

Sexually transmitted infections: Epidemiology and control

M Díez, A Díaz

Epidemiology Department on HIV and Risk Behaviors. Secretary of the National Plan on AIDS.
Ministry of Health, Social Policy and Equality. National Centre for Epidemiology.
Health Institute Carlos III

ABSTRACT

Sexually transmitted infections (STI) include a group of diseases of diverse infectious etiology in which sexual transmission is relevant.

The burden of disease that STI globally represent is unknown for several reasons. Firstly, asymptomatic infections are common in many STI; secondly, diagnostic techniques are not available in some of the most affected countries; and finally, surveillance systems are inexistent or very deficient in many areas of the world. The World Health Organization has estimated that in 1999 there were 340 million new cases of syphilis, gonorrhoea, Chlamydia infection and trichomoniasis. An increasing trend in the incidence of gonorrhoea and syphilis has been noticed in the last years in the European Union, including Spain.

Co-infection with other STI, especially HIV, should be ruled out in all STI patients. Chlamydia screening is also of particular importance since this is the most common STI in Europe and frequently goes unnoticed.

STI prevention and control should be based on health education, early diagnosis and treatment, screening for asymptomatic infections, contact investigation and vaccination for those diseases for which a vaccine is available.

Key words: HIV; syphilis; sexually transmitted infections; prisons; prisoners; public health; STI; screening

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INTRODUCTION

Sexually transmitted infections (STI) include a series of diseases of diverse infectious etiology, in which sexual transmission plays a primary epidemiologic role, although sometimes they can also spread differently, such as from mother to child or through blood products and tissue transfer. This term includes asymptomatic forms, since these can entail subclinical lesions with a potential for transmission. This is why this term is preferably used instead of the term "sexually transmitted disease", previously used.

Human beings are the only natural reservoir for STI etiological agents. Transmission takes place through person-to-person direct sexual contact after infected individuals (with acute, chronic or asymptomatic clinical forms). The probability of infection from infected individuals to their partners may

differ broadly between STIs: it can reach up to 80% in the case of *Haemophilus ducreyi*, it is about 50% in primary syphilis and gonorrhoea, and it is estimated that it can reach about 10% for the human immunodeficiency virus (HIV-1) and it is even lower for the hepatitis C virus¹.

Susceptibility to STIs is general and, except for viral hepatitis, past episodes do not leave any immunity, so that the possibility of reinfection persists before a new exposure, including reinfection after the same partner if both members are not treated.

Local manifestations are among the most common signs of STIs, especially in the genitourinary system, even though general manifestations and the involvement of other organs are not uncommon. Several STI can concur in one same individual, since transmission mechanisms are shared and since, infections which cause either ulcers or inflammation in the genitouri-

nary system, favor the transmission of other infections, such as HIV or hepatitis C virus. Table 1 provides a list of the main STI, including its etiological agent and the clinical manifestations caused by them ².

Even though the infection by HIV is clearly a STI, its severity, and its emerging nature together with its pandemic condition entail a different consideration than the rest of STI, and will therefore not be included in this revision.

EPIDEMIOLOGICAL SITUATION OF STI

The burden of disease that STI represent is not completely known. This is due to not only the restrictions of epidemiological surveillance systems, which are either inexistent or insufficient even in the most developed countries, but to other factors which have an effect on the quality and thoroughness of the epidemiological data on STI, such as the natural history of each disease, search patterns of assistance among patients and active search programs for STI cases.

In developing countries, STI and their complications are among the 5 most common causes of health-care demand. The World Health Organization (WHO) has estimated that in 1999 there were 340 million new cases of the top four most common STI: syphilis (12 million), gonorrhea (62 million), Chlamydia infection (92 million) and trichomoniasis (174 million). Incidence is usually higher among people living in urban areas, who are single and young, and the risk of becoming infected by one of these pathogens grows

with the underutilization of preservatives and a higher number of sexual partners ³.

