



# STI with *Mycoplasma genitalium*—more common than *Chlamydia trachomatis* in patients attending youth clinics in Sweden

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## Abstract

The prevalence of *Chlamydia trachomatis* in Sweden is well known, whereas the prevalence of *Mycoplasma genitalium* is less well documented. Youth clinics offer free contraception advice, sexually transmitted infection (STI) testing and/or contact tracing for the age group 15–25 years. The main objective of this study was to determine the prevalence of STIs, the presence of symptoms and the role of contact tracing. From July 2013 to March 2014, 1001 persons, 509 women and 492 men, were included in this study of six youth clinics in the Region of Västra Götaland. Symptoms were registered and whether the patient was tested because of contact tracing. Collection of urine samples, testing, treatment and disease registration were performed according to clinical routines. Urine samples were analysed for *C. trachomatis*/*N. gonorrhoeae* on the Cobas 4800 system (Roche). *M. genitalium* was analysed by lab-developed PCR. Genital infection was present in 16.8%. The prevalence of *M. genitalium* was higher than for *C. trachomatis* (9.6% and 7.1%). Men with symptoms have a significantly higher relative risk for infection with *M. genitalium* or *C. trachomatis* compared to asymptomatic men, while there is no increase for women. Contact tracing is important since positive outcome has a high relative risk for both infections. The prevalence of *M. genitalium* was higher than *C. trachomatis* in this study population. Initial testing for both *C. trachomatis* and *M. genitalium* should at least be considered for young men presenting with symptoms of genital infection. In finding positive cases, contact tracing is of great importance.

**Keywords** STI · *Mycoplasma genitalium* · *Chlamydia trachomatis* · Youth clinic · Prevalence

## Introduction

*Mycoplasma genitalium*, mainly found in the genital tract, causes a bacterial STI with a symptomatology that resembles *Chlamydia trachomatis*. If and when one should test for this

infection is discussed. What is the prevalence of *M. genitalium*? Is screening of individuals the best method or should symptoms be of guidance? How should it be treated and, more important, should it be treated at all? To answer these questions, one must know its medical implications.

*M. genitalium* was first isolated from men with urethritis in 1980 [1]. Its role as a sexually transmitted infection (STI) has been established [2], and it has been shown to cause urethritis in both men and women and is associated with cervicitis and vaginal discharge even though there are discrepancies in study results due to inconsistency of definitions [3]. A recent meta-analysis evaluating the association between cervicitis and *M. genitalium* infection showed a significantly increased risk. Pelvic inflammatory disease (PID) can cause chronic pelvic pain, ectopic pregnancy and tubal factor infertility (TFI). In the analysis, a significantly increased risk for PID was shown [4], which implicates a role in TFI. Another meta-analysis of the association between *M. genitalium* and TFI suggests a causal link but displays heterogeneity between investigated studies [3]. An association between infection with

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*M. genitalium* and preterm birth and spontaneous abortion has been shown [4].

Of interest is if both symptomatic and asymptomatic *M. genitalium* infections are important to treat. According to the present Swedish algorithm, only symptomatic patients who are *C. trachomatis* negative or not cured using a standard regime of doxycycline should be tested for *M. genitalium* and treated. Sexual partners are recommended to be tested and treated if positive.

The incidence of both *N. gonorrhoeae* and *C. trachomatis* is well known in countries with compulsory notification like Sweden [5]. In 2008, the World Health Organization (WHO) estimated 106 million new cases of urogenital chlamydia among adults globally. This places chlamydia as the most prevalent bacterial STI together with gonorrhoea [6].

Prevalence estimates vary a lot for *C. trachomatis* because of population sample heterogeneity [7]. Also, studies of *M. genitalium* show variability in prevalence due to different settings. Different sampling methods as well as different laboratory assays have been used, explaining variations [3].

A French study of 2652 urogenital specimens showed an *M. genitalium* prevalence of 3.4% but significantly higher in patients receiving care in STI clinics and prisons than in gynaecologic, obstetric and reproduction centres (4.0% vs 1.7%) [8].

