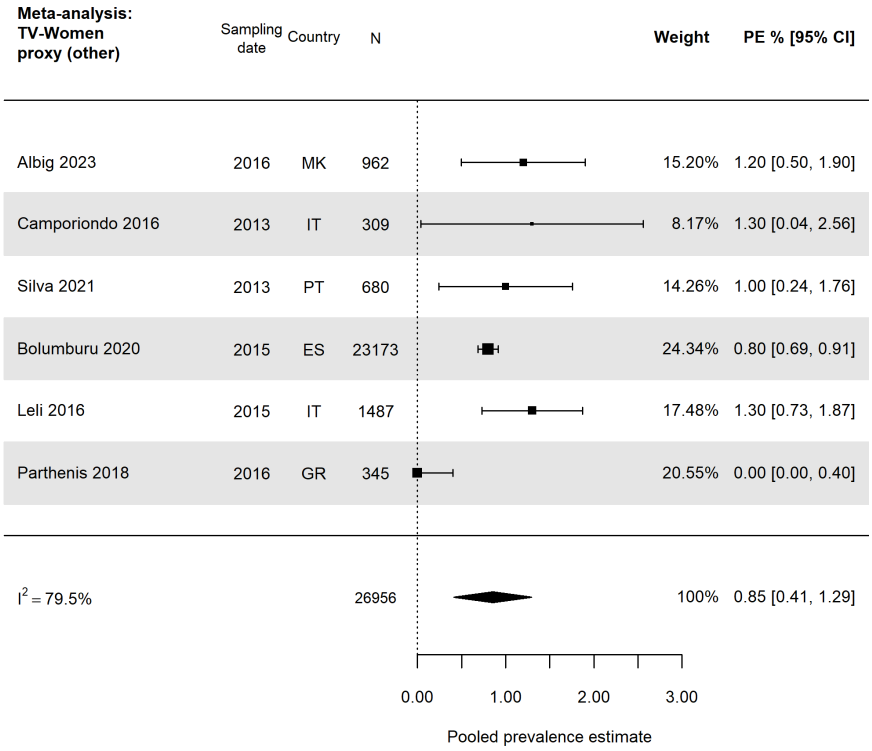


Figure 46. Pooled estimates for trichomoniasis in women, other proxy populations



Trichomoniasis in men

Overall prevalence of TV was estimated to be 0.00% (95% CI 0.00–0.21) among men (see Table 22Table and Figure 47). Only one study was identified for men representative of the general population, reporting a prevalence of 0.00% (95% CI 0.00–0.44, see Table 22). Based on two studies among male proxy populations, including male partners of women in ANC, pooled TV prevalence is estimated to be 0.00% (95% CI 0.00–0.28, see Figure 48).

Table 22. Prevalence estimates for trichomoniasis in the general male population

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18-49[3]	register	urine	NAAT	430	0.00	0.00–0.44	medium
Proxy other													
Netherlands	Op de Coul 2021 [27]	NR/2012	NR/2016	convenience	partners of women in ANC	29.0	clinical	urine	NAAT	425	0.00	0.00–0.44	high
Estonia	Tjagur 2021 [43]	01/2010	12/2012	convenience	partners of women in ANC	31.8	clinical	urine	NAAT	248	0.00	0.00–0.76	medium

ANC: antenatal care; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; RoB: risk of bias.
1 median, unless indicated otherwise
2 mean
3 range.

Figure 47. Pooled estimates for trichomoniasis in men, total

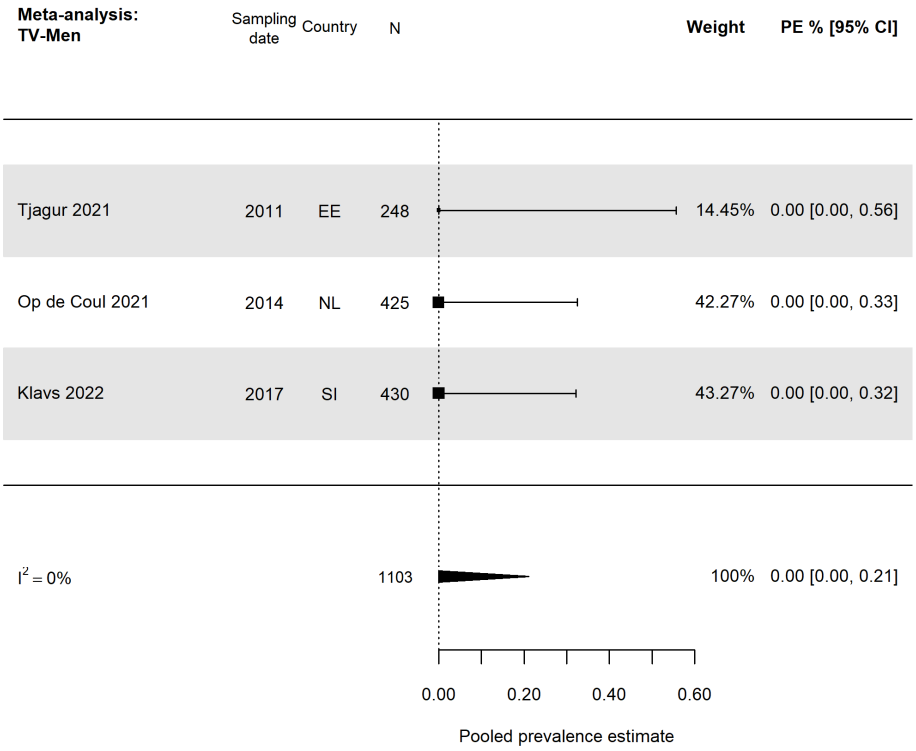
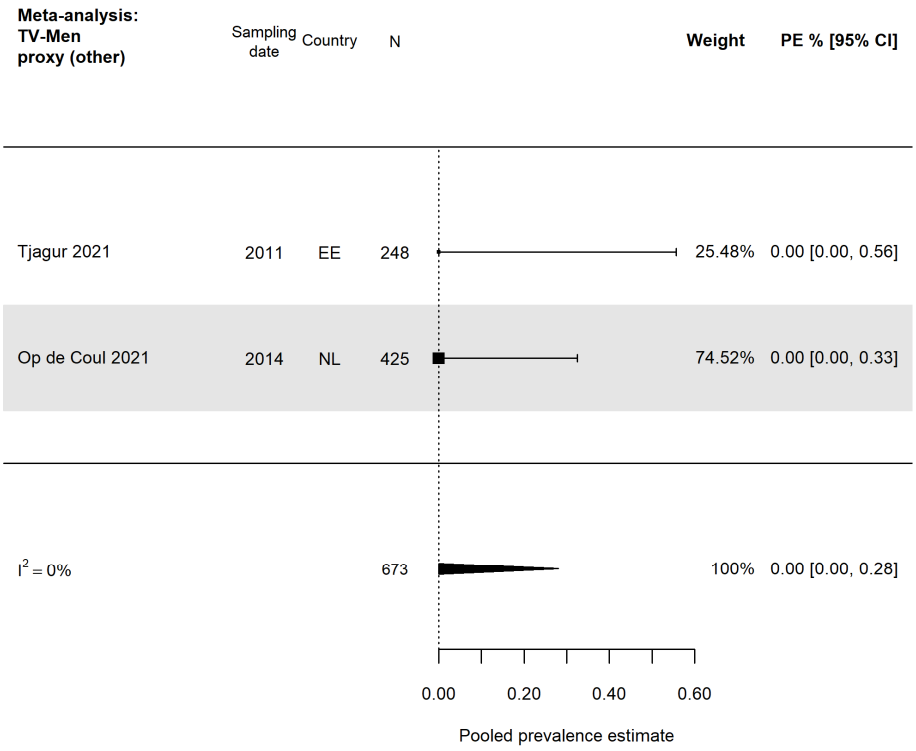


Figure 48. Pooled estimates for trichomoniasis in men, other proxy populations



Trichomoniasis in young women

Overall prevalence of TV among young women is estimated to be 0.64% (95% CI 0.00–1.40, Table 23). Among young women representative of the general population of young people, prevalence is estimated to be 0.20% (95% CI 0.00–0.62, Figure 12Figure), and among young women in antenatal care 2.04% (95% CI 0.61–3.46, Figure 13).

Table 23. Prevalence estimates for trichomoniasis in young women

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Spain	Espies 2023 [46]	09/2021	05/2022	convenience	representative	20.0[2, 4]	community	urine	NAAT	445	0.22	0.00–0.66	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18–24[3]	register	urine	NAAT	107	0.00	0.00–1.74	medium
Proxy ANC													
Spain	Dorado Criado 2021 [49]	11/2018	06/2019	convenience	ANC	22.0	clinical	urine	NAAT	136	3.60	0.51–6.84	high
Spain	Munoz Santa 2022 [50]	01/2019	10/2020	convenience	ANC	<25.0	NR	genital	NAAT	599	1.70	0.64–2.70	high
Proxy other													
Portugal	Silva 2021 [98]	01/2010	12/2016	convenience	students	15–25[3]	community	genital	NAAT	536	0.19	0.00–0.55	high

ANC: antenatal care; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; RoB: risk of bias.

1 median, unless indicated otherwise
2 mean
3 range
4 comprises men and women (not reported separately).