Existing epidemiological data from European Union (EU) countries show a descending trend in most of them until the decade of 1990, mainly attributed to the changes in sexual behaviors that took place after the appearance of HIV⁴. However, since 1996, gonorrhea cases underwent an ascending trend in the United Kingdom, Ireland, Netherlands and Sweden ⁵. Since then, the cases of syphilis have also increased in several countries in Northern and Western Europe, and several outbreaks have been described in European cities mainly involving young people, men who have sex with men (MSM) ⁶, heterosexual prostitution contacts and drug users⁷. Other STI, such as the Chlamydia infection, genital herpes and genital warts, have also experienced an upward trend⁸ and several lymphogranuloma venereum (LGV) outbreaks have been described in different European countries, involving HIV-positive MSM ^{9,10}, while in Spain and Portugal cases of LGV have also been detected in heterosexual individuals^{11,12}.

In 2008, epidemiological data showed that the infection by *Chlamydia trachomatis*, which mainly involves young women, is the most commonly reported bacterial STI in Europe, even though its surveillance is not implemented in all countries. The gonococcal infection has also experienced an upward trend as to previous years, although not consistently in all countries, and likewise syphilis, which has also suffered an increase, it is more common among MSM¹³.

Etiological agent	Disease/Syndrome
Bacteria	
<i>Neisseria gonorrhoeae</i>	Men: urethritis, epididymitis, orchitis, infertility Women: cervicitis, endometritis, salpingitis, PID, infertility, premature rupture of membranes, perihepatitis Both: proctitis, pharyngitis, disseminated gonococcal infection Newborn: conjunctivitis, cornea scar deformation and blindness
<i>Treponema pallidum</i>	Syphilis Both: primary sore (chancre), with localized lymphadenopathy, skin rash, condylomata lata; bone, cardiovascular and neurological lesions Pregnant women: abortion, fetal death, preterm birth Newborn: fetal death, congenital syphilis
<i>Chlamydia trachomatis</i>	Men: urethritis, epididymitis, orchitis, infertility Women: cervicitis, endometritis, salpingitis, PID, infertility, premature rupture of membranes, perihepatitis; normally asymptomatic Both: proctitis, pharyngitis, Reiter's Syndrome Newborn: conjunctivitis, pneumonia

Etiological agent	Disease/Syndrome
<i>Chlamydia trachomatis</i> (serotypes L1-L3)	Lymphogranuloma venereum Both genders: ulcer, groin lump, proctitis
<i>Mycoplasma genitalium</i>	Men: urethral discharge (nongonococcal urethritis) Women: bacterial vaginosis, probably PID
<i>Ureaplasma urealyticum</i>	Men: urethral discharge (nongonococcal urethritis) Women: bacterial vaginosis, probably PID
<i>Gardnerella vaginalis</i>	Women: vaginosis, PID
<i>Haemophilus ducreyi</i>	Soft chancre or chancroid Both: painful genital ulceration, may concur with groin lump
<i>Klebsiella granulomatis</i>	Granuloma inguinale (Donovanosis) Both: swollen lymph nodes, inguinal and anogenital ulceration
<i>Streptococcus agalactiae</i>	Both: neonatal sepsis, meningitis
<i>Shigella</i> *	Both: enterocolitis
<i>Salmonella</i> *	Both: enterocolitis
<i>Campylobacter</i> *	Both: enterocolitis
Virus	
Herpes simplex types 1 and 2	Genital herpes Both: blisters, anogenital ulceration, aseptic meningitis Newborn: birth-acquired herpes(frequently fatal)
Herpes simplex type 8	Kaposi's Sarcoma
Papillomavirus	Condylomata acuminata, laryngeal papilloma, cervical, anal, vaginal, vulvar an penis cancer
Hepatitis B virus	Viral hepatitis Both: acute hepatitis, hepatic cirrhosis, liver cancer
Cytomegalovirus	CMV infection Both: subclinical or unspecific fever, diffuse inflammation of lymph nodes, liver disease
Molluscum contagiosum	Molluscum contagiosum Both: solid umbilicated skin papules, genital or disseminated
Human immunodeficiency virus (HIV-1 and HIV-2)	Acquired Immunodeficiency Syndrome (AIDS)
Hepatitis A virus	Viral Hepatitis
Protozoa	
<i>Trichomonas vaginalis</i>	Men: urethral discharge (nongonococcal urethritis);usually asymptomatic Women: abundant thick and clumpy vaginal discharge, vulvar itching or irritation
<i>Entamoeba histolytica</i> *	Amebiasis
<i>Giardia lamblia</i> *	Giardia infections
Fungi	
<i>Candida albicans</i>	Yeast infections Men: superficial irritation of the glans Women: vulvovaginitis with thick and clumpy discharge, vulvar itching or irritation
Arthropods	
<i>Phthirus pubis</i>	Pubic lice
<i>Sarcoptes scabiei</i>	Scabies