A recent retrospective, US multi-centre study showed high prevalence rates for both *C. trachomatis* and *M. genitalium* in men (17.2% and 17.8%, respectively) and equally high *M. genitalium* rates in women (16.3%) and was associated with non-Hispanic and African-American ethnicity, younger age and female symptomatic status [9].

In a Danish nationwide retrospective study of *M. genitalium*, an increasing testing trend from 2006 to 2010 was observed. The positivity rates at the end of the study were 3.8% in women and 10.3% in men [10].

The number of partners [7] and experience of earlier STIs affect the risk of contracting *C. trachomatis* [11, 12]. In the case of chlamydia, reinfection from a partner seems to play a role.

Usually, these studies are performed on individuals with urogenital symptoms and/or having a risky sexual behaviour and presenting the prevalence in a specific population rather than in ordinary sexually active youths between the ages of 15–25. In Sweden, they represent the great majority of all cases of *C. trachomatis*.

Many Swedish laboratories have recently introduced a combination assay for both *C. trachomatis* and *N. gonorrhoeae* showing that the latter infection is rare (< 1%) [5]. In 2016, nearly 36,000 cases of *C. trachomatis* and almost 1800 cases of *N. gonorrhoeae* were notified for all ages [5]. No notification is made for *M. genitalium*.

In Swedish youth clinics, tests and treatment for *C. trachomatis* and *N. gonorrhoeae* are free of charge. Most

of the patients are women. Only about 30% of those tested for *C. trachomatis* are men, but of those having symptoms or being subject to contact tracing, a larger proportion is men. Many women visit these clinics for other reasons than STI, such as contraceptives, and are often tested for STIs at the same time. Contact tracing for *C. trachomatis* and *N. gonorrhoeae* is mandatory according to Swedish law.

A rising concern about *M. genitalium* and antibiotic resistance makes it important to decide whether this STI ought to be screened for in a similar manner as *N. gonorrhoeae* and *C. trachomatis*. The most common treatment in Europe for both infections is a single dose of 1 g of azithromycin. No treatment failure is observed for *C. trachomatis*. In a systematic review and meta-analysis, the efficacy of this treatment for urogenital *M. genitalium* has decreased to 60% [13] and even lower in an American study [9]. There is a need for a routine that simultaneously detects *M. genitalium* and the known resistance gene. A quinolone could be an alternative treatment but is also prone to bring resistance [3, 14]. Recently, the first European multidrug-resistant *M. genitalium* was found [15].

The main objective of this study was to determine the prevalence of *M. genitalium*, *N. gonorrhoeae* and *C. trachomatis* among Swedish youths in connection with symptoms or contact tracing. A secondary aim was to give recommendations for STI testing.

## Materials and methods

### Study design

Patients between the ages 15 and 25 visiting a youth clinic to be tested for *C. trachomatis* could take part in the study. To avoid gender imbalance, consecutive male patients and the next female visitor were included. Six youth clinics in the county of Västra Götaland were part of the study. Oral and written informed consents were obtained. The hypothesis that 5% of the attendees would be *M. genitalium* positive leads to the conclusion that 1000 patients, 500 males and 500 females, should be sufficient for a significant result concerning the prevalence in both sexes.

The patients were asked for specific symptoms at the time of inclusion. Since a patient subject to contact tracing has a higher risk of being positive for a specific STI, a question about contact tracing was added to the protocol.

At the time of the study, urine was the standard sampling material. Molecular diagnostics were performed to detect *C. trachomatis*, *N. gonorrhoeae* and *M. genitalium* using the same urine sample.

The protocol was sent to the laboratory where the results of the three analyses were summarized. In all other aspects, the patient was treated according to standard procedure.

