



Association between endometriosis and Sjögren's syndrome; a systematic review and meta-analysis

Shiva Khodarahmi¹, Armaghan Hossein Sarbazi², Sara Abutalebi Nasrabad³, Amirmohammad Razavi⁴, Maryam Farajisani⁵, Zeinab Zamanpour⁶, Zahra Hamidi Madani⁷, Sara Ghaseminejad Kermani⁸, Sana Amiri⁹, Aynaz Boostan¹⁰

¹Mother and Child Care Research Center, School of Nursing and Midwifery, Hamadan University of Medical Sciences, Hamadan, Iran

²Emergency Medicine Department, Zahedan University of Medical Sciences, Zahedan, Iran

³Department of Obstetrics and Gynecology, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

⁴Student Research Committee, Faculty of Nursing and Midwifery, Zahedan University of Medical Sciences, Zahedan, Iran

⁵Department of Gynecology and Obstetrics, Imam Khomeini Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran

⁶Department of Gynecology and Obstetrics, School of Medicine, Jundishapur University of Medical Sciences, Ahvaz, Iran

⁷Department of Obstetrics and Gynecology, Reproductive Health Research Center, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran

⁸Department of Emergency Medicine, Imam Hossein Hospital, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran

⁹Rheumatology Research Center, School of Medicine, Iran University of Medical Sciences, Tehran, Iran

¹⁰Department of Obstetrics and Gynecology, Shahid Akbar-Abadi Hospital, Iran University of Medical Sciences, Tehran, Iran

*Correspondence to

Aynaz Boostan, Email:
ainaz_bostan@yahoo.com

Received 22 Dec. 2025

Revised: 20 Feb. 2026

Accepted 26 Feb. 2026

ePublished 15 Mar. 2026

Keywords: Endometriosis, Endometrioma, Endometrioses, