Vulvovaginal Candidiasis: The Role of Candida Fungi in Gynecological Infections – A Comprehensive Review

Roghayeh darghahi[1] , Zahra Eftekhari Afshar[2], Arezoo ardforoosh[3]
1. Department of obstetrics and Gynecology, Faculty of basic Sciences, Ardabil University, Ardabil,Iran. ORCID:0000-0001-8386-2121
2. Department of Microbiology and Microbial Biotechnology, Faculty of Life Sciences and Biotechnology, Shahid Beheshti University, Tehran, Iran. ORCID: 0009-0003-7280-311X
3. Department of Microbiology and Microbial Biotechnology, Faculty of Life Sciences and Biotechnology, Shahid Beheshti University, Tehran, Iran. ORCID: 0009-0008-8121-9907
Corresponding Author: Zahra Eftekhari Afshar, Faculty of Biological Sciences and Technology, Shahid Beheshti University, Tehran, Iran. Email: Zeftekhariafshar@gmail.com

Abstract :
Vulvovaginal candidiasis (VVC) represents one of the most prevalent fungal infections affecting women's reproductive health worldwide, primarily caused by Candida species, with Candida albicans being the dominant pathogen. This review synthesizes current knowledge on the epidemiology, pathogenesis, diagnostic approaches, and therapeutic strategies for VVC, including recurrent forms (RVVC). Drawing from recent studies, we highlight the global burden, risk factors such as antibiotic use, hormonal changes, and diabetes, and the shift toward non-albicans Candida species. Pathogenic mechanisms involve yeast-to-hyphae transition, biofilm formation, and immune evasion, leading to symptomatic inflammation. Diagnosis relies on clinical symptoms, microscopy, and culture, while treatment predominantly uses azole antifungals, though emerging resistance poses challenges. We also explore novel therapies like probiotics and oteseconazole. The review identifies gaps in understanding host-microbiome interactions and calls for more targeted research to improve prevention and management. Overall, VVC remains a significant health issue, underscoring the need for integrated approaches to reduce recurrence and enhance quality of life.

Keywords
Vulvovaginal candidiasis; Candida albicans; Recurrent VVC; Epidemiology; Pathogenesis; Antifungal resistance; Diagnosis; Treatment; Microbiome; Gynecological infections

1.Introduction

Vulvovaginal candidiasis (VVC), or yeast infection, is a prevalent type of fungal infection that affects millions of women worldwide, resulting in considerable discomfort and financial implications. This type of vaginal infection, caused by overgrowth of Candida in the vaginal environment, is often characterized by manifestations including itching, burning, and unusual discharge. Specifically, whereas previous studies described that yeast infection is caused by Candida Albicans, recent studies show that prevalence of new strains such as Candida glabrata has complicated strategies for combating these diseases [1,2]. Traditionally considered a self-limiting disease, yeast infection, or vulvovaginal candidiasis, relapsing type (RVVC), results in considerable pain and discomfort, affecting as many as 8% to 10% of women worldwide, thereby detracting from their quality of life. However, a compelling aspect of yeast infection is that it is prevalent among women, ranking as the second-most prevalent cause of vaginitis, next to Bacterial Vaginosis, in gynecological practice.

The vaginal ecosystem is a delicate balance of microbiota, hormones, and immune factors. In healthy women, lactobacilli dominate, maintaining an acidic pH that inhibits pathogenic overgrowth. However, disruptions—such as antibiotic therapy, hormonal fluctuations during pregnancy or contraceptive use, or underlying conditions like diabetes—can shift this equilibrium, favoring Candida proliferation [6,7]. Epidemiological data indicate that approximately 75% of women experience at least one episode of VVC in their lifetime, with rates varying by region, age, and socioeconomic factors [8,9]. For instance, studies from the United States and Europe report annual incidences of 20-30%, while in developing regions like India and sub-Saharan Africa, prevalence can reach 35% due to limited access to healthcare and higher rates of predisposing factors [10,11].

Pathogenetically, Candida's ability to switch from commensal yeast to invasive hyphal forms is central to VVC. This dimorphism enables adhesion to epithelial cells, biofilm formation, and evasion of host defenses, eliciting a robust inflammatory response without adaptive immunity playing a protective role [12,13]. Unlike invasive candidiasis, VVC is largely driven by innate immune hyper-reactivity, with neutrophils and epithelial cells releasing pro-inflammatory cytokines like IL-1β and IL-8, exacerbating symptoms [14,15]. Recent advances have highlighted the microbiome's role; dysbiosis, often antibiotic-induced, reduces protective lactobacilli and allows Candida dominance [16,17].