**Table 1** Numbers of sexually transmitted infections and genital symptoms observed in the study of 1001 youths in Sweden. *Chlamydia trachomatis* (Ct), *Mycoplasma genitalium* (Mg) and *Neisseria gonorrhoeae* (Ng)

Gender	With genital symptoms	Without symptoms	No STI	Ct positive	Mg positive	Double infection, Ct and Mg	Ng positive
Women	133	366	447	23	39	4	0
Men	89	389	386	48	57	7	1
Total in the study	222	755	833	71	96	11	1

## Questionnaire

A short questionnaire was filled in by the health care professional: Symptoms: Yes or No. The following symptoms were included for both sexes: dysuria (painful urination)/urgency/urethral discharge. Specifically for women: Vaginal discharge/irregular vaginal bleeding/ pain in the lower abdomen (PID). Specifically for men: Scrotal pain.

Contact tracing: Yes or No (*C. trachomatis*/*M. genitalium*/*N. gonorrhoeae*).

## Laboratory diagnostics of *M. genitalium*, *C. trachomatis* and *N. gonorrhoeae*

Collection of urine was performed in Cobas PCR Urine Sample Kit (Roche Molecular Diagnostics). Transport of urine samples from the youth clinics, STI-testing in the laboratory and disease registration to the infectious disease control unit were performed according to clinical routine. Urine samples were analysed for *C. trachomatis*, *N. gonorrhoeae* and *M. genitalium* at a daily basis with a TAT of 1–2 days. The Cobas 4800 CT/NG test (Roche Molecular Diagnostics) was used on the Cobas 4800 system. Results from the analyses are presented as positive, negative or invalid for *C. trachomatis* and *N. gonorrhoeae* respectively. *M. genitalium* was analysed by a conventional MGB probe-based laboratory-developed real-time PCR detecting specifically the 16S rDNA gene. The method was used for daily routine analysis of clinical samples in the laboratory and was performed on the same DNA eluate as used for the CT/NG test. A volume of 22.5 µL was used for the 50-µL PCR which was performed on a LC480 real-time PCR instrument with a 50-cycle amplification program. Samples with an S-shaped curve and a cycle threshold value (Ct-value) < 45 was evaluated as positive for *M. genitalium*. Samples with no Ct-value or a Ct-value > 45 cycles were evaluated as negative. Samples invalid on the CT/NG test were not evaluated on the *M. genitalium* test until the primary urine sample was rerun without signs of inhibition. Testing results for the three assays were reported to the youth clinics according to routines. All testing results were summarized with other study data in a separate file during the 9-month study period.

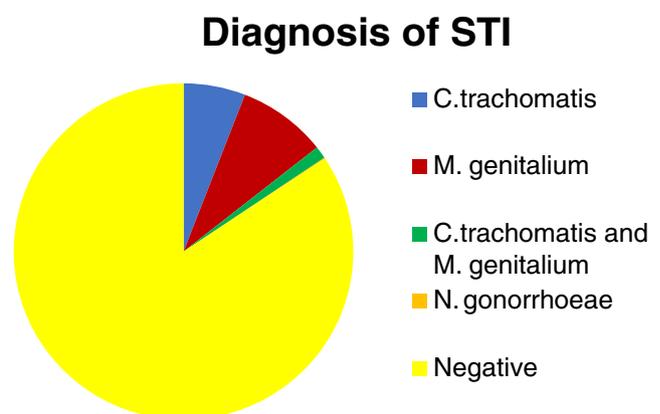
## Statistical analysis

Descriptive statistics as mean and frequencies were calculated. As all statistical comparisons were performed with respect to categorical variables, chi-square test was used. A *P* value < 0.05 was considered as statistically significant. To compare and quantify the risk for different outcomes between different categories, a relative risk (RR) of 95% confidence intervals was used. The statistical analysis was performed by using the software IBM-SPSS v 22.

## Results

From July 2013 to March 2014, a total of 1001 individuals, 509 women and 492 men, were included in this study and had urine samples tested in the laboratory. The questionnaire was completed or partly completed in 985 of the study subjects, 59 did not submit data about contact tracing and 24 not about symptoms. The mean and median age of the women was 20 and of the men 21 (Table 1).