Figure 49. Pooled estimates for trichomoniasis in young women, total

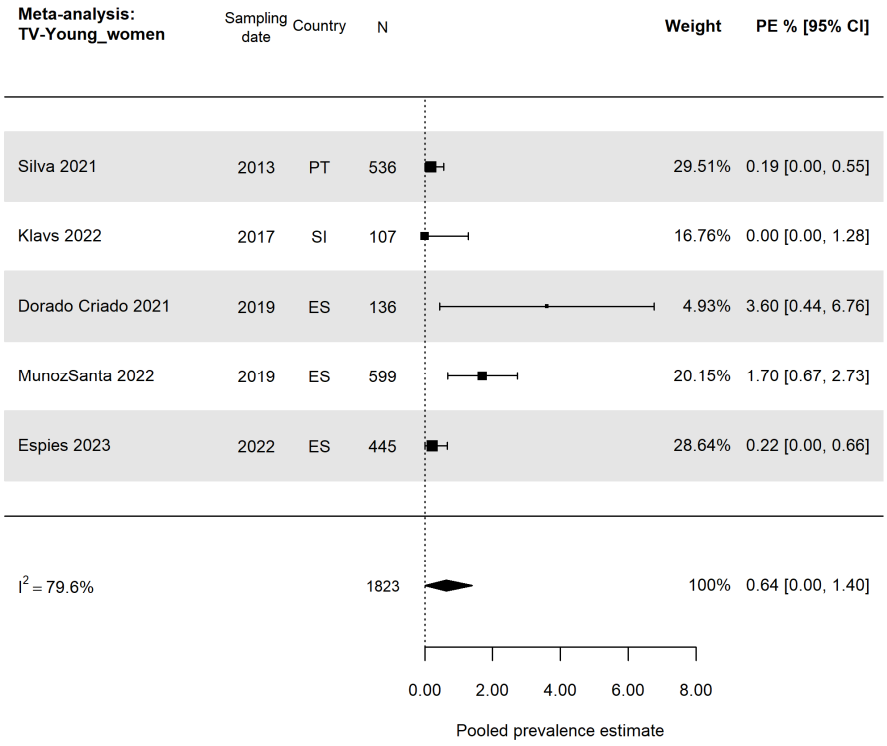


Figure 50. Pooled estimates for trichomoniasis in young women, representative of the general population

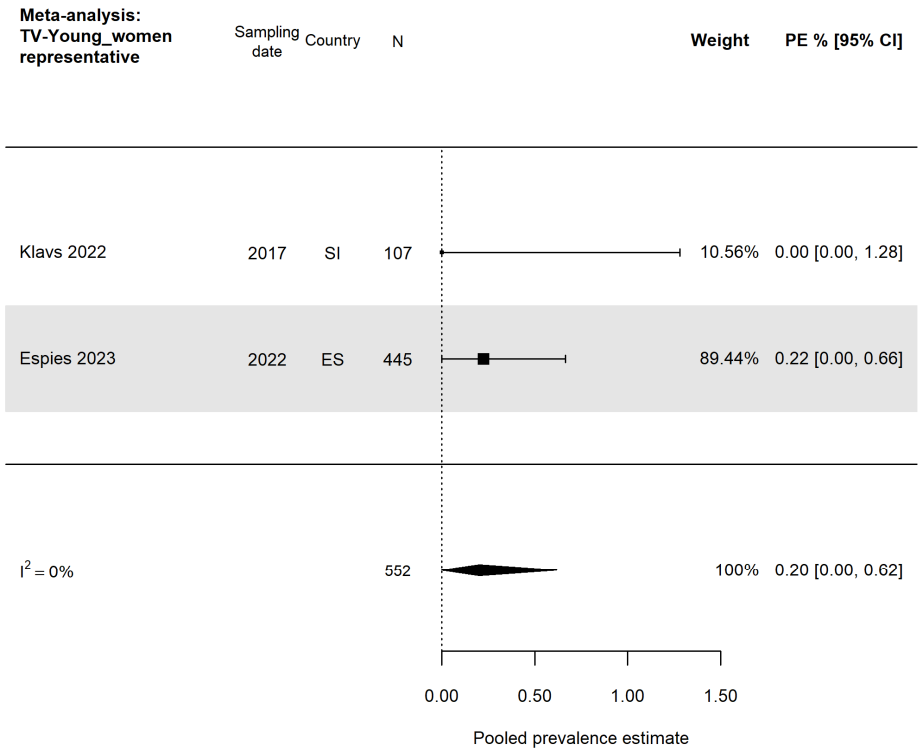
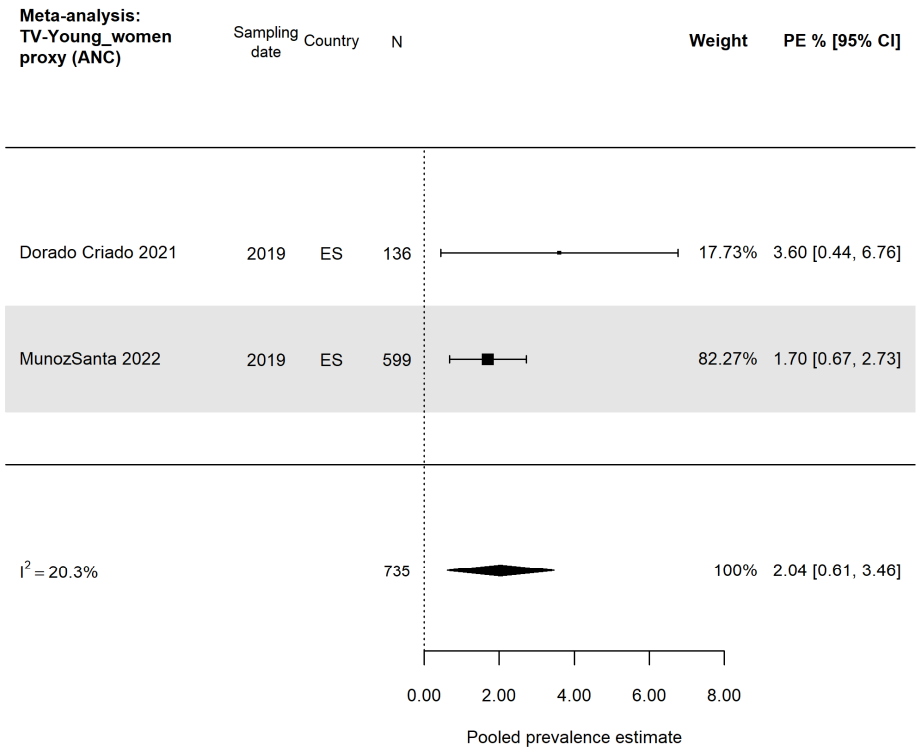


Figure 51. Pooled estimates for trichomoniasis in young women in antenatal care (proxy population)



Trichomoniasis in young men

Based on the two studies among young men (both representative) conducted in Spain and Slovenia, pooled TV prevalence is estimated to be 0.00% (95% CI 0.00–0.75) (see Table 24 and Figure 53).

Table 24. Prevalence estimates for trichomoniasis in young men

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Representative													
Spain	Espies 2023 [46]	09/2021	05/2022	convenience	representative	20.0[2, 4]	community	urine	NAAT	166	0.00	0.00–1.13	high
Slovenia	Klavs 2022 [22]	10/2016	07/2017	probability	representative	18–24[3]	register	urine	NAAT	76	0.00	0.00–2.44	high

NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; RoB: risk of bias.

1 median, unless indicated otherwise
2 mean
3 range
4 comprises men and women (not reported separately).

Figure 52. Pooled estimates for trichomoniasis in young men, total

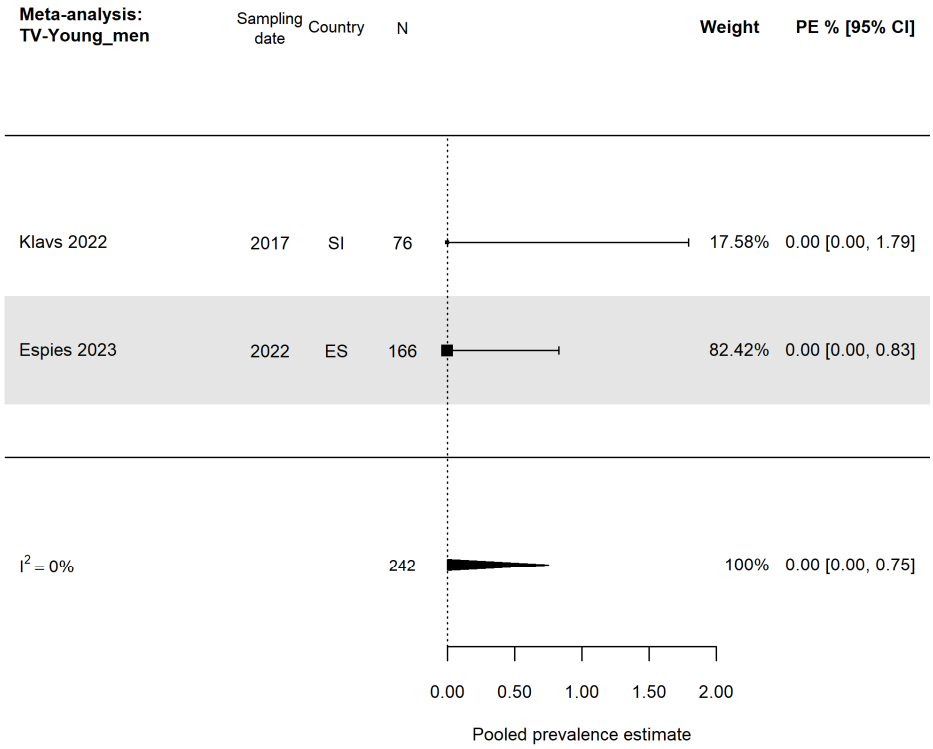
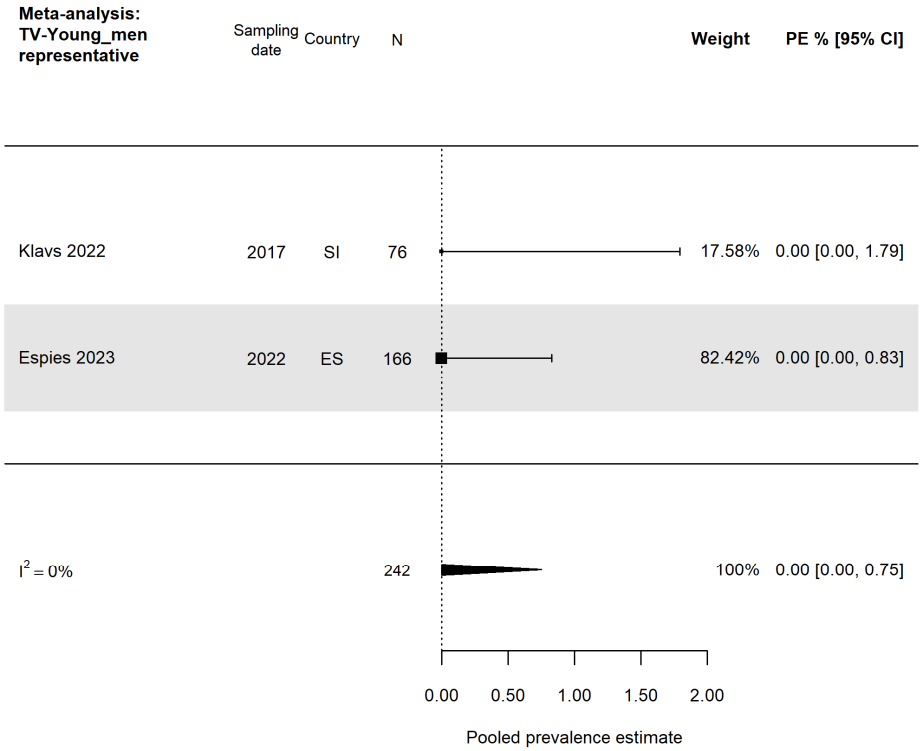