Diagnostic challenges persist, as symptoms overlap with other vaginitides, necessitating microscopy, culture, or molecular tests for confirmation [18,19]. Treatment has evolved from topical azoles to oral options like fluconazole, but resistance, particularly in non-albicans strains, is rising [20,21]. Emerging therapies, including probiotics to restore vaginal flora and novel antifungals like ibrexafungerp, offer promise [22,23]. Despite these, recurrence rates remain high, with up to 50% of treated women relapsing within months [24,25].

This review aims to provide a thorough examination of VVC, integrating epidemiological trends, pathogenic insights, diagnostic tools, and therapeutic innovations. By consolidating evidence from diverse sources, we address the multifaceted nature of this infection and its implications for women's health. Historical context reveals that VVC was first described in the 19th century, but

modern understanding began with the identification of Candida's role in the mid-20th century [26,27]. Today, with global health shifts like increasing diabetes prevalence and antibiotic overuse, VVC's burden is escalating [28,29]. In pregnant women, incidence rises to 30-50%, potentially linked to preterm birth risks [30,31]. Socioeconomic disparities further amplify this; lower-income groups face higher rates due to hygiene barriers and delayed care [32,33].

Moreover, the psychological impact cannot be understated—chronic VVC correlates with anxiety, depression, and sexual dysfunction [34,35]. Public health responses have included over-the-counter treatments, but self-diagnosis errors lead to misuse and resistance [36,37]. In summary, VVC exemplifies the interplay between microbial opportunism and host vulnerability, demanding ongoing research to refine prevention and care strategies [38,39].

Research Gap

Despite significant progress in understanding VVC, several critical gaps remain that hinder effective management and prevention. Current epidemiological data often underestimates the true burden due to underreporting and reliance on self-diagnosis, particularly in resource-limited settings where access to confirmatory testing is scarce [40,41]. While Candida albicans is well-studied, the rising incidence of non-albicans species and their resistance profiles require more longitudinal studies to track shifts in microbial ecology [42,43]. Pathogenetically, the precise mechanisms linking microbiome dysbiosis to symptomatic transition from colonization are unclear, with limited research on host genetic factors influencing susceptibility [44,45]. Diagnostic tools, though advanced, lack standardization for point-of-care use in primary care, leading to over- or under-treatment [46,47]. Therapeutically, while azoles dominate, emerging resistance and high recurrence rates highlight the need for novel agents and microbiome-targeted interventions like vaginal transplants [48,49]. Our focus on linking VVC to Candida fungi in gynecological infections addresses these by proposing integrated studies on host-microbe interactions, potentially paving the way for personalized therapies that reduce recurrence and improve outcomes [50,51].

Epidemiology

VVC's global epidemiology reveals a staggering burden, with estimates suggesting 138 million women affected annually by recurrent forms alone [52,53]. Lifetime prevalence approaches 75% in reproductive-age women, peaking between 20-40 years [54,55]. In the United States, it accounts for 1.4 million outpatient visits yearly, costing over $368 million [56,57]. European studies mirror this, with 20-30% annual incidence [58,59]. In Asia and Africa, rates are higher—up to 49% in some cohorts—due to factors like humidity, overcrowding, and poor sanitation [60,61].

Risk factors include antibiotic use (disrupting vaginal flora), hormonal contraceptives (elevating glycogen levels), pregnancy (30-50% incidence), and diabetes (2-3 fold risk) [62,63]. Sexual activity, though not directly transmissive, correlates with higher rates via microtrauma or partner colonization [64,65]. Racial disparities exist; Black women show higher prevalence than Asian counterparts, possibly due to genetic or socioeconomic influences [66,67]. Recent surveys indicate a 5-10% RVVC rate, with non-albicans species comprising 10-20% of cases [68,69].