Genital infection was present in 16.8% of the study subjects (Fig. 1). Prevalence of *C. trachomatis* and *M. genitalium* was 7.1% and 9.6% respectively. Coinfections of *C. trachomatis* and *M. genitalium* were found in 1.1%. Of the infections, 6.5% were double infections. The prevalence of *C. trachomatis* (9.0%) and *M. genitalium* (11.9%) in men was higher than in women (4.4% and 7.8%), Table 2.



**Fig. 1** Distribution of genital infections by aetiological agent

**Table 2** Number (%) of patients positive and negative for *Chlamydia trachomatis* (Ct) and *Mycoplasma genitalium* (Mg) with and without symptoms

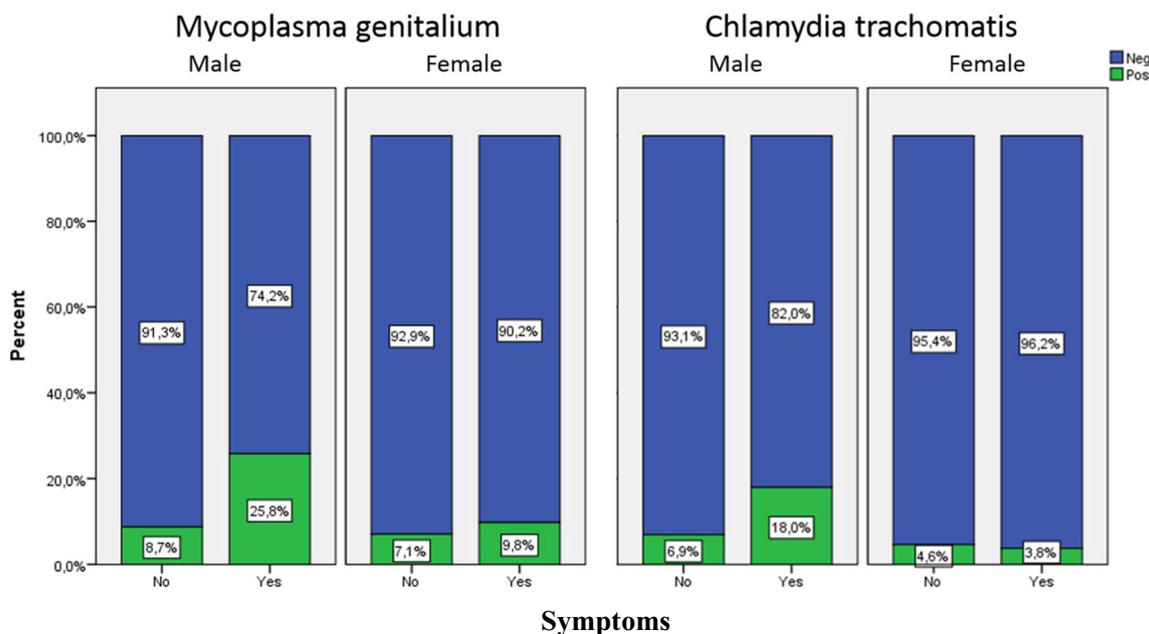
Gender	Symptoms	Ct		Mg		Total
		Neg	Pos	Neg	Pos	
Men	No	362 (93.1)	27 (6.9)	355 (91.3)	34 (8.7)	389 (100)
	Yes	73 (82.0)	16 (18.0)	66 (74.2)	23 (25.8)	89 (100)
	All	435 (91.0)	43 (9.0)	421 (88.1)	57 (11.9)	478 (100)
Women	No	349 (95.4)	17 (4.6)	340 (92.9)	26 (7.1)	366 (100)
	Yes	128 (96.2)	5 (3.8)	120 (90.2)	13 (9.8)	133 (100)
	All	477 (95.6)	22 (4.4)	460 (92.2)	39 (7.8)	499 (100)
Both sexes	No	711 (94.2)	44 (5.8)	695 (92.1)	60 (7.9)	755 (100)
	Yes	201 (90.5)	21 (9.5)	186 (83.8)	36 (16.2)	222 (100)
	All	912 (93.3)	65 (6.7)	881 (90.2)	96 (9.8)	977 (100)

Only one person was positive for *N. gonorrhoeae*. The overall prevalence of the three STIs, *C. trachomatis*, *M. genitalium* and *N. gonorrhoeae*, during the same time and in the same geographic area as the study subjects, was lower for *C. trachomatis* and *M. genitalium*, 5.8% and 7.2% respectively, but higher for *N. gonorrhoeae*, 0.5%.