Figure 53. Pooled estimates for trichomoniasis in young men, representative of the general population



Populations of special interest

Trichomoniasis in men who have sex with men

Few studies investigated the prevalence of TV in MSM (see Table 25). The prevalence of TV is estimated to be 0.10% (95% CI 0.00–0.22) in MSM visiting STI clinics, based on one study from Germany, 0.94% (95% CI 0.00–2.78) in MSM living with HIV, based on one study from Türkiye and 1.54% (95% CI 0.00–4.67) in MSM engaging in 'high-risk' sexual behaviour, based on one study from Germany and one study from Switzerland (see Figure 54).

Table 25. Prevalence estimates for trichomoniasis in MSM

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
MSM visiting STI clinics													
Germany	Jansen 2020 [70]	02/2018	07/2018	convenience	39.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	2 203	0.10	0.00–0.22	medium
MSM "high risk"													
Germany	Streeck 2022 [81]	06/2018	03/2019	convenience	33.0	STI/GUM clinic	any-site (AR/UR/PH)	UR, PH, AR	NAAT	1 043	0.00	0.00–0.18	medium
Switzerland	Schmidt 2020 [79]	01/2016	06/2017	convenience	33.0	STI/GUM clinic	pooled (AR/UG/PH)	none	NAAT	779	3.20	1.97–4.45	high
Non-EU/EFTA													
MSM HIV													
Türkiye	Taspinar Sen 2023 [88]	08/2018	02/2020	convenience	38.4[2]	STI/GUM clinic	urine	none	NAAT	106	0.94	0.00–2.78	high

AR: ano-rectal swab; GUM: genitourinary medicine; NAAT: nucleic acid amplification test; NR: not reported; PH: pharyngeal swab; RoB: risk of bias; STI: sexually transmitted infection; UG: urogenital swab; UR: urine.

1 median, unless indicated otherwise
2 mean.

Figure 54. Pooled estimates for trichomoniasis in high-risk MSM

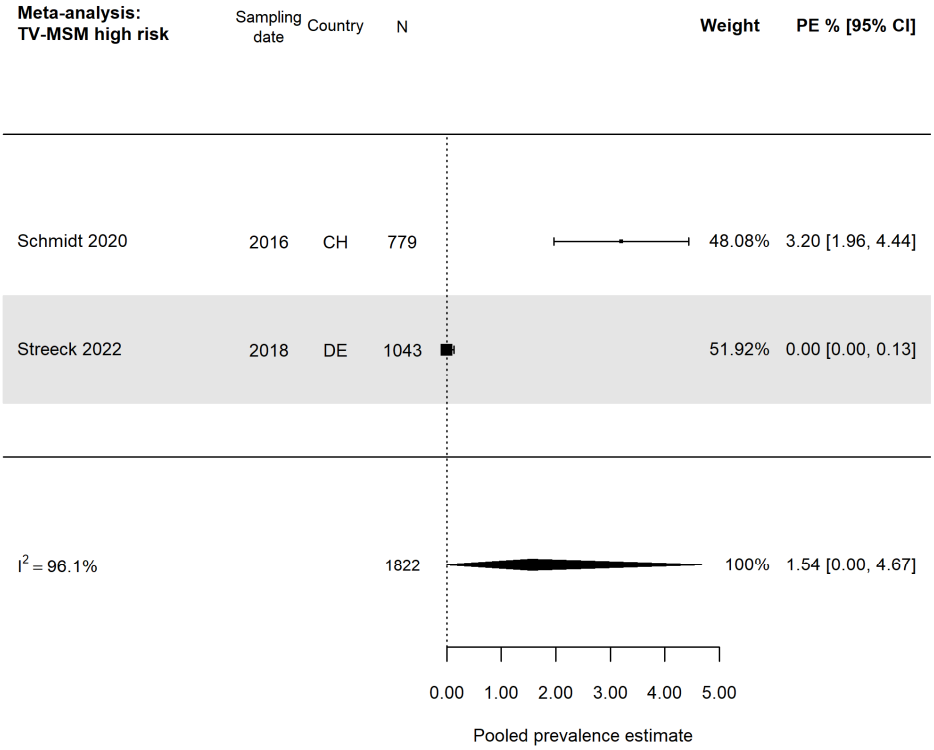
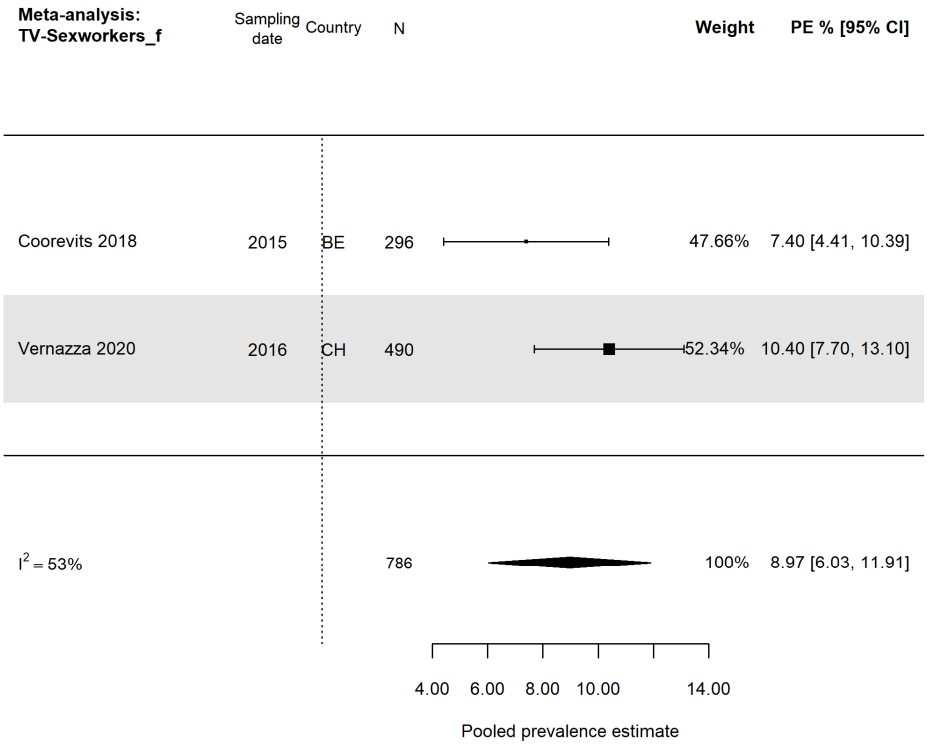


Figure 55. Pooled estimates for trichomoniasis in female sex workers



Trichomoniasis in sex workers

Among female sex workers, pooled TV prevalence is estimated to be 8.97% (95% CI 6.03–11.91, see Figure 55). No studies were identified reporting TV prevalence data for male and transgender sex workers.

Table 26. Prevalence estimates for trichomoniasis in sex workers

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Female sex workers													
Belgium	Coorevits 2018 [90]	06/2015	06/2016	convenience	33.0[2]	outreach	urine or genital	none	NAAT	296	7.40	4.44–10.42	high
Switzerland	Vernazza 2020 [93]	01/2016	06/2017	convenience	31.0	STI clinic	pooled (AR/UG/PH)	none	NAAT	490	10.40	7.70–13.11	medium

AR: ano-rectal; NAAT: nucleic acid amplification test; NR: not reported; PE: prevalence estimate; PH: pharyngeal; RoB: risk of bias; STI: sexually transmissible infections; UG: uro-genital.

1 median, unless indicated otherwise
2 mean
3 range.

Trichomoniasis in people who inject drugs

No studies were identified reporting TV prevalence data for PWID.

3.6 Syphilis prevalence estimates

The following table summarises the pooled syphilis prevalence estimates for all study populations (prevalence estimates from individual studies are presented for populations or sub-groups where only one study was available). Details of the studies included and the meta-analyses are provided in the sub-chapters below.

Table 27. Prevalence estimates for syphilis in all study populations

Population	Sub-group	No. studies	No. individuals	pooled estimate [%]	95%-CI lower	95%-CI upper	I^2
Women	combined[1]	8	249 945	0.14	0	0.29	99.67
Women	proxy (ANC)	7	249 600	0.16	0	0.33	99.77
Women	proxy (other)	1	345	0.00	0.00	0.54	N/A
Young women	proxy (ANC)	1	596	0.00	0.00	0.32	N/A
MSM	visiting STI clinics	14	310 227	6.53	3.2	9.86	99.95
MSM	"high risk"	4	2 090	5.21	1.44	8.98	94.42
MSM	HIV	4	780	14.36	1.1	27.63	98.39
MSM	PrEP	5	2 096	6.48	3.95	9.02	81.89
Sex workers	female	6	3 345	1.75	0.04	3.46	92.98
Sex workers	male+trans	4	125	22.09	5.14	39.03	77.29
PWID	–	2	483	1.56	0.45	2.67	0

ANC: antenatal care; HIV: human immunodeficiency virus; PrEP: pre-exposure prophylaxis; STI: sexually transmissible infection.

