

A Systematic Review of Sexually Transmitted Diseases Responsible for Bacterial Pathogens Epidemiology, Diagnosis and Treatment

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Abstract:- Bacterial pathogens such as *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Mycoplasma genitalium*, *Treponema pallidum*, *Granuloma inguinale*, and *Ureaplasma urealyticum* play significant roles in sexually transmitted diseases (STDs), posing risks of severe reproductive complications. This systematic review aimed to collect and analyze data on bacterial pathogens, focusing on their gender-specific infection rates, age prevalence, annual infection rates, epidemiological patterns, clinical manifestations, diagnostic methods, complications, and treatment approaches. A comprehensive review was conducted from 2015 to 2024, covering epidemiological patterns, diagnostic practices, and treatment protocols associated with these pathogens. Findings reveal that *Chlamydia trachomatis* affects 60% women and 40% men, primarily among those aged 15-49, with 128.5 million new infections annually. *Neisseria gonorrhoeae* infects 43% women and 57% men in the 15-24 age group, with 82 million new cases annually. *Mycoplasma genitalium* and *Treponema pallidum* affect predominantly young adults, with infection rates of 48% and 52% in men and women, respectively, and over 3 million new infections each year. Other notable findings include high prevalence rates of *Granuloma inguinale* in men (85-90%), and *Ureaplasma urealyticum* in women (67.9%). This study underscores the importance of accurate pathogen identification and epidemiological insight in preventing and treating STDs, which remain a major public health concern worldwide.

Keywords:- Epidemiological Patterns, Infections, Prevalence, Reproductive Complications, Risk.

I. INTRODUCTION

Sexually transmitted diseases (STDs) continue to be a significant public health concern worldwide, affecting millions of individuals each year. Among these, bacterial pathogens such as *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Treponema pallidum*, and *Mycoplasma genitalium* are particularly noteworthy for their prevalence and associated complications. *Chlamydia*, for instance, is one of the most common STDs globally, often leading to serious reproductive health issues if left untreated (WHO, 2023; NHS, 2023).

The impact of *Neisseria gonorrhoeae* and *Treponema pallidum* is also profound, as both are responsible for gonorrhea and syphilis, respectively—two infections that can lead to severe health complications if not addressed promptly (NIAID, n.d.). Furthermore, *Mycoplasma genitalium*, initially considered a rare infection, has gained recognition due to its potential to cause urethritis and pelvic inflammatory disease, complicating the landscape of STDs.

Additional pathogens such as *Ureaplasma* species and *Klebsiella granulomatis*, the causative agent of granuloma inguinale, underscore the diverse range of bacterial infections that pose risks for both sexual health and overall well-being (MSD Manual, n.d.; STD Center NY, n.d.). This systematic review aims to consolidate current knowledge on these bacterial pathogens, elucidating their clinical significance, transmission dynamics, symptoms, and treatment options. By integrating findings from various authoritative sources, this paper seeks to highlight the importance of early detection, appropriate management, and public health strategies in combating the rising tide of STDs.

II. METHODOLOGY

The study aimed to systematically review bacterial pathogens responsible for sexually transmitted diseases including epidemiology, diagnosis and treatment. The research period spanned from 2015 to 2024, with a focus on the Bacterial Pathogens Responsible for Sexually Transmitted Diseases. Epidemiology, Diagnosis and Treatment.

➤ Data Source

Following PRISMA guidelines, relevant studies were systematically selected from four widely recognized databases: PubMed (2), ScienceDirect (5), Google Scholar (25), ResearchGate (1), ASM Journals (1), and the International Journal of Epidemiology (1).

➤ Inclusion and Exclusion

• Inclusion:

This systematic review focuses globally on bacterial pathogens responsible for sexually transmitted diseases (STDs). It includes data on the epidemiology of each

pathogen, covering gender distribution, annual incidence rates of new cases, and affected age ranges. Key clinical aspects are examined, including diagnostic methods, clinical manifestations, potential complications, and available treatments for each bacterial pathogen.

• *Exclusion:*

This systematic review excluded studies focused on non-bacterial sexually transmitted diseases, articles published prior to 2015, and content primarily addressing preventive measures for sexually transmitted infections.