Among the 222 patients with symptoms, 9.5% tested positive for *C. trachomatis* and 16.2% for *M. genitalium*. Symptoms were slightly less common among *C. trachomatis*- than *M. genitalium*-positive individuals, 32.3% and 37.5% respectively, and more common among men (37.2% and 40.4%) than women (22.7% and 33.3%) (Fig. 2). In total, 35.2% of those with infection had genital symptoms, thus two thirds of the infections were asymptomatic. Symptoms with negative tests were recorded in more women (26.1%) than in men (15.7%). The study also showed

that 17.4% of the study subjects were visiting the youth clinic due to contact tracing for a specified infection, and men to a higher degree than women (26.9% and 8.2% respectively). Of these women, 33.3% were positive for *C. trachomatis* and 55.6% for *M. genitalium*, while the proportions of men positive for *C. trachomatis* were 23.4% and 43.8% for *M. genitalium*.

The relative risks for a positive test is presented in Table 3. In women, symptoms and relative risks were not significant, while in men, the relative risks for symptoms for both *C. trachomatis* and *M. genitalium* were statistically significant, 2.59 and 2.96, respectively. In women, contact tracing for *C. trachomatis* had the highest relative risk of 13.54 and for *M. genitalium*, 8.12, while in men, the relative risks were 4.15 and 4.09 respectively, all numbers statistically significant.



**Fig. 2** Distribution of symptoms in infection with *Mycoplasma genitalium* (Mg) and *Chlamydia trachomatis* (Ct), respectively

**Table 3** Relative risk (RR) for positive outcome in men and women, for symptoms and contact tracing respectively, in infection with *Chlamydia trachomatis* (Ct) or *Mycoplasma genitalium* (Mg)

Gender	(No. of patients)		RR	95% CI
Positive outcome Ct (%)				
Men	Symptoms (89)	18	2.59*	1.46–4.60
	No symptoms (389)	6.9	Ref.	–
Women	Symptoms (133)	3.8	0.81	0.30–2.15
	No symptoms (366)	4.6	Ref.	–
Men	Contact tracing CT (111)	23.4	4.15*	2.41–7.13
	No contact tracing (354)	5.6	Ref.	–
Women	Contact tracing CT (30)	33.3	13.54*	6.26–29.33
	No contact tracing (447)	2.5	Ref.	–
Positive outcome Mg (%)				
Men	Symptoms (89)	25.8	2.96*	1.84–4.76
	No symptoms (389)	8.7	Ref.	–
Women	Symptoms (133)	9.8	1.38	0.73–2.60
	No symptoms (366)	7.1	Ref.	–
Men	Contact tracing MG (16)	43.8	4.09*	2.21–7.58
	No contact tracing (449)	10.7	Ref.	–
Women	Contact tracing MG (9)	55.6	8.12*	4.14–5.19
	No contact tracing (468)	6.8	Ref.	–

## Discussion

The medical impact of *M. genitalium* infections is still not fully known. No commercial tests were available until recently, resulting in several laboratory-developed tests with varying analytical sensitivity and specificity. For urine samples, the volume used for testing is important for a sensitive detection. *M. genitalium* infections are known to have a low number of detectable organisms even in symptomatic patients. During this study, urine samples were used for screening of STI in youths according to local recommendations. Later, an updated recommendation for the use of vaginal swabs have been defined which might improve detection rates, although there is some evidence that urine may suffice also for women. A recent study showed good concordance of results between urine and cervical swabs [16]. Another study showed no significant difference between cervical swab detection rates versus those of first-void urine and vaginal swab [17]. The use of molecular tests for detection of macrolide and quinolone resistance is also available today and there are discussions to always include resistance testing for *M. genitalium*.