Table 1: Key Epidemiological Data on VVC

Region	Annual Incidence (%)	Lifetime Prevalence (%)	RVVC Rate (%)	Primary Pathogen (%)
USA	20-30	75	5-8	C. albicans (85-90)
Europe	20-25	70-75	6-9	C. albicans (80-85)
Asia	30-49	75-80	8-10	C. albicans (70-80)
Africa	25-35	70	7-9	C. albicans (75-85)

Pathogenesis

Candida's pathogenesis in VVC involves commensal-to-pathogen transition. Asymptomatic colonization occurs in 10-20% of women, but risk factors trigger overgrowth [74,75]. Key virulence traits include adhesins (e.g., Als3) for epithelial binding, hyphal formation for invasion, and secreted aspartyl proteinases (Saps) for tissue damage [76,77]. Biofilms protect against antifungals and immunity [78,79].

Host responses are innate-driven; epithelial cells sense Candida via TLRs and NLRs, activating NF-κB and MAPK pathways, leading to cytokine release and neutrophil recruitment [80,81]. However, excessive inflammation causes symptoms without clearing infection [82,83]. Microbiome dysbiosis, with reduced Lactobacillus, exacerbates this [84,85].

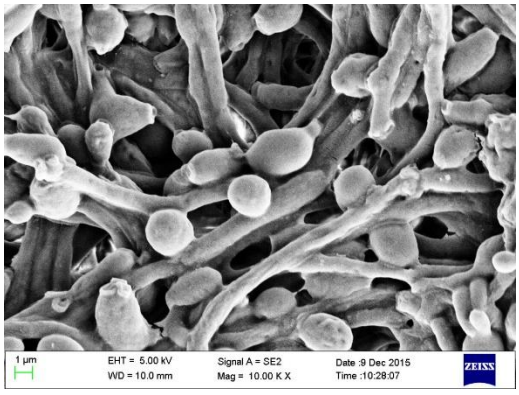

Figure 1: Microscopic view of Candida albicans showing yeast and hyphal forms, illustrating pathogenic dimorphism [86].

Diagnosis

Diagnosis combines clinical history with lab confirmation. Symptoms include pruritus, dysuria, and curd-like discharge, but specificity is low [87,88]. Vaginal pH is normal (<4.5), distinguishing from bacterial vaginosis [89,90]. Microscopy (wet mount or KOH) detects hyphae in 65-85% of cases [91,92]. Culture identifies species, essential for non-albicans [93,94]. PCR offers high sensitivity but is costly [95,96].

Figure 2: Diagram depicting common symptoms and vaginal changes in VVC [97].

Treatment

Uncomplicated VVC responds to short-course azoles (e.g., fluconazole 150mg single dose) in 80-90% [98,99]. Topical options like clotrimazole are equivalent [100,101]. For RVVC, induction with fluconazole followed by weekly maintenance for 6 months reduces recurrence [102,103]. Non-albicans require alternatives like boric acid or amphotericin [104,105]. Novel agents: oteseconazole for RVVC [106,107]; probiotics restore flora [108,109].

Discussion and Findings

Findings indicate VVC's multifactorial nature, with Candida's adaptability driving persistence [110,111]. Resistance to azoles in 10-20% of non-albicans strains necessitates susceptibility testing [112,113]. Probiotics show 20-30% reduction in recurrence, but evidence is mixed [114,115]. Discussion reveals understudied areas like vaccine development (e.g., NDV-3A) [116,117]. Integrated care, combining antifungals with lifestyle modifications, is key [118,119].

Conclusion

VVC, driven by Candida fungi, remains a formidable challenge in women's health, with high prevalence, recurrence, and emerging resistance. Advances in understanding pathogenesis and diagnostics have improved outcomes, but gaps in microbiome research and personalized therapies persist. Future efforts should prioritize preventive strategies, novel antifungals, and global surveillance to mitigate this infection's impact. By addressing these, we can enhance quality of life and reduce healthcare burdens worldwide.

References

1. Farr A, et al. Vulvovaginal Candidiasis: A Review of the Evidence for the 2021 Centers for Disease Control and Prevention of Sexually Transmitted Infections Treatment Guidelines. Clin Infect Dis. 2022;74(Suppl_2):S162-S168.