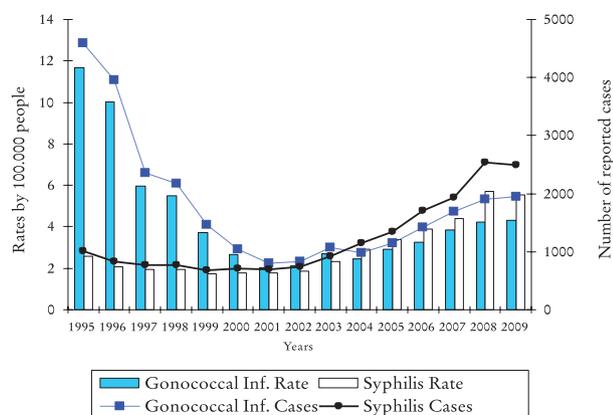
* Agents which are exclusively transmitted through oral and anal sex

PID: Pelvic inflammatory disease

Source: World Health Organization. Global strategy for the prevention and control of sexually transmitted infections: 2006-2015. Breaking the chain of transmission. Geneva: World Health Organization; 2007

Table 1. Etiological agents of sexually transmitted infections and their diseases or syndromes

In Spain, data from the information system of reportable diseases shows a downward trend in the incidence of syphilis and gonococcal infection from 1995 to 2001, when the incidence rate of syphilis was 1.8 cases every 100,000 inhabitants and that of gonococcal infection was 2.0/100,000. Since then, a continuous increase in the incidence of both diseases has been reported and in 2009 the diseases' respective rates were: 5.3/100,000 and 4.3/100,000 inhabitants (see Figure 1). Data from the Microbiology Information System follow the same trend, with increased diagnosis of gonococcus, Chlamydia and herpes since 2002^{14, 15}. As well as in other European countries, the exacerbation of STI, especially syphilis, mostly seems to affect MSM^{16, 17}.



Source: NotifiableDiseases. National Epidemiological Surveillance Network. National Epidemiology Center

Figure 1. Incidence of sexually transmitted infections. Number of cases and rates per 100,000 inhabitants. Spain 1995-2009

PREVENTION AND CONTROL OF STI

STI prevention and control measures are mainly based on health education and the promotion of safe sex, the identification of both symptomatic and asymptomatic infections, the immunization against STI for which a vaccine has been developed and epidemiological surveillance^{18, 19}.

Latex condoms are a very effective means of preventing STI^{18, 20}. Their rate of slippage and breakage during coitus is approximately 2%. In order to avoid these and other causes of failure, only approved condoms should be used, instructions for use must be carefully followed, lubricant must be used when necessary (always chose water-based if using latex condoms) and it must be withdrawn while the penis is still erect. Female condoms are polyurethane or nitrile membranes with a ring on each end, which are placed inside the vagina. They have proven to be an effective barrier device for semen and STI, and some of their advantages are that they can be used with any lubricant, the risk of slippage and breakage is lower and they can be placed before coitus. They are more expensive than regular condoms, but they can be useful as an alternative device when these can't be used¹⁸.

Early diagnosis and treatment of STI are important to reduce their spreading and avoid consequent after-effects. When dealing with symptomatic patients seeking assistance, an appropriate medical history is essential in order to guide clinical diagnosis and required complementary tests²¹. Apart from

Aspects of sexual behavior	Objective
Number of sexual partners for the last 12 months	Evaluation of risk; to facilitate the study of contacts
Last sexual intercourse/ Previous partners (if different from the last one)	
• Gender	To guide the collection of samples, early diagnosis of hepatitis
• Type of intercourse (oral, vaginal, anal)	To guide the collection of samples, early diagnosis of hepatitis
• Use of condoms and frequency of use	Evaluation of risk, promotion of condom use
• Relationship with sexual partner (sporadic stable)	To facilitate the study of contacts
• presence of symptoms/signs in partner	To facilitate the diagnosis of STI