In our study, *M. genitalium* has a higher prevalence than *C. trachomatis* in sexually active youths. Studies of *C. trachomatis*, *M. genitalium* and *N. gonorrhoeae* in different subpopulations have been presented over the years, and these show that the prevalence and incidence of these STIs differ significantly in different settings [7, 10, 18], which makes comparison difficult.

In this study, STI symptoms are more common in infections caused by *M. genitalium* than by *C. trachomatis*, and more prominent in men than in women. Men are usually tested

while having symptoms. Women are often tested without symptoms, and if having symptoms, there are frequently other possible causes than in men. This is also confirmed by our results in which there were no significance in relative risk for a positive test in women in connection with or without symptoms for neither *C. trachomatis* nor *M. genitalium*. If symptoms will be used as a major criterion for testing, a higher proportion of symptomatic men will be found infected than ditto women. Of major interest is if both symptomatic and asymptomatic *M. genitalium* infections are important to treat.

In our study, the prevalence and relative risks in contacts were significantly higher for both *C. trachomatis* and *M. genitalium*, and more so in women than men. We show that contact tracing is of great importance to find cases, and ought to reduce the risk of reinfection.

The number of partners [7, 19] as well as experience of earlier STIs [11, 12] have been shown to affect the risk of contracting *C. trachomatis* and should be factors to take into consideration in future studies concerning *M. genitalium*. In Sweden, contact tracing in cases of *C. trachomatis* infections usually finds an average of two to three contacts per index case when tracing back 1 year [20].

The great majority of youths attending Swedish youth clinics are not inclined to a risky sexual behaviour, apart from the fact that unprotected sex is common. Only 25% of young people between 16 and 29 years of age used a condom during their last intercourse [21]. The difference in usage of barrier contraceptives might be part of the explanation for the diverging prevalence results found in studies. The findings in our study could also be the result of an ongoing change in the prevalence of *M. genitalium*.

A secondary aim of the study was to give recommendations about STI testing in a youth clinic. In 2015, the Medical Products Agency of Sweden issued a recommendation for the treatment of bacterial STIs. General screening for *M. genitalium* is not recommended. Instead, testing should be performed in symptomatic patients negative for *C. trachomatis* or with persistent symptoms after *C. trachomatis* treatment [22]. The prevalence of *M. genitalium* is higher than *C. trachomatis* in this study population and even more so in men. Therefore, initial testing for both *C. trachomatis* and *M. genitalium* is recommended for young men presenting with symptoms of genital infection.

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**Author's Contribution** PN initiated the study, applied to the ethics committee and participated in data analysis and writing of the manuscript. EB participated in data analysis and writing of the manuscript. HE participated in planning of the study, reviewed the questionnaire and the ethics application, was responsible for analysis of the study samples, participated in data analysis, writing of the manuscript and applied for funding for the laboratory analyses from Unilabs R&D fund in collaboration with PN. SN performed the statistical analyses of the data and in editing the manuscript.

## Compliance with ethical standards

**Competing interests** The authors declare that they have no competing interests.

**Ethics approval** This study was approved by the Regional ethics committee of Gothenburg, Sweden 2013 (399-13).

**Patient consent** Written informed consent was obtained from all study subjects at the youth clinic at the time of inclusion in the study.