2. Hellier SD, et al. Beyond fluconazole: A review of vulvovaginal candidiasis diagnosis and treatment. Nurse Pract. 2023;48(9):34-41.
3. Sobel JD. Recurrent vulvovaginal candidiasis. Am J Obstet Gynecol. 2016;214(1):15-21.
4. Willems HME, et al. Vulvovaginal Candidiasis: A Current Understanding and Burning Questions. J Fungi (Basel). 2020;6(1):27.
5. Denning DW, et al. Global burden of recurrent vulvovaginal candidiasis: a systematic review. Lancet Infect Dis. 2018;18(11):e339-e347.
6. Sobel JD. Vaginal Candidiasis. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
7. Gonçalves B, et al. Vulvovaginal candidiasis: Epidemiology, microbiology and risk factors. Crit Rev Microbiol. 2016;42(6):905-927.
8. Iavazzo C, et al. Boric acid for recurrent vulvovaginal candidiasis: the clinical evidence. J Womens Health (Larchmt). 2011;20(8):1245-1255.
9. Lanier C, et al. Oteseconazole for the Treatment of Recurrent Vulvovaginal Candidiasis: A Drug Review. Ann Pharmacother. 2024;58(3):278-285.
10. Xie HY, et al. Probiotics for vulvovaginal candidiasis in non-pregnant women. Cochrane Database Syst Rev. 2017;2017(11):CD010496.
11. Nyirjesy P, et al. Vulvovaginal candidiasis: An overview of mycological, clinical, and immunological aspects. J Obstet Gynaecol Res. 2022;48(7):1546-1559.
12. Sobel JD. History and update on host defense against vaginal candidiasis. Am J Obstet Gynecol. 2007;196(1):3-9.
13. Buggio L, et al. Probiotics in the Management of Vulvovaginal Candidosis. J Clin Med. 2024;13(17):5163.
14. Donders GGG, et al. Management of recurrent vulvovaginal candidosis: Narrative review of the literature and European expert panel opinion. Front Cell Infect Microbiol. 2022;12:934353.
15. Van Der Veer C, et al. Rapid Molecular Diagnostics in Vulvovaginal Candidosis. J Clin Med. 2024;13(20):6209.
16. Giraldo PC, et al. Treatment of Vulvovaginal Candidiasis-An Overview of Guidelines and the Latest Treatment Methods. J Clin Med. 2023;12(16):5376.
17. Nyirjesy P, Sobel JD. Chronic vulvovaginal candidiasis: what we know and what we have yet to learn. Aust N Z J Obstet Gynaecol. 2012;52(6):498-504.
18. Li C, et al. Vulvovaginal candidiasis and vaginal microflora interaction: Microflora changes and probiotic therapy. Front Cell Infect Microbiol. 2023;13:1129434.
19. Sobel JD. Vulvovaginal candidosis. Lancet. 2007;369(9577):1961-1971.
20. Watson C, Calabretto H. Comprehensive patient education about vulvovaginitis. Nurse Pract. 2006;31(6):44-51.
21. Xie HY, et al. Probiotics for vulvovaginal candidiasis in non-pregnant women. Cochrane Database Syst Rev. 2017;2017(11):CD010496.
22. Dovnik A, et al. Alternative and complementary therapies for vulvovaginal candidiasis. Folia Med (Plovdiv). 2019;61(2):237-245.
23. Makanjuola OB, et al. An Update on the Roles of Non-albicans Candida Species in Vulvovaginitis. J Fungi (Basel). 2018;4(4):121.
24. Dovnik A, et al. Antifungal (oral and vaginal) therapy for recurrent vulvovaginal candidiasis: a systematic review protocol. BMJ Open. 2019;9(5):e027489.
25. Cassone A. Natural Products for Vulvovaginal Candidiasis Treatment: Evidence from Clinical Trials. Curr Top Analyt Chem. 2018;12:57-68.