➤ *Conceptual Framework*

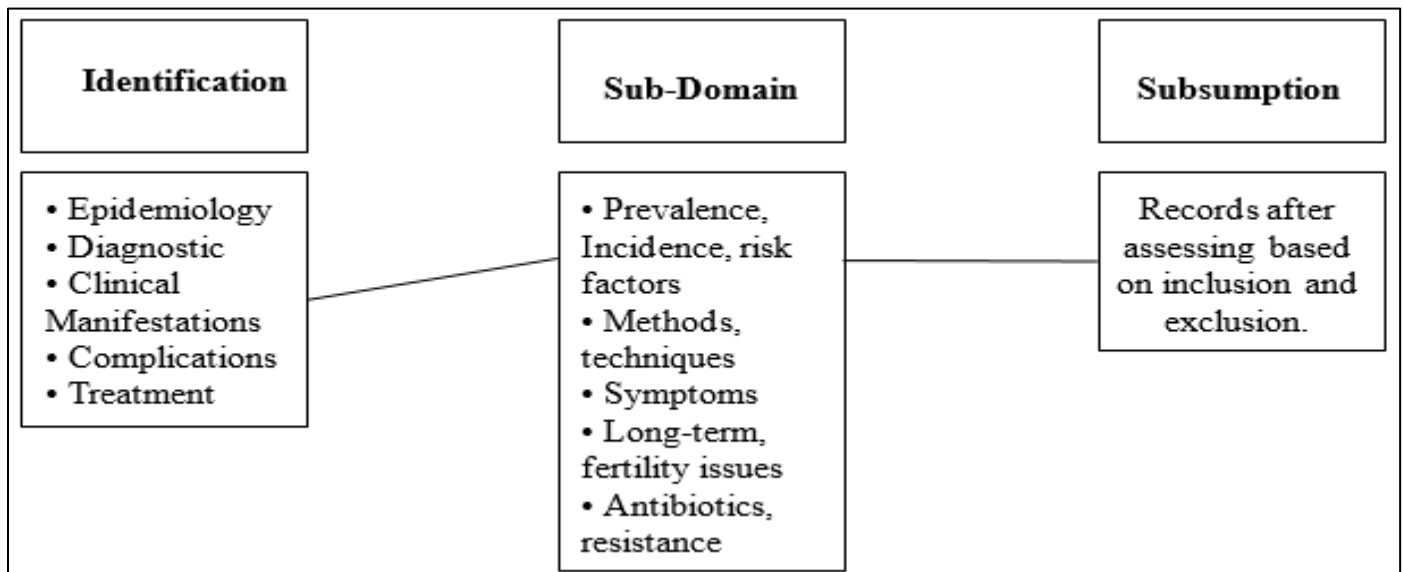


Fig 1 Conceptual Framework

➤ *Data Extraction*

This systematic review provides an overview of bacterial pathogens responsible for sexually transmitted diseases. From an initial pool of 35 articles, a total of 10 were selected for in-depth analysis. The following data were systematically collected from each article: author and

publication year, specific bacterial infections, epidemiological data (including gender distribution, common age groups, and annual incidence rates), as well as clinical manifestations, diagnostic methods, complications, and treatment approaches.

III. RESULTS

Table 1 Epidemiology of Bacterial Pathogens

Bacterial pathogens	% in Women	% in Men	Common age group	Annual new infection	Reference
Chlamydia trachomatis	54.4%	45.6%	Under 25 years old	127 million	(Huai et al. 2020)
Neisseria gonorrhoeae	62.5%	37.5%	20–40 years	87 million	(Chemaitelly et al. 2020)
Mycoplasma genitalium	48%	52%	16-34 years old	3 million	(Sonnenberg et al., 2015)
Treponema pallidum	19%	81%	30-34 years old	130,000	(Morris,2023)
Granuloma inguinale (donovanosis)	10-15%	85-90%	20 and 40 years	20,000 to 100,000	(Belda, 2020)
Ureaplasma urealyticum	67.9%	32.1%	14-50 years old	-	(Song et al., 2022)

Table 2 Clinical Manifestations, Diagnostics, Complications, and Treatments of Bacterial Pathogens

Bacterial pathogens	Clinical manifestations	Diagnostics	Complications	Treatments
Chlamydia trachomatis	Women: -Vaginal discharge -Painful urination Pelvic pain Men: -Urethritis	-Nucleic acid amplification tests -Cell culture methods	-Pelvic inflammatory disease (PID) -Urethritis - Epididymitis	-Azithromycin -Doxycycline -Screening

	-Discharge from the penis			
<i>Neisseria gonorrhoeae</i>	Women: -Vaginal discharge -Pain or Burning when urinating -Vaginal Bleeding Men: - Discharge from the penis -Pain or Burn when urinating -Painful or Swollen Testes	-Gram stain microscopy -Clinical examination -Speculum examination	-Epididymis -Proctitis -Gonococcal arthritis -Pelvic Inflammatory Disease (PID)	-Cephalosporins -Ceftriaxone -Cefixime
<i>Mycoplasma genitalium</i>	Women: -Vaginal discharge - vaginal itching -burning during urination Men: -urethral discharge -painful peeing	- Nucleic acid amplification tests (NAATs)	- Urethritis - Cervicitis - Pelvic Inflammatory Disease (PID)	- Azithromycin - Moxifloxacin
<i>Treponema pallidum</i>	Women: - Chancre - Rash - Hair loss - Mucous patches Men: - Chancre - Mucous patches - Neurosyphilis - Gummatous syphilis	- Serologic reaginic tests - Serologic treponemal tests	- Neurosyphilis - Cardiovascular Syphilis - Ocular Syphilis - Gummatous Syphilis	-Benzathine penicillin G - Aqueous penicillin -Treatment of sex partners
<i>Granuloma inguinale (donovanosis)</i>	Women: - Painless, red bumps or sores - Ulceration -Granulomatous tissue Men: - Painless, red bumps or sores - Ulceration - Granulomatous tissue	- Microscopic examination - Biopsy	- Genital mutilation - Infertility -Lymphadenopathy - Elephantiasis	- Tetracyclines - Macrolides -Trimethoprim/sulfamethoxazole (TMP/SMX) -Ceftriaxone - Aminoglycosides -Fluoroquinolones -Chloramphenicol.
<i>Ureaplasma urealyticum</i>	Women: - Abdominal pain - Fever - Abnormal vaginal discharge Men: - Painful urination - Unusual discharge	- Culture of genital specimens - Polymerase chain reaction (PCR) -Enzyme-linked immunosorbent assay (ELISA) - Nucleic acid amplification tests (NAATs)	- Pelvic inflammatory disease (PID) - Pneumonia - Meningitis - Sepsis - Urethritis - Infertility	- Erythromycin - Azithromycin - Oral doxycycline