1 prevalence estimates combining both, representative studies and studies in proxy populations.

General population

Syphilis in women

Overall prevalence of TP was estimated to be 0.14% (95% CI 0.00–0.29) among women (see Table 28 and Figure 56). No studies were identified reporting on prevalence data for women representative of the general population, or proxy populations. Among women in antenatal care, pooled prevalence of TP is estimated to be 0.16% (95% CI 0.00–0.33, see Figure 57), with the highest prevalence reported in Romania (0.92%; 95% CI 0.32–1.52).

Syphilis in men

No studies were identified reporting TP prevalence data among men in the general population or proxy populations.

Syphilis in young women

One study was identified (see Table 29) conducted among young women in antenatal care, reporting a TP prevalence of 0.00% (95% CI 0.00–0.32).

Syphilis in young men

No studies were identified reporting TP prevalence data for young men.

Table 28. Prevalence estimates for syphilis in the general female population

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method[5]	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Proxy ANC													
Hungary	Balla 2018 [103]	01/2016	12/2016	convenience	ANC	NR	outpatient	blood	dual	17 257	0.31	0.22–0.39	high
Romania	Manolescu 2019 [104]	07/2017	09/2017	convenience	ANC	29.0[2, 4], 15–47[3]	clinical	blood	dual	982	0.92	0.32–1.51	high
Spain	Piñeiro 2016 [28]	01/2011	12/2014	convenience	ANC	33.0	clinical	blood	dual	11 687	0.00	0.00–0.02	high
Poland	Radon-Pokracka 2017 [105]	12/2015	02/2016	convenience	ANC	NR	clinical	NR	NR	465	0.00	0.00–0.40	high
Netherlands	RIVM 2023 [106]	01/2021	12/2021		ANC	NR	NR	blood	NR	176 460	0.01	0.01–0.01	high
Italy	Dalmartello 2019 [107]	NR/2007	NR/2014	convenience	ANC	32.0	clinical	blood	single	38 441	0.29	0.24–0.34	high
Proxy other													
Greece	Parthenis 2018 [34]	10/2015	10/2016	convenience	routine cancer screening	33.2[2]	clinical	genital	single	345	0.00	0.00–0.54	high
Non-EU/EFTA													
Proxy ANC													
Türkiye	Ensari 2015 [108]	01/2014	06/2014	convenience	ANC	26.5[2]	clinical	blood	dual	4 308	0.02	0.00–0.07	high

ANC: antenatal care; NR: not reported; PE: prevalence estimate; RoB: risk of bias.

1 median, unless indicated otherwise
2 mean
3 range
4 positive individuals only
5 'dual' indicates that at least two independent and different tests were used to ascertain TP infection/'single' indicates that diagnosis of TP infection was based on a single test.

Figure 56. Pooled estimates for syphilis in women, total

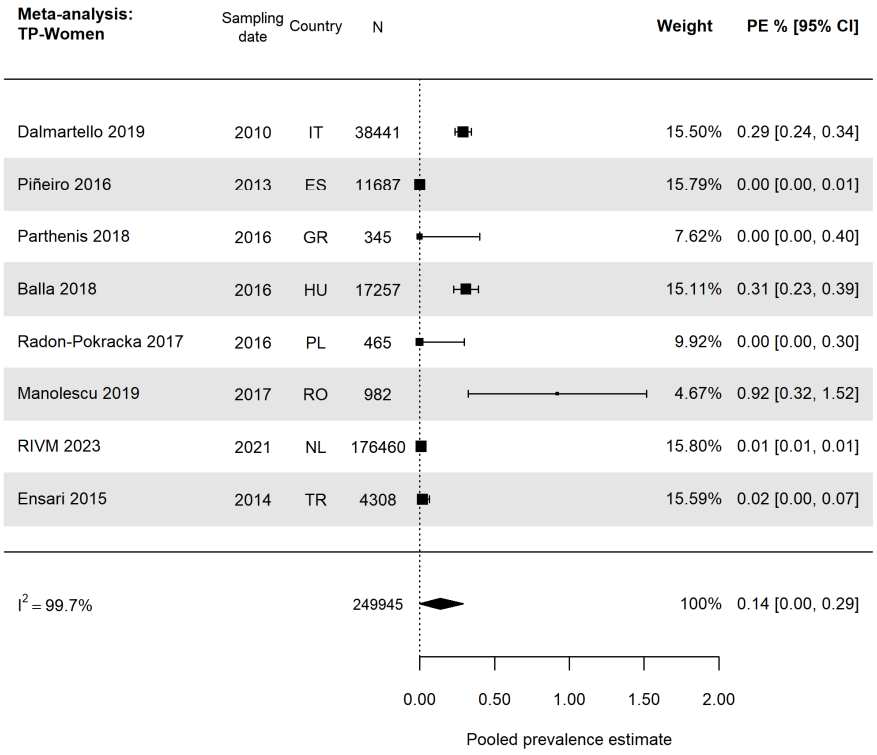


Figure 57. Pooled estimates for syphilis in women in antenatal care (proxy population)

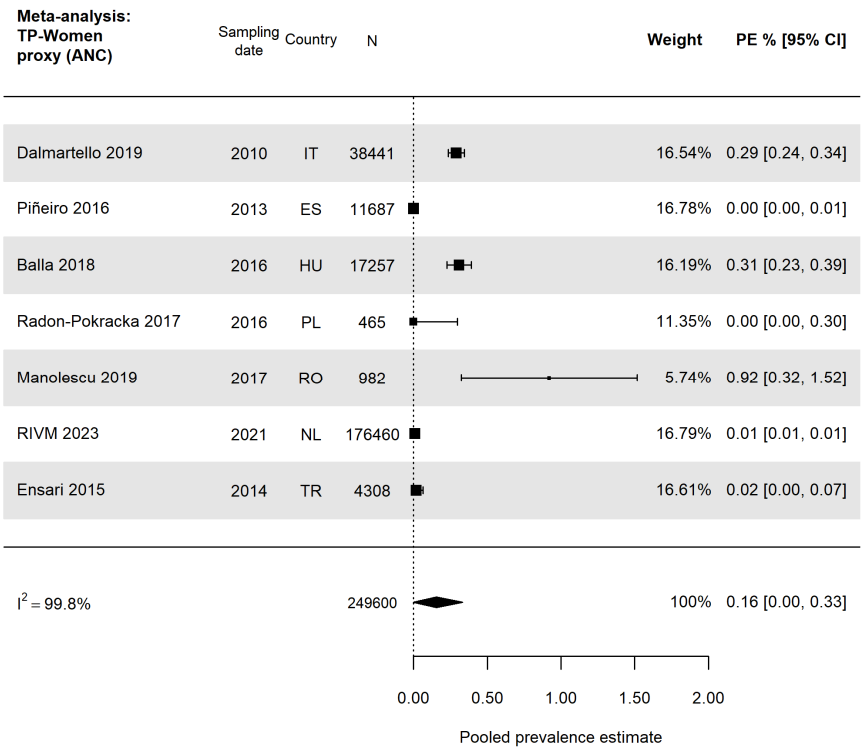


Table 29. Prevalence estimates for syphilis in young women

Country	Author year	Sampling period start	Sampling period end	Sampling method	Population details	Age[1]	Setting	Specimen	Test method[2]	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Proxy ANC													
Spain	Piñeiro 2016 [28]	01/2011	12/2014	convenience	ANC	<25.0	clinical	blood	dual	596	0.00	0.00–0.32	high

ANC: antenatal care; NR: not reported; PE: prevalence estimate; RoB: risk of bias.

1 median, unless indicated otherwise
2 'dual' indicates that at least two independent and different tests were used to ascertain TP infection/'single' indicates that diagnosis of TP infection was based on a single test.

Populations of special interest

Syphilis in men who have sex with men

The prevalence of TP is estimated to be 6.53% (95% CI 3.20–9.86) in MSM visiting STI clinics, 14.36% (95% CI 1.10–27.63) in MSM living with HIV (see Figure 59), 6.48% (95% CI 3.95–9.02) in MSM on PrEP (see Figure 59) and 5.21% (95% CI 1.44–8.98) in MSM engaging in 'high-risk' sexual behaviour (see Table 30 and Figure 61).

Syphilis in sex workers

Among female sex workers, pooled TP prevalence is estimated to be 1.75% (95% CI 0.04–3.46) and 22.09% (95% CI 5.14–39.03) among male and transgender sex workers. TP prevalence among female sex workers who inject drugs was found to be 7.80% (95% CI 1.81–13.78), based on a Czech study; and one conference abstract was identified reporting a TP prevalence of 26.10% (95% CI 8.14–44.03) among mixed gender sex workers in the UK (see Table 31, Figure 62 and Figure 63).