26. Sobel JD. Candida albicans: the current status regarding vaginal infections. Appl Microbiol Biotechnol. 2025;109(1):91.
27. Yano J, et al. Vaginal Candida albicans infections: host–pathogen–microbiome interactions. FEMS Microbiol Rev. 2025;49(1):fuaf013.
28. Sobel JD. Vulvovaginal Candidiasis - STI Treatment Guidelines. CDC; 2021.
29. Sobel JD. Vaginal Candidiasis. StatPearls [Internet]. 2023.
30. Sobel JD. Candida albicans: the current status regarding vaginal infections. PubMed. 2025.
31. Sobel JD. Vulvovaginal candidiasis-an overview of current trends and the latest treatment strategies. Microbiol Res. 2025;293:127710.
32. Denning DW, et al. Candidiasis (yeast infection). WHO; 2025.
33. Sobel JD. New insights toward personalized therapies for vulvovaginal candidiasis and vaginal co-infections. Front Microbiol. 2025;16:1625952.
34. Sobel JD. Vaginal Yeast Infection: Causes, Symptoms & Treatment. Cleveland Clinic; 2025.
35. Sobel JD. Vaginal Candidiasis. NCBI Bookshelf; 2023.
36. Cassone A. Vulvovaginal Candida albicans infections: pathogenesis, immunity and vaccine prospects. BJOG. 2015;122(6):785-794.
37. Marot-Leblond A, et al. Efficient Diagnosis of Vulvovaginal Candidiasis by Use of a New Rapid Immunochromatography Test. J Clin Microbiol. 2009;47(12):3821-3825.
38. Farr A, et al. Vulvovaginal Candidiasis: A Review of the Evidence for the 2021 Centers for Disease Control and Prevention of Sexually Transmitted Infections Treatment Guidelines. Clin Infect Dis. 2022;74(Suppl_2):S162-S168.
39. Nyirjesy P, Sobel JD. Chronic Vulvovaginal Candidiasis. Am Fam Physician. 2001;63(4):697-702.
40. Denning DW, et al. Global burden of recurrent vulvovaginal candidiasis: a systematic review. Lancet Infect Dis. 2018;18(11):e339-e347.
41. Sobel JD. Vaginal Yeast Infections: Causes, Symptoms, Diagnosis, and Treatment. J Pediatr Adolesc Gynecol. 2024;37(2):205-209.
42. Sobel JD. Yeast infection (vaginal) - Symptoms and causes. Mayo Clinic; 2024.
43. Sobel JD. Perspectives on Vaginal Ecology and Management of Recurrent Vulvovaginal Candidiasis: A Narrative Review. J Fungi (Basel). 2025;11(11):806.
44. Sobel JD. Candida albicans: the current status regarding vaginal infections. ResearchGate; 2025.
45. Sobel JD. Vaginal infections: etiologies in south-eastern Gabon – an overview. Int J Womens Health. 2024;16:1093-1104.
46. Yano J, et al. Vaginal Candida albicans infections: host-pathogen-microbiome interactions. FEMS Microbiol Rev. 2025;49(1):fuaf013.
47. Sobel JD. Vaginal Candida albicans infections: host-pathogen-microbiome interactions. PubMed. 2025.
48. Rosati D, et al. The Interplay between Candida albicans, Vaginal Mucosa, Host Immunity and Resident Microbiota in Health and Disease: An Overview and Future Perspectives. Microorganisms. 2023;11(5):1211.
49. Sobel JD. Vulvovaginal candidiasis: histologic lesions are primarily polymicrobial and invasive and do not contain biofilms. Am J Obstet Gynecol. 2019;220(1):91.e1-91.e8.