Source: Modified from French P, Sexual History-Taking Working Party; Clinical effectiveness Group of the British Association for Sexual Health and HIV. BASHH 2006 National Guidelines—consultations requiring sexual history taking. Int J STD AIDS. 2007 Jan; 18 (1): 17-22

Table 2: Aspects of sexual behavior required in clinical history and the objective of their inclusion

checking on the presence of symptoms and signs and completing the usual points of a clinical history, it is necessary to ask about certain aspects of the sexual behavior (see Table 2) as to guide the collection of samples for microbiological study according to sexual acts and to assess risk behaviors for the spreading of STI, which should be targeted with preventive counseling. Moreover, it is highly recommended to take information on previous STI and treatments, drug use and administration routes, serological condition /vaccination against hepatitis A and B, serological condition against hepatitis C and HIV and the use of birth control measures and reproductive history in women²². The only way to identify asymptomatic patients or symptomatic patients who are not seeking assistance for whatever reason^{23, 24}, is by means of early detection programs. A classical example of such programs is prenatal screening for the detection of HIV and other STI, which apart from enabling early detection of pregnant women, is also an essential primary prevention measure since it reduces mother-to-child transmission of STI. In the case of STI with a high rate of asymptomatic infections, such

as the Chlamydia infection, the extent and quality of screening programs determine de knowledge on the burden of disease that such infections entail²⁵.

Active contact tracing of STI patients is essential to reduce the possibility of transmission of such infections and prevent the patient's reinfection, but it is not an easy task, both for practical reasons and for the ethical and emotional connotations that it entails²⁶. The objective of such partner notification is to report to the primary case's sexual partners on the possibility of exposure, to diagnose and treat them if necessary as well as to provide counseling on the prevention of future infections²⁷. The search and report period depends on the STI diagnosed in the index case^{1, 28} (see Table 3).

There are no works determining whether the study of STI contacts reduces the incidence and prevalence of these infections in the population, but there are some which assess intermediate indicators- such as the number of reinfections in the index case- which have allowed highlighting its usefulness²⁹. There is general agreement on the beneficial effects of contact tracing for STI with higher morbidity and

STI	Notification period
Chancroid	10-15 days before the initiation of symptoms
Chlamydia infection	60 days before the initiation of symptoms
Donovanosis	40-80 days before the initiation of symptoms
Gonococcal infection	60 days before the initiation of symptoms
Hepatitis A	Between 2 weeks before and 1 week after the initiation of symptoms
Hepatitis B	2 weeks before the initiation of jaundice
Herpes virus	Current partner
HIV infection	3 months before a previous negative test
Lymphogranuloma venereum	30 days before the initiation of symptoms
Lice	12 weeks before the initiation of symptoms
Scabies	8 weeks before the initiation of symptoms
Syphilis	- Primary: 3 months before the initiation of symptoms - Secondary: 6 months before the initiation of symptoms - Early Latent: 12 months before diagnosis
Trichomoniasis	60 days before the initiation of symptoms or diagnosis
Anogenital warts	Current partner

Source: Peterman T, Kahn R, Partner notification & Management. In: Klausner JFHE, editor. Current diagnosis & Treatment New York: McGraw Hill Medical; 2007. p. 194-203 and Pattman R, Snow M, Handy P, Sankar KN, Elawad B. Oxford Handbook of genitourinary medicine, HIV and AIDS. Oxford University Press; 2005.

Table 3: Periods for partner notification according to the index case sexually transmitted infection.

mortality rates (gonococcus, *C. trachomatis*, syphilis and HIV)³⁰. There are two main strategies of carrying out contact tracing: a) sexual partners are reached by the infected index case (patient led) or b) by health providers- by the responsible doctor or other health providers specifically trained for doing so, who can carry out the study in all patients or only in those who do not report to their partners by the agreed time. There is no consensus of which strategy is better. In a 2001 systematic review, the provider led approach proved more efficient for some STI such as gonococcal infection or syphilis³¹, but other authors hold that such approach is more resource-expensive and less approved by patients²⁶, although the later can differ depending on the type of STI, patient's characteristics³² and available resources³³. The WHO recommends patient led partner notification³⁴ and Centers for Disease Control and Prevention (CDC) do not have a preference for one strategy over the other¹⁸.