Table 30. Prevalence estimates for syphilis in MSM

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method[4]	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
MSM visiting STI clinics													
Netherlands	Druckler 2018 [61]	07/2016	12/2016	convenience	35.0	STI/GUM clinic	blood	none	single	4 925	3.00	2.53–3.48	high
Netherlands	Evers 2022 [62]	NR/2016	NR/2017	convenience	37.0	STI/GUM clinic	NR	none	NR	161 275	2.70	2.62–2.78	high
Spain	Ayerdi Aguirrebengoa 2020 [64]	01/2016	12/2018	convenience	18.1[2]	STI/GUM clinic	NR	none	unclear	149	10.10	5.24–14.90	high
Netherlands	Achterbergh 2020 [66]	09/2017	12/2017	convenience	35.0	STI/GUM clinic	blood	none	NR	4 455	3.60	3.05–4.14	high
Croatia	Gasbarrini 2021 [109]	05/2018	05/2018	convenience	NR	STI/GUM clinic	blood	none	single	144	2.08	0.00–4.42	high
Spain	Hoyos-Mallecot 2022 [69]	11/2016	11/2019	convenience	34.0	STI/GUM clinic	blood	none	dual	6 256	3.60	3.14–4.06	medium
Switzerland	Bigler 2023 [99]	01/2017	12/2019	convenience	NR	STI/GUM clinic	blood	none	dual	647	4.60	3.02–6.26	medium
France	Rahib 2022 [71]	04/2018	06/2018	convenience	30.0	dating app/social media	blood	none	single	1 062	12.20	10.27–14.21	high
Spain	Fernandez-Lopez 2022_ES	08/2018	11/2019	convenience	30.0	STI/GUM clinic	blood	none	single	103	2.90	0.00–6.16	high
Latvia	Fernandez-Lopez 2022_LV	08/2018	11/2019	convenience	30.0	STI/GUM clinic	blood	none	single	150	6.70	2.67–10.66	high
Slovenia	Fernandez-Lopez 2022_SI [110]	08/2018	11/2019	convenience	30.0	STI/GUM clinic	blood	none	NR	141	2.80	0.10–5.58	high
MSM HIV													
Germany	Spinner 2018 [72]	02/2016	08/2016	convenience	43.2	STI/GUM clinic	blood	none	NR	296	5.07	2.57–7.57	high
France	Farfour 2021 [73]	09/2017	12/2017	convenience	47.0	STI/GUM clinic	blood	none	dual	291	1.68	0.23–3.21	high
MSM PrEP													
Belgium	Reyniers 2018 [74]	09/2015	06/2016	convenience	38.0	unclear	blood	none	dual	200	7.50	3.85–11.15	medium
Italy	Nozza 2022 [75]	05/2017	05/2022	convenience	34.5	STI/GUM clinic	blood	none	NR	624	4.60	3.00–6.30	high

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method[4]	No. tested	PE (%)	95%-CI	RoB
Switzerland	Hovaguimian 2022 [76]	04/2019	01/2020	convenience	40.0	STI/GUM clinic	blood	none	dual	731	3.70	2.33–5.06	medium
Bulgaria	Pakov 2022 [77]	10/2020	08/2022	convenience	33.0	STI/GUM clinic	blood	none	unclear	410	10.30	7.31–13.18	high
Austria	Chromy 2023 [78]	07/2020	12/2021	convenience	33.8	STI/GUM clinic	blood	none	NR	131	8.00	3.09–12.18	high
MSM "high risk"													
Switzerland	Schmidt 2020 [79]	01/2016	06/2017	convenience	33.0	STI/GUM clinic	blood	none	dual	779	1.70	0.77–2.57	high
Italy	Foschi 2018 [80]	01/2017	11/2017	convenience	35.5[2]	STI/GUM clinic	blood	none	dual	165	10.30	5.66–14.94	medium
Germany	Streeck 2022 [81]	06/2018	03/2019	convenience	33.0	STI/GUM clinic	blood	none	dual	1 043	3.50	2.42–4.67	medium
Poland	Szetela 2023_hr [82]	12/2019	12/2020	convenience	NR	STI/GUM clinic	blood	none	dual	103	7.76	2.60–12.94	high
MSM other													
Poland	Szetela 2023_lr[5] [82]	12/2019	12/2020	convenience	NR	STI/GUM clinic	blood	none	dual	64	3.12	0.00–7.39	high
Non-EU/EFTA													
MSM visiting STI clinics													
Georgia	Kevlishvili 2023 [87]	NR/2019	NR/2019	convenience	18-65[3]	STI/GUM clinic	blood	none	dual	1 698	25.30	23.26–27.39	medium
Ukraine	Fernandez-Lopez 2022_UA [110]	08/2018	11/2019	convenience	30.0	STI/GUM clinic	blood	none	single	450	9.80	7.03–12.52	high
UK	Ogaz 2019 [86]	01/2017	12/2017	convenience	NR	STI/GUM clinic	blood	none	NR	128 772	2.70	2.61–2.79	high
MSM HIV													
Türkiye	Koksal 2020 [111]	03/2018	06/2018	convenience	NR	STI/GUM clinic	blood	none	dual	87	28.70	19.23–38.24	high
Türkiye	Taspinar Sen 2023 [88]	08/2018	02/2020	convenience	38.4[2]	STI/GUM clinic	blood	none	unclear	106	24.53	16.34–32.72	high

GUM: genitourinary medicine; NR: not reported; RoB: risk of bias; STI: sexually transmitted infection.
1 median, unless indicated otherwise; 2 mean; 3 range; 4 'dual' indicates that at least two independent and different tests were used to ascertain TP infection/'single' indicates that diagnosis of TP infection was based on a single test; 5 MSM reporting sexual behaviour classified as 'low-risk' by the study authors.