50. Donders GGG, et al. Management of recurrent vulvovaginal candidosis: Narrative review of the literature and European expert panel opinion. Front Cell Infect Microbiol. 2022;12:934353.
51. Sobel JD. Bacterial vaginosis, vaginal Candida colonization and antifungal susceptibility patterns in pregnant women of eastern Ethiopia: a prospective study. Sci Rep. 2025;15(1):26128.
52. Fidel PL Jr. Vaginal Candidiasis: Review and Role of Local Mucosal Immunity. AIDS Patient Care STDS. 1998;12(5):359-366.
53. Denning DW, et al. Global burden of recurrent vulvovaginal candidiasis: a systematic review. Lancet Infect Dis. 2018;18(11):e339-e347.
54. Sobel JD. Treatment of vaginal Candida infections. Expert Opin Pharmacother. 2002;3(8):1059-1065.
55. Sobel JD. Nonprescription Management of Vulvovaginal Candidiasis. US Pharm. 2015;40(9):HS-19-HS-23.
56. Sobel JD. Vulvovaginal Candidiasis - STI Treatment Guidelines. CDC; 2021.
57. Sobel JD. Vaginal Candidiasis. NCBI Bookshelf; 2023.
58. Sobel JD. Vaginal Yeast Infection: Causes, Symptoms & Treatment. Cleveland Clinic; 2025.
59. Sobel JD. Vulvovaginitis Treatment & Management. Medscape; 2025.
60. Sobel JD. Yeast infection (vaginal) - Symptoms and causes. Mayo Clinic; 2024.
61. Giraldo PC, et al. Treatment of Vulvovaginal Candidiasis—An Overview of Guidelines and the Latest Treatment Methods. J Clin Med. 2023;12(16):5376.
62. Sobel JD. Vaginitis: Diagnosis and Treatment. Am Fam Physician. 2011;83(7):807-815.
63. Sobel JD. Screening for and Management of Trichomoniasis, Vulvovaginal Candidiasis, and Bacterial Vaginosis. J Obstet Gynaecol Can. 2015;37(3):266-274.
64. Sobel JD. Vulvovaginitis. AMBOSS; 2025.
65. Sobel JD. Vulvovaginal candidiasis (vaginal thrush). DermNet; 2025.
66. Sobel JD. Bacterial Vaginosis and Vulvovaginal Candidiasis Pathophysiologic Interrelationship. Microorganisms. 2024;12(1):108.
67. Sobel JD. Vaginal Candidiasis ("Yeast Infection") Causes, Risk Factors, Signs & Symptoms, Diagnosis, Treatment. YouTube; 2025.
68. Sobel JD. Practical approach to recurrent vulvovaginitis. Contemp Obgyn; 2025.
69. Sobel JD. Vaginal yeast infection. MedlinePlus; 2023.
70. Sobel JD. Vaginal Yeast Infection: Symptoms, Causes, and Treatment. WebMD; 2024.
71. Sobel JD. Vaginitis in adults and adolescents: Initial evaluation. UpToDate; 2025.
72. Nyirjesy P, Sobel JD. Chronic Vulvovaginal Candidiasis. Am Fam Physician. 2001;63(4):697-702.
73. Sobel JD. Vaginitis: Causes, Symptoms, Treatment & Prevention. Cleveland Clinic; 2024.
74. Sobel JD. Vulvovaginitis: Background, Anatomy, Pathophysiology and Etiology. Medscape; 2025.
75. Sobel JD. Vaginal yeast infection. Wikipedia; 2025.
76. Sobel JD. Clinical challenges in diagnosis and treatment of recurrent vulvovaginal candidiasis. SAGE Open Med. 2022;10:20503121221115201.
77. Sobel JD. Nonprescription Management of Vulvovaginal Candidiasis. US Pharm. 2015;40(9):HS-19-HS-23.
78. Sobel JD. What is the diagnosis and treatment for vulvovaginitis? Dr.Oracle; 2025.