IV. DISCUSSION

➤ Epidemiology

Bacterial pathogens responsible for sexually transmitted infections (STIs) present varying patterns of prevalence, affected age groups, and annual new infections. For instance, In table 1, *Chlamydia trachomatis* is more common in women (54.4%) than men (45.6%), with the highest incidence in individuals under 25 years old. It causes an estimated 127 million new infections annually, making it one of the most prevalent STIs worldwide (Huai et al., 2020).

Similarly, *Neisseria gonorrhoeae* affects 62.5% of women and 37.5% of men, with the most common age group being 20–40 years. This pathogen is responsible for about 87 million new infections each year (Chemaitelly et al., 2020). Like Chlamydia, gonorrhea often leads to complications like pelvic inflammatory disease (PID) and epididymitis if left untreated.

Mycoplasma genitalium shows a fairly balanced distribution between genders, with 48% of infections occurring in women and 52% in men. It primarily affects individuals aged 16–34 years, with an estimated 3 million new infections annually (Sonnenberg et al., 2015). This pathogen is often linked to urethritis in men and cervicitis in women.

Treponema pallidum, the causative agent of syphilis, has a notably higher prevalence in men (81%) than women (19%). It mainly affects individuals in the 30–34 age group, with approximately 130,000 new cases each year (Morris, 2023). Syphilis can lead to severe complications, including cardiovascular and neurological issues, if untreated.

Granuloma inguinale (donovanosis) is a rare STI, with a predominant prevalence in men (85–90%) and typically affecting those aged 20–40 years. The annual new infection rate is between 20,000 and 100,000 cases, often in subtropical regions (Belda, 2020). This condition can cause severe genital ulcers and requires early diagnosis and treatment to avoid complications.

Ureaplasma urealyticum is found in 67.9% of women and 32.1% of men, primarily affecting individuals aged 14–50 years. While not as widely studied, this pathogen is associated with urethritis and reproductive complications, though the annual infection rate is not clearly reported (Jingjuan et al., 2022). In conclusion, these bacterial pathogens show diverse trends in gender distribution, age group susceptibility, and annual infection rates, underscoring the need for targeted prevention and treatment strategies. Regular screening, public health education, and access to healthcare are crucial in reducing the burden of these infections and their associated complications.

➤ Clinical Manifestations, Diagnostics, Complications, and Treatments of Bacterial Pathogens

In table 2, *Chlamydia trachomatis* presents with vaginal discharge, pelvic pain, and painful urination in women, while men experience urethritis and penile discharge. It is

diagnosed using nucleic acid amplification tests (NAATs) and treated with azithromycin or doxycycline. Complications include pelvic inflammatory disease (PID) in women and epididymitis in men (Rodrigues et al., 2022).

Neisseria gonorrhoeae causes vaginal discharge, pain during urination, and irregular bleeding in women, while men may have penile discharge, painful urination, and swollen testicles. Diagnosis involves Gram stain microscopy and clinical exams. Untreated, it can lead to PID, gonococcal arthritis, and epididymitis. Treatment includes ceftriaxone or cefixime (Unemo et al., 2019).

Mycoplasma genitalium symptoms include pelvic pain, discomfort during sex, and watery discharge. Diagnosed via NAATs, it can result in PID and urethritis if untreated. Standard treatment involves azithromycin or moxifloxacin (Sonnenberg et al., 2015).

Treponema pallidum, which causes syphilis, presents with chancres, rashes, and neurological symptoms. Blood tests are used for diagnosis. Without treatment, complications like neurosyphilis and cardiovascular damage may occur. Penicillin remains the primary treatment (Morris, 2023).

Granuloma inguinale, caused by *Klebsiella granulomatis*, is a sexually transmitted infection characterized by painless red sores or bumps that can develop into ulcerative, granulomatous tissue. These lesions are chronic and may bleed easily. Diagnosis is made through microscopic examination or biopsy. If untreated, it can lead to severe complications such as genital mutilation, infertility, lymphadenopathy, and elephantiasis. Treatment involves antibiotics like doxycycline, ciprofloxacin, erythromycin, or azithromycin to manage the infection and prevent complications (Belda, 2020).

Ureaplasma urealyticum causes abnormal discharge, painful urination, and abdominal pain. Diagnosed via PCR or NAATs, it can lead to PID, infertility, and sepsis. Antibiotics such as azithromycin or doxycycline are used for treatment (Song et al., 2022).

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