Figure 58. Pooled estimates for syphilis in MSM visiting STI clinics

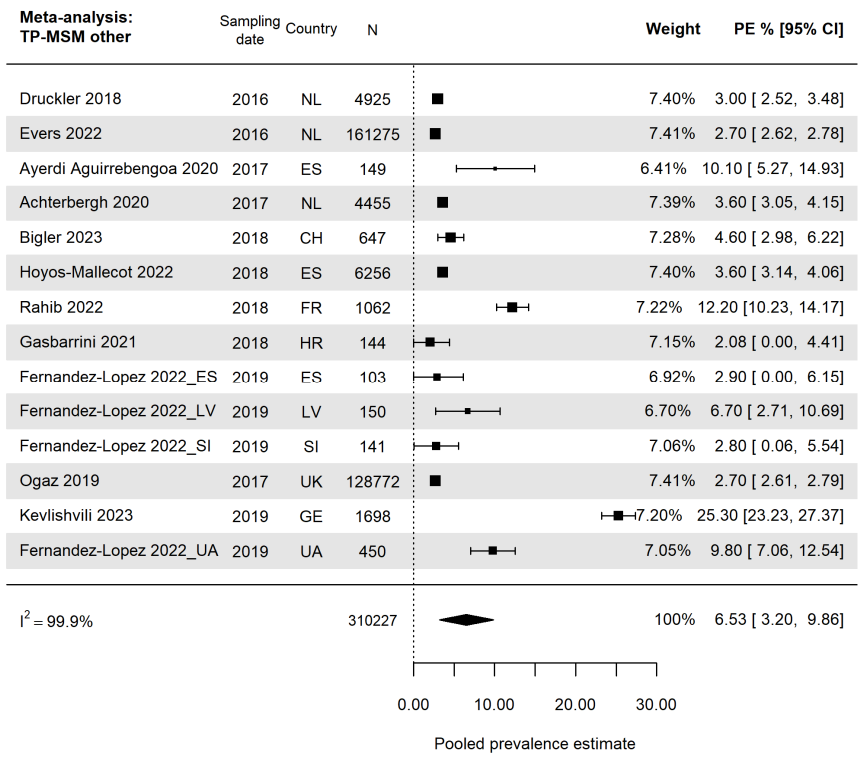


Figure 59. Pooled estimates for syphilis in MSM living with HIV

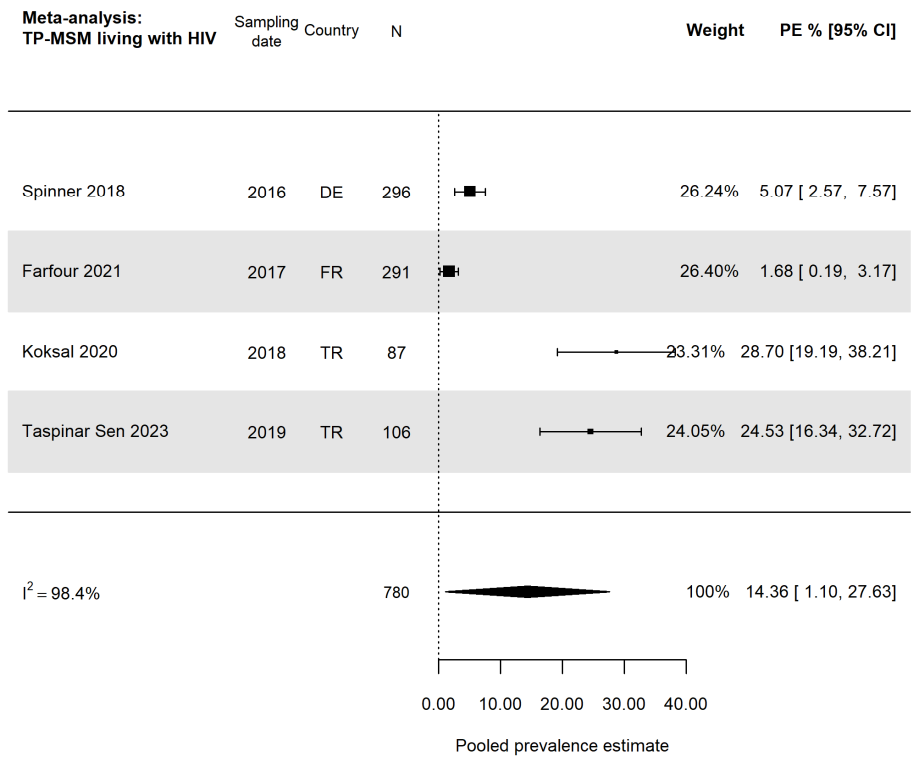


Figure 60. Pooled estimates for syphilis in MSM on PrEP

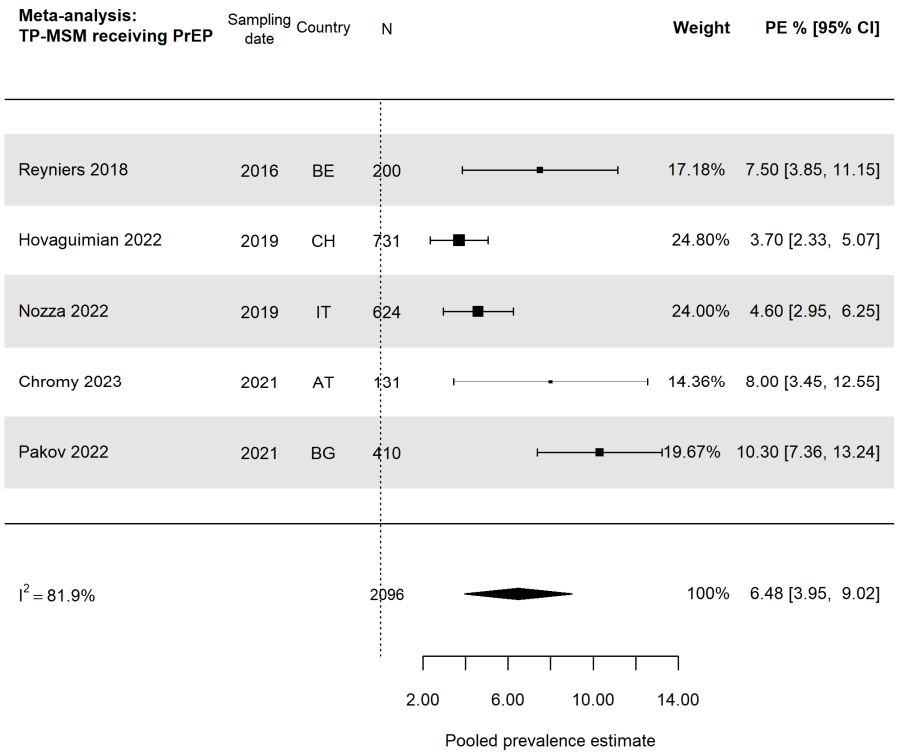


Figure 61. Pooled estimates for syphilis in high-risk MSM

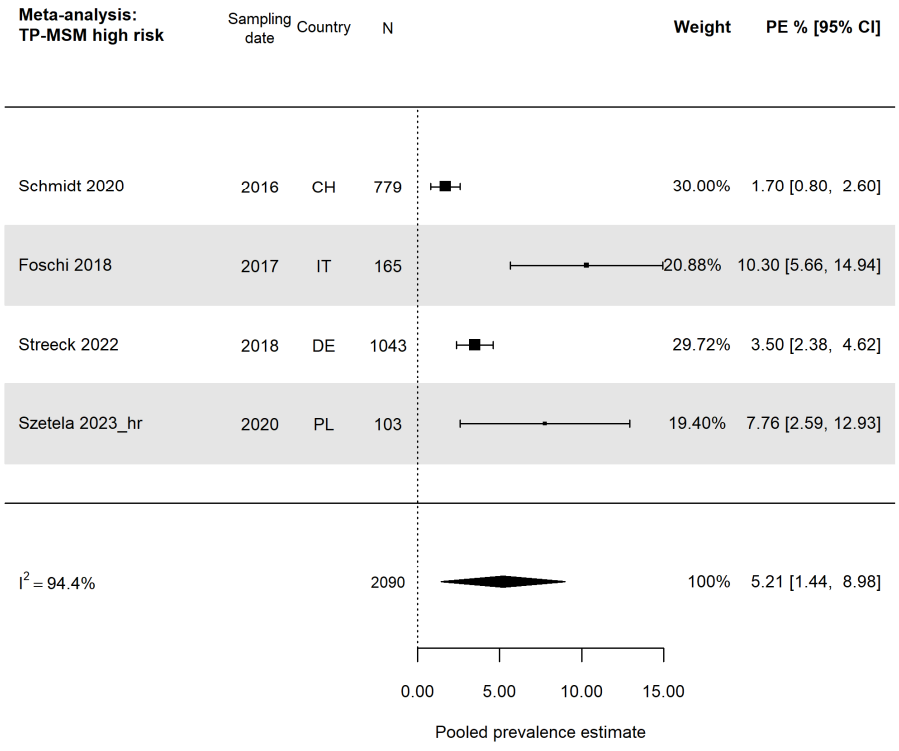


Table 31. Prevalence estimates for syphilis in sex workers

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method[5]	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
Female sex workers													
Portugal	Almeida 2020_f [89]	09/2015	09/2016	convenience	36.2[2, 4]	outreach	blood	none	dual	74	1.40	0.00–3.98	high
Italy	Marrone 2023 [112]	01/2020	12/2020	convenience	17–52[3]	community	blood	none	dual	82	0.00	0.00–2.27	high
Netherlands	Druckler 2020_f [91]	01/2014	12/2015	convenience	28.0	health centre	blood	none	single	1 390	4.60	3.50–5.71	high
Netherlands	van Dulm 2020 [92]	01/2016	09/2016	convenience	28.0	community	blood	none	dual	1 213	0.00	0.00–0.16	medium
Switzerland	Vernazza 2020 [93]	01/2016	06/2017	convenience	31.0	STI clinic	blood	none	dual	490	1.20	0.25–2.20	medium
Switzerland	Vu 2020 [95]	04/2015	12/2016	convenience	18-60[3]	community	blood	none	dual	96	5.00	0.76–9.65	high
Male and transgender sex workers													
Portugal	Almeida 2020_m [89]	09/2015	09/2016	convenience	36.2[2, 4]	outreach	blood	none	dual	12	8.30	0.00–23.97	high
Portugal	Almeida 2020_t [89]	09/2015	09/2016	convenience	36.2[2, 4]	outreach	blood	none	dual	14	21.40	0.00–42.92	high
Netherlands	Druckler 2020_m [91]	01/2014	12/2015	convenience	28.0	health centre	blood	none	single	84	15.00	7.74–23.21	high
Netherlands	Druckler 2020_t [91]	01/2014	12/2015	convenience	39.0	health centre	blood	none	single	15	53.30	28.09–78.58	high
Female sex workers PWID													
Czechia	Sekera 2022 [113]	NR/2003	NR/2018	convenience	28.8[2]	outreach	blood	none	single	77	7.80	1.81–13.78	high
Non-EU/EFTA													
Mixed gender sex workers													
UK	Sultan 2021 [97]	NR	NR	convenience	NR	outreach	blood	none	NR	23	26.10	8.14–44.03	high

NR: not reported; RoB: risk of bias; STI: sexually transmitted infection.
1 median, unless indicated otherwise; 2 mean; 3 range; 4 comprises male, female, and transgender sex workers (not reported separately); 5 'dual' indicates that at least two independent and different tests were used to ascertain TP infection/'single' indicates that diagnosis of TP infection was based on a single test.

Figure 62. Pooled estimates for syphilis in female sex workers

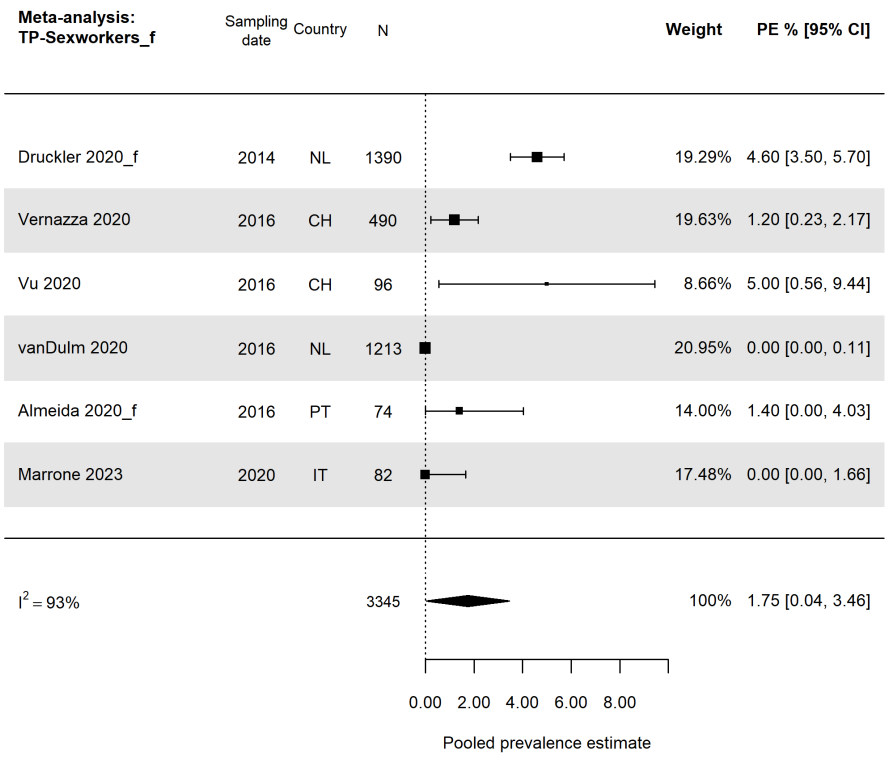
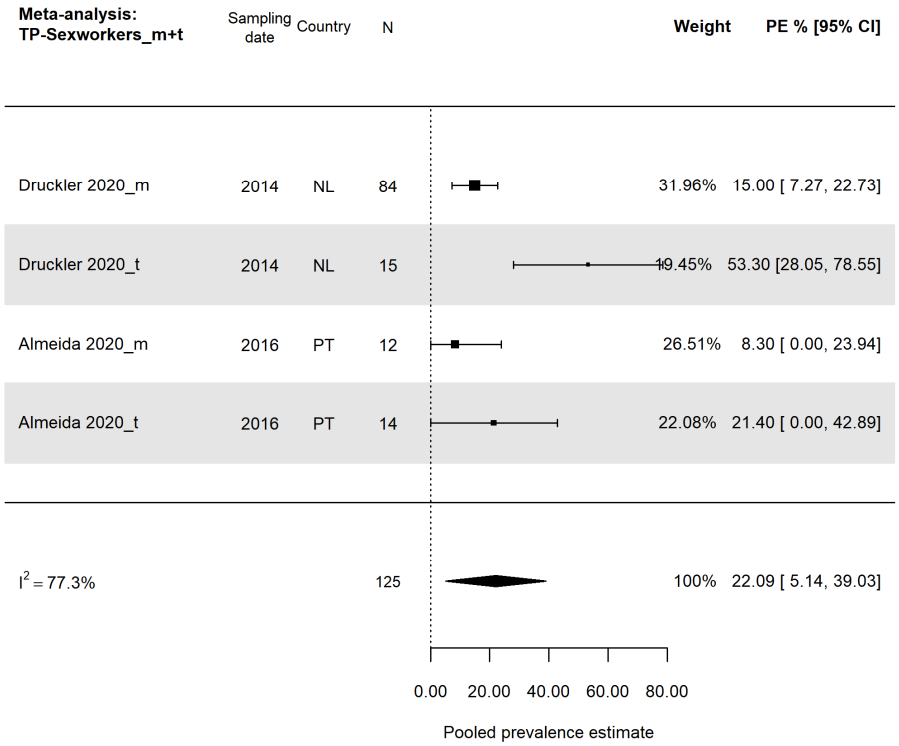