When partner notification is carried out by the patient, sometimes treatment is provided so that it can be offered to partners²⁷. This proceeding, known as "direct medication dispensing system through the index case", is usually done when there are well-founded reasons to believe that partners won't be seeking care, and is only recommended for Chlamydia or gonococcal infections^{18, 32}. As far as these are concerned, it has been established that such system reduces recurrence and reinfection rates in index cases. Nevertheless, it also entails restrictions such as a lack of control of medication side effects, the potential generation of bacterial resistance due to improper use and the lost of the opportunity of seeking professional counseling in order to modify risk behaviors³⁰. This system is also inappropriate for specific population groups such as MSM, who present high co-infection rates with other STI³⁵.

Some STI, such as hepatitis A and B, can be prevented through vaccination. In Spain, vaccination strategies against hepatitis B in children and adolescents have succeeded in immunizing most of those born after 1980, yet there are a lot of non-vaccinated adults who have risk behaviors for the spreading of these STI. Therefore, any patient evaluated for STI who has not undergone the infection or is not vaccinated against it should be vaccinated. The hepatitis A vaccine is recommended for MSM, injecting drug users, people with several sexual partners and sexual workers³⁶. There is a combined hepatitis A and B vaccine³⁷.

Since recently, there are two vaccines against the human papillomavirus (HPV): a bivalent HPV vaccine which includes both main oncogenic types

(16 and 18), responsible for almost 70% of cervical cancer and premalignant lesions; and a quadrivalent vaccine, which also includes two other types associated to genital warts (types 6 and 11). These vaccines help prevent the HPV infection and must be administered before having the infection, so that they are routinely recommended before the initiation of sexual intercourse. In Spain, they are licensed and sold in drugstores since September 2007 and they have been included in the vaccination calendar for girls between 11 and 14 since January 2008^{38, 39}.

EPIDEMIOLOGICAL SURVEILLANCE

Knowledge on the incidence and trend of STI, as well as patient characterization, are essential tools for the control of these infections.

STI surveillance in different European countries is broadly heterogeneous and therefore, any comparison between them is difficult⁸. In 2009, the European Centre for Disease Control and Prevention (ECDC) started to coordinate STI surveillance in the EU, so future improvement is expected in this area. The main changes of STI epidemiological surveillance undertook by European authorities are the following: a) the inclusion of the infection by *C. trachomatis* and LGV among reportable diseases and b) the collection of a minimum group of variables for all STI under surveillance⁴⁰.

In Spain, until now, the gonococcal infection, syphilis, congenital syphilis and hepatitis B are reportable diseases from the moment they are suspected, with a numerical and weekly basis. Cases of Hepatitis B and congenital syphilis must be reported together with extended information⁴¹. As to the characteristics of HIV reporting, law establishes that new HIV diagnoses be reported with a minimum collection of variables⁴². Currently, work is being developed to standardize national surveillance to European requirements.

KEY POINTS

STI include pathologies caused by bacteria, virus, fungi, protozoa and ectoparasites in which sexual transmission is important from the point of view of public health.

The global burden of disease of STI is unknown since there is a lack of epidemiological surveillance in many areas. In the EU, there are deficient information systems which are also heterogeneous, so that comparison is not feasible.

Reportable bacterial STI show an upward trend in Spain in the period 2002-2009.

Co-infection of HIV and other STI is very common. HIV testing should be offered to all patients seeking care after the suspicion of a STI.

Asymptomatic infections are very common in a lot of STI. In any patient with such infections, co-infection with other pathogens should be ruled out. This is especially important to identify Chlamydia infection, the most common STI in Europe, in which the absence of symptoms prevails.

The prevention and control of STI is based on health education, appropriate diagnosis and treatment, the identification of asymptomatic infections, partner treatment and counseling and the immunization of those cases for which there is an available vaccine.

CORRESPONDENCE

Mercedes Díez

Área de Epidemiología del VIH y Conductas de Riesgo (*HIV and Risk Behavior Epidemiology Area*)
Centro Nacional de Epidemiología
Instituto de Salud Carlos III
C/ Monforte de Lemos 5, Pabellón 12
28029 Madrid

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