## References

- Tully JG, Taylor-Robinson D, Cole RM et al (1981) A newly discovered mycoplasma in the human urogenital tract. *Lancet* 1(8233):1288–1291
- Hjorth SV, Bjornelius E, Lidbrink P et al (2006) Sequence-based typing of *Mycoplasma genitalium* reveals sexual transmission. *J Clin Microbiol* 44(6):2078–2083
- Daley GM, Russell DB, Tabrizi SN et al (2014) *Mycoplasma genitalium*: a review. *Int J STD AIDS* 25(7):475–487
- Lis R, Rowhani-Rahbar A, Manhart LE (2015) *Mycoplasma genitalium* infection and female reproductive tract disease: a meta-analysis. *Clin Infect Dis* 61(3):418–426
- Sweden TPHAo (2017) Public health reporting and statistics. Secondary public health reporting and statistics. <https://www.folkhalsomyndigheten.se/the-public-health-agency-of-sweden/public-health-reporting-and-statistics/>
- World Health Organization, Unemo M (2013) *Laboratory diagnosis of sexually transmitted infections, including human immunodeficiency virus / edited by Magnus Unemo \* [et al]* - in IRIS. Geneva: World Health Organization
- Fenton KA, Mercer CH, Johnson AM et al (2005) Reported sexually transmitted disease clinic attendance and sexually transmitted infections in Britain: prevalence, risk factors, and proportionate population burden. *J Infect Dis* 191(Suppl 1):S127–S138
- Pereyre S, Laurier Nadalie C, Bebear C et al (2017) *Mycoplasma genitalium* and *Trichomonas vaginalis* in France: a point prevalence study in people screened for sexually transmitted diseases. *Clin Microbiol Infect* 23(2):122 e1–122 e7
- Getman D, Jiang A, O'Donnell M et al (2016) *Mycoplasma genitalium* prevalence, coinfection, and macrolide antibiotic resistance frequency in a multicenter clinical study cohort in the United States. *J Clin Microbiol* 54(9):2278–2283
- Salado-Rasmussen K, Jensen JS (2014) *Mycoplasma genitalium* testing pattern and macrolide resistance: a Danish nationwide retrospective survey. *Clin Infect Dis* 59(1):24–30
- Batteiger BE, Tu W, Ofner S et al (2010) Repeated chlamydia trachomatis genital infections in adolescent women. *J Infect Dis* 201(1):42–51
- Hosenfeld CB, Workowski KA, Berman S et al (2009) Repeat infection with Chlamydia and gonorrhoea among females: a systematic review of the literature. *Sex Transm Dis* 36(8):478–489
- Lau A, Bradshaw CS, Lewis D et al (2015) The efficacy of azithromycin for the treatment of genital mycoplasma genitalium: a systematic review and meta-analysis. *Clin Infect Dis* 61(9):1389–1399
- Manhart LE (2014) Diagnostic and resistance testing for *Mycoplasma genitalium*: what will it take? *Clin Infect Dis* 59(1):31–33
- Braam JF, van Dommelen L, Henquet CJM et al (2017) Multidrug-resistant *Mycoplasma genitalium* infections in Europe. *Eur J Clin Microbiol Infect Dis* 36(9):1565–1567
- Gratrix J, Plitt S, Turnbull L et al (2017) Prevalence and antibiotic resistance of *Mycoplasma genitalium* among STI clinic attendees in Western Canada: a cross-sectional analysis. *BMJ Open* 7(7):e016300
- Munson E (2017) Molecular diagnostics update for the emerging (if not already widespread) sexually transmitted infection agent *Mycoplasma genitalium*: just about ready for prime time. *J Clin Microbiol* 55(10):2894–2902
- Clarivet B, Picot E, Marchandin H et al (2014) Prevalence of *Chlamydia trachomatis*, *Neisseria gonorrhoeae* and *Mycoplasma genitalium* in asymptomatic patients under 30 years of age screened in a French sexually transmitted infections clinic. *Eur J Dermatol* 24(5):611–616
- Hamasuna R, Imai H, Tsukino H et al (2008) Prevalence of *Mycoplasma genitalium* among female students in vocational schools in Japan. *Sex Transm Infect* 84(4):303–305
- Carre H, Boman J, Osterlund A et al (2008) Improved contact tracing for *Chlamydia trachomatis* with experienced tracers, tracing for one year back in time and interviewing by phone in remote areas. *Sex Transm Infect* 84(3):239–242
- Sweden] FTPHAo. Sexualitet och hälsa bland unga i Sverige [Sexuality and health among young people in Sweden]. Version 1 ed. Solna, Sweden, 2017:140
- Sweden] LMPAo. Sexuellt överförbara bakteriella infektioner - behandlingsrekommendation. Uppsala: Läkemedelsverket [Medical Products Agency of Sweden], 2015:22–23