Figure 63. Pooled estimates for syphilis in male and transgender sex workers



Syphilis in people who inject drugs

Among people who inject drugs, pooled TP prevalence is estimated to be 1.56% (95% CI 0.45–2.76, see Table 32). TP prevalence among PWID was found to be 1.82% (95% CI 0.48–3.16), based on a Czech study (54.7% males), and 1.00% (95% CI 0.00–2.98) based on a Serbian study (81.8% males) (see Figure 64).

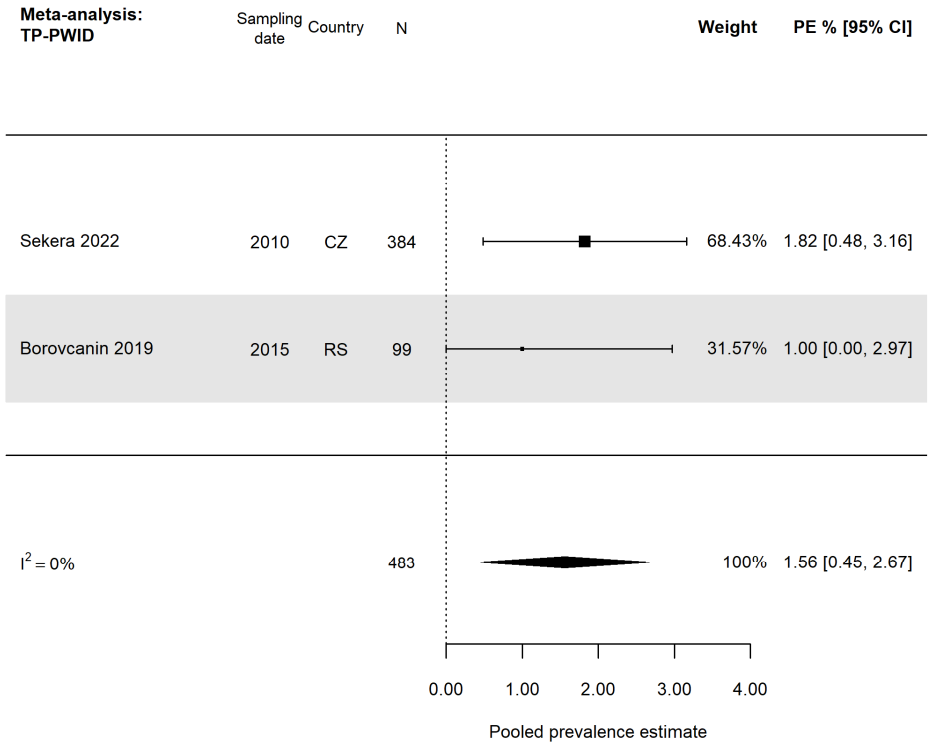
Table 32. Prevalence estimates for syphilis in PWID

Country	Author year	Sampling period start	Sampling period end	Sampling method	Age[1]	Setting	Specimen	Additional specimen tested	Test method[4]	No. tested	PE (%)	95%-CI	RoB
EU/EFTA													
PWID													
Czechia	Sekera 2022 [113]	NR/2003	NR/2018	convenience	28.8[2]	outreach	blood	none	single	384	1.82	0.48–3.16	high
Serbia	Borovcanin 2019 [114]	07/2015	08/2015	convenience	19-63[3]	clinical	blood	none	single	99	1.00	0.00–2.98	high

NR: not reported; RoB: risk of bias; STI: sexually transmitted infection.

1 median, unless indicated otherwise
2 mean
3 range
4 'dual' indicates that at least two independent and different tests were used to ascertain TP infection/'single' indicates that diagnosis of TP infection was based on a single test.

Figure 64. Pooled estimates for syphilis in people who inject drugs



4. Discussion

This systematic review aimed to identify and synthesise the existing evidence on the prevalence of the four curable STIs in the general population and populations of special interest (MSM, sex workers, and PWID) in the European region. The general aim of this project was to support the understanding of STI epidemiology in Europe and the monitoring of STI trends by providing epidemiological information gathered in prevalence studies. These data constitute an important complement to routine STI case surveillance of diagnosed cases reported to ECDC, which is dependent on surveillance system characteristics, testing policies and practices that vary by country and over time and cannot fully capture asymptomatic infections. Prevalence estimates from nationally representative studies retrieved by a previous ECDC literature review on chlamydia epidemiology indicated a more homogeneous distribution of the infection in the general population across European countries than that depicted by case-based surveillance data [115]. STI prevalence studies may serve as proof of concept for using prevalence estimates as a complementary source to monitor progress towards elimination targets, in particular where STI surveillance is not comprehensive. By tracking changes in prevalence rates over time, policymakers can target prevention efforts, assess their impact and adjust strategies to reduce the burden of STIs.

Summary of the evidence

With the evidence base gathered in this systematic review, we were able to produce European pooled estimates. Substantial variation in the prevalence estimates for CT, NG, TV, and TP were observed between countries, both in the general population and in populations of special interest. However, these need to be interpreted with great caution, taking into consideration the different sampling dates and methodological aspects of the underlying studies.

General population and proxy populations

Overall, the current burden of CT in the European region is estimated to be 2.76% (95% CI 1.65–3.87) among women (1.99% in representative studies, 1.83% in antenatal care, 3.79% in other proxy populations), and 2.64% (95% CI 0.61–4.67) among men (1.11% in representative studies, 4.05% in proxy populations). Overall prevalence of NG is estimated to be 0.24% (95% CI 0.00–0.50) among women (0.07% in representative studies, 0.02% in antenatal care, 0.53% in other proxy populations), and 0.10% (95% CI 0.00–0.22) among men (0.08% in representative studies, 0.91% in proxy populations). Overall prevalence of TV is estimated to be 0.69% (95% CI 0.38–0.99) among women (0.64% in antenatal care, 0.85% in other proxy populations), and 0.00% (95% CI 0.00–0.21) among men (only proxy populations available). Overall prevalence of TP was estimated to be 0.14% (95% CI 0.00–0.29) among women (only antenatal care available). Among men in the general population, no TP estimates were identified.

For comparison, the review by Rowley et al. (2019) [11], based on a meta-analysis of studies spanning from 2009 to 2016, indicated a slightly higher CT prevalence of 3.2% (95% uncertainty interval [UI]: 2.5–4.2) and a very similar NG prevalence of 0.3% (95% UI: 0.1–0.6) among European women aged 15-49 years. For this population group, they reported a slightly lower TP prevalence of 0.1% (95% UI: 0.0–0.4) and a higher TV estimate of 1.6% (95% UI: 1.1–2.3). Differences in methodological approaches, such as using antenatal care data for TP and adjustment ratio for TV (versus CT), need to be acknowledged when comparing results from the two literature reviews alongside potential changes in prevalence in more recent years.

For the general male population, the estimates from the current meta-analysis fall within the uncertainty intervals for the prevalence estimates proposed by Rowley et al. (2019) [11]. They estimated a prevalence of 2.2% (UI 1. –3.0) for CT, 0.3% (95% UI 0.1–0.5) for NG, and 0.2% (95% UI 0.1–0.3) for TV. This review did not identify studies reporting the prevalence of TP in men; however, Rowley et al. [11] proposed a figure of 0.1% (95% UI 0.0-0.3), based on a prevalence ratio of 1 for syphilis in males versus females.

Young people

In young people aged 15 to 24 years, the pooled prevalence estimates of CT, NG, and TV were substantially higher when compared to the general population: CT prevalence is estimated to be 5.54% in young women (4.44% in representative studies, 8.19% in antenatal care, 5.16% in other proxy populations) and 3.32% in young men (2.91% in representative studies, 4.14% in proxy populations). NG prevalence is estimated to be 0.51% in young women (0.20% in representative studies, 1.42% in antenatal care, 0.26% in other proxy populations) and 0.07% in young men (2.00% in representative studies, 0.45% in proxy populations). TV prevalence is estimated to be 0.64% in young women (0.20% in representative studies, 2.04% in antenatal care) and 0.00% in young men (based on two representative studies). For TP in young people, only one study conducted among young women in antenatal care was identified, reporting a prevalence of 0.00%.

Differences between representative studies and proxy populations (including antenatal care)

The prevalence estimates derived from proxy populations other than antenatal care are generally higher than those derived from representative studies. These differences may suggest higher STI risks in the studies of proxy population. However, they might also be explained by stronger participation bias associated with convenience sampling, which was employed in these studies, or simply by different countries contributing to the various estimates. Interestingly, prevalences of CT and NG are markedly increased in antenatal care compared to representative studies in young people, while no such difference was observed in mixed-age studies. This may suggest a higher STI risk in women who become pregnant at a comparatively young age. However, since the pooled estimates are mostly based on small numbers of studies with considerable risk of bias, the results can only be interpreted very cautiously and should be explored further in additional studies.