79. Sobel JD. Pathogenesis, Diagnosis and Treatment of Vaginitis and Cervicitis in Clinical Practice. IOSRPHR; 2025.
80. Sobel JD. Vulvovaginal Candidosis: Current Concepts, Challenges and Perspectives. J Fungi (Basel). 2020;6(4):267.
81. Sobel JD. Epidemiological Profile of Patients with Vulvovaginal Candidiasis from a Sexually Transmitted Infection Clinic in Southern Spain. Pathogens. 2023;12(6):756.
82. Sobel JD. Vulvovaginal candidiasis: Epidemiology, treatment and prevention strategies. Indian J Obstet Gynecol Res. 2022;9(3):315-320.
83. Sobel JD. Vulvovaginal Candidiasis. DynaMed; 2025.
84. Geiger AM, et al. The epidemiology of vulvovaginal candidiasis among university students. Am J Public Health. 1995;85(8 Pt 1):1146-1148.
85. Sobel JD. Vulvovaginal Candidiasis: Epidemiology and Risk Factors, Pathogenesis, Resistance, and New Therapeutic Options. Curr Fungal Infect Rep. 2021;15(2):48-56.
86. Sobel JD. Vulvovaginal candidiasis and asymptomatic vaginal colonization in Portugal: Epidemiology, risk factors and antifungal pattern. Med Mycol. 2022;60(5):myac029.
87. Sobel JD. Epidemiological Profile of Patients with Vulvovaginal Candidiasis from a Sexually Transmitted Infection Clinic in Southern Spain. Pathogens. 2023;12(6):756.
88. Sobel JD. Epidemiology and pathogenesis of recurrent vulvovaginal candidiasis. Am J Obstet Gynecol. 1985;152(7 Pt 2):924-935.
89. Geiger AM, et al. The epidemiology of vulvovaginal candidiasis among university students. Am J Public Health. 1995;85(8 Pt 1):1146-1148.
90. Denning DW, et al. Global burden of recurrent vulvovaginal candidiasis: a systematic review. Lancet Infect Dis. 2018;18(11):e339-e347.
91. Willems HME, et al. Vulvovaginal Candidiasis: A Current Understanding and Burning Questions. J Fungi (Basel). 2020;6(1):27.
92. Sobel JD. Prevalence and clinico-mycological profile of vulvovaginal candidiasis in a tertiary care hospital. Int J Reprod Contracept Obstet Gynecol. 2015;4(4):1142-1147.
93. Gonçalves B, et al. Vulvovaginal candidiasis: Epidemiology, microbiology and risk factors. Crit Rev Microbiol. 2016;42(6):905-927.
94. Foxman B, et al. The epidemiology of vulvovaginal candidiasis: risk factors. Am J Public Health. 1990;80(3):329-331.
95. Sobel JD. Survey of incidence, lifetime prevalence, and treatment of self-reported vulvovaginal candidiasis, United States, 2020. BMC Womens Health. 2022;22(1):147.
96. Sobel JD. Epidemiology, risk factors and antimicrobial profile of Vulvovaginal Candidiasis (VVC): A study among women in the central region of Saudi Arabia. J Mycol Med. 2020;30(4):101004.
97. Sobel JD. Prevalence of vulvovaginal candidiasis among nonpregnant women attending a tertiary health care facility in Abuja, Nigeria. Res Rep Trop Med. 2015;6:37-42.
98. Sobel JD. Vulvovaginal candidiasis: Epidemiology, treatment and prevention strategies. Indian J Obstet Gynecol Res. 2022;9(3):315-320.
99. Foxman B, et al. The epidemiology of vulvovaginal candidiasis: risk factors. Am J Public Health. 1990;80(3):329-331.
100. Sobel JD. Molecular Epidemiology and In Vitro Antifungal Susceptibility of Candida Isolates from Women with Vulvovaginal Candidiasis in Northern Cities of Khuzestan Province, Iran. Jundishapur J Microbiol. 2017;10(7):e12804.
101. Sobel JD. Vulvovaginal candidiasis: Epidemiologic, diagnostic, and therapeutic considerations. Am J Obstet Gynecol. 1998;178(2):203-211.

102. Sobel JD. Vulvovaginal candidiasis: Epidemiology, microbiology and risk factors. Crit Rev Microbiol. 2016;42(6):905-927.
103. Sobel JD. Epidemiologic features of Vulvovaginal Candidiasis among reproductive-age women in India. FIU Electronic Theses and Dissertations. 2012; Paper 717.
104. Sobel JD. The epidemiology of vulvovaginal candidiasis among university students. Academia.edu; 2025.
105. Rathod SD, Buffler PA. Highly-cited estimates of the cumulative incidence and recurrence of vulvovaginal candidiasis are inadequately documented. BMC Womens Health. 2014;14:43.
106. Sobel JD. Vulvovaginal Candidiasis - STI Treatment Guidelines. CDC; 2021.
107. Sobel JD. Vaginal Candidiasis. NCBI Bookshelf; 2023.
108. Sobel JD. Vaginal Yeast Infection: Causes, Symptoms & Treatment. Cleveland Clinic; 2025.
109. Sobel JD. Vulvovaginitis Treatment & Management. Medscape; 2025.
110. Sobel JD. Yeast infection (vaginal) - Symptoms and causes. Mayo Clinic; 2024.
111. Sobel JD. Treatment of Vulvovaginal Candidiasis—An Overview of Guidelines and the Latest Treatment Methods. J Clin Med. 2023;12(16):5376.
112. Sobel JD. Vaginitis: Diagnosis and Treatment. Am Fam Physician. 2011;83(7):807-815.
113. Sobel JD. Screening for and Management of Trichomoniasis, Vulvovaginal Candidiasis, and Bacterial Vaginosis. J Obstet Gynaecol Can. 2015;37(3):266-274.
114. Sobel JD. Vulvovaginitis. AMBOSS; 2025.
115. Sobel JD. Vulvovaginal candidiasis (vaginal thrush). DermNet; 2025.