Populations of special interest

Men who have sex with men

The STI prevalence estimates available in the identified literature cannot be generalised to the whole population of MSM. We calculated pooled estimates for various sub-groups of MSM: in MSM visiting STI clinics, the estimated prevalences are 9.72% for CT, 10.46% for NG, 0.10% for TV and 6.53% for TP. In MSM living with HIV, the estimated prevalences are 6.08% for CT, 4.74% for NG, 0.94% for TV and 14.36% for TP. In MSM on PrEP, the estimated prevalences are 9.57% for CT, 8.99% for NG and 6.48% for TP. In MSM engaging in 'high-risk' sexual behaviour, the estimated prevalences are 15.35% for CT, 14.37% for NG, 1.54% for TV and 5.21% for TP. It is interesting to note that the prevalence of CT and NG is markedly lower in MSM living with HIV than in MSM visiting STI clinics. This may suggest a lower STI risk in MSM living with HIV, however, the pooled estimates are based on only three studies and the prevalence of TP is higher in MSM living with HIV than in MSM visiting STI clinics.

A recent systematic review and meta-analysis by Tsuboi et al. (2021) [116] employed a broader scope, both geographically (global) and temporally (including studies between 2000 and 2020). The review proposed a pooled prevalence of 3.4% (95% CI: 1.8-5.4) for the Sustainable Development Goals region 'Europe and Northern America'. This estimate is based on 35 study estimates from 16 countries, about half of which stem from countries not included in our systematic review (USA, Canada, Russia). While the review authors excluded studies based on some factors with potential for bias (e.g. participants exclusively HIV-infected; routine STI clinics attendees) to achieve more representative estimates for the general MSM population, they did include studies exhibiting a range of other factors with potential for bias. Examples are studies exclusively in transgender individuals, sex workers, methamphetamine users or individuals selected for high-risk behaviour. Most of the studies included employed convenience sampling in various settings potentially associated with an increased risk of STI, such as walk-in STI testing facilities, saunas and bathhouses, clubs, cruising areas and homeless shelters. The authors reported that TP prevalence estimates were high in studies exclusively involving male sex workers, transgender women, and transgender women sex workers, as well as in studies where HIV prevalence was greater than 5.0%, which is consistent with the findings of the current review.

Potentially representative of the larger MSM population, the 2017 European MSM Internet Survey (EMIS) estimated that of 127 792 respondents from 44 European countries 4.5%, 5.2% and 4.4% had a self-reported diagnosis of CT, NG and TP, respectively in the previous 12 months [117, 118]. In addition to the bias generally associated with self-reported diagnoses, the authors of the report note that due to a translation error, the French questionnaire on TP, CT and NG may have been understood by some men as having undergone a test rather than having a positive test result, possibly affecting the estimates from France, Belgium and Switzerland.

Sex workers

We identified several STI prevalence studies among sex workers, suggesting a high prevalence of STIs among this vulnerable population. In female sex workers, pooled prevalences are estimated to be 5.50% for CT, 2.22% for NG, 8.97% for TV, and 1.75% for TP. Among male and transgender (male to female) sex workers, prevalence estimates were found to be particularly high, with pooled prevalences estimated to be 6.04% for CT, 6.36% for NG and 22.09% for TP.

People who inject drugs

Only two studies were identified for PWID, and both reported on the prevalence of TP. The pooled TP prevalence is estimated to be 1.56%, based on the studies from Czechia and Serbia.

Quality of the evidence

Even though a substantial number of studies were identified in total, the body of evidence for the prevalence of the four STIs studied in the European region has significant gaps. Specifically, there are 17 countries for which no relevant studies were identified. In addition, the majority of the available studies have a high or medium risk of bias. The main sources of bias across the studies are the sampling frames and the sampling methods. Representative studies employing probability-sampling would provide prevalence estimates with much higher certainty and are feasible in the general population. Other sources of bias are due to insufficiently detailed reporting of important information, such as characteristics of the individuals included, testing methods (especially

for TP) and response or participation rates. These shortcomings could be reduced with more comprehensive and transparent reporting practices. Limited geographical coverage in studies was also a frequent issue, with regional or local data being more regularly available than national estimates.

Most of the pooled estimates calculated had high values in the I^2 statistics, suggestive of considerable heterogeneity. However, high I^2 values are very common in pooled estimates of prevalence and should be interpreted much more cautiously than in other types of meta-analyses [20]. However, it is noteworthy that the pooled estimates which only include representative studies employing probability sampling present substantially lower I^2 values than pooled estimates which include studies in proxy populations and studies which use convenience sampling. This further underscores the value and the importance of well-designed representative studies of STI prevalence.

While publication bias was not statistically assessed, it is noteworthy that a substantial number of studies were only available as conference abstracts.

Gaps in evidence at European level

The identified studies are unevenly distributed throughout the European region, with 20, 30, 33 and 37 countries having no studies available reporting CT, NG, TV, and TP prevalence for the general population, respectively. Therefore, caution is warranted when comparing prevalence estimates across countries.

Representative studies employing probability-based sampling are very scarce for all the STIs studied, and not a single one is available for the prevalence of TP in any population. While this type of study is resource-intensive, studies in certain proxy populations, such as women in antenatal care, or individuals attending routine check-ups or cancer screenings, can be conducted much more easily. Conducting studies in proxy populations could provide valuable information for countries where estimates of the STI prevalences are not available from studies with probability-based sampling.

MSM are a population of considerable interest, with more than 30 studies included in total. However, the evidence on STI prevalence in MSM is severely impaired by the fact that the studies almost exclusively recruited participants through STI clinics. Individuals visiting STI clinics are very likely to have a higher risk of STI, therefore the identified prevalence estimates in this systematic review can only be viewed as estimates of prevalence in MSM who visit STI clinics, and are not representative of the whole MSM population. Comparison between the studies on MSM and the general population included in this systematic review is hindered by two factors. Firstly, the fact that the baseline risk of STIs presumably differs, depending on where/how individuals are recruited for studies. Secondly, the fact that most prevalence estimates reported for MSM are composite or pooled prevalences from the sampling of different anatomical regions (usually urogenital, pharyngeal, and ano-rectal swabs). In contrast, most prevalence estimates reported for the general population were based on the results from urine samples, and urogenital swabs for females. Composite prevalence estimates from multiple anatomical sites are bound to be higher than single-site prevalence estimates. In addition, the sensitivity of STI tests in urine samples might be different to that in urogenital or other swabs.

Strengths and limitations

This review is based on an in-depth and well-defined search strategy, which was applied to an extensive set of databases. Input from ECDC experts ensured that the appropriate research questions, objectives, search strategy and eligibility criteria were used. In addition to the bibliographic databases, supplementary and grey literature was searched and existing contacts with national and international experts were queried for additional published articles or grey literature providing prevalence estimates. While the primary aim of the review is to provide insights for policymakers in the European region, the geographical scope was broadened to encompass not only EU/EFTA Member States, but also EU candidate and potential candidate countries, as well as the United Kingdom. The risk of bias was assessed for each study by using a predefined methodology to investigate the impact of differences in study design and conduct (e.g. study population selection and sampling, different laboratory tests, and sample types).

However, there are several shortcomings and limitations regarding the methodological choices made in this systematic review. For example, study populations that were not considered appropriate proxies for the general population included blood donors. While some recent systematic reviews have integrated blood donors as proxy populations [119], they were excluded from this review due to concerns regarding their representativeness of the general population. This decision was influenced by the common practice by transfusion services of excluding donors who report risks or exhibit infections during screening procedures [120]. Incorporating studies involving blood donors could offer valuable supplementary insights, particularly regarding the prevalence of TP, given the limited availability of studies on TP prevalence in the general population. In addition, studies on individuals who visit STI clinics that do not specifically target MSM were not included in this systematic review. If such studies had been included and a comparison made between the prevalence of STIs in non-MSM individuals visiting STI clinics with MSM individuals visiting STI clinics, this could have added valuable information to the review and helped with the contextualisation and interpretation of the prevalence estimates for MSM. Most of the studies involving MSM and sex workers used samples from different anatomical sites and reported prevalence estimates from the various sampling sites separately, in addition to the composite estimates. Analysing these different estimates in more detail could provide valuable additional insights into the epidemiology of the STIs studied, however this was beyond the scope of this report.

5. Conclusions

This review provides evidence-based prevalence estimates for CT, NG, TV and TP for the general population and some populations of special interest that will be useful for policy action to limit the spread of curable STIs in the European region. However, efficient infection prevention and control policies would require the availability of relatively recent prevalence estimates from most of the countries in the region and the current evidence base is insufficient. Moreover, many of the studies that are available have a considerable risk of bias, further limiting the certainty of the available evidence. Key populations, such as sex workers and PWID, are very poorly studied. Studies on MSM are more numerous but were almost exclusively conducted in STI clinics and are therefore of limited value for estimating the true STI prevalence in the general MSM population. The significant gaps in both the quantity and the quality of the evidence on the prevalence of curable STIs in the European region identified in this review should be addressed in future high-quality studies.

Actions that can be taken based on this evidence assessment

Against the backdrop of this study, and in line with the recommendations formulated in WHO's Regional action plans for ending AIDS and the epidemics of viral hepatitis and sexually transmitted infections 2022–2030 [2], several public health actions are advisable, especially for countries with a less comprehensive description of STI epidemiology.

Strengthen the capacity to describe STI epidemiology

- by conducting prevalence studies representative of the general population, employing probability-based sampling where this is missing, or if routine surveillance is not comprehensive, or data is not of acceptable quality;
- by considering/collecting estimates for proxy populations that may be available from specific settings (such as antenatal care programmes, routine check-ups or screenings for other conditions, or for military recruits) as a more feasible and less resource-intensive alternative to representative probability-based sampling studies.

Implement evidence-based STI prevention and control measures

- by using prevalence estimates in combination with other epidemiology data to inform national prevention policies targeting the population groups most affected by STI epidemics, such as young people, specific sub-groups of MSM and/or sex workers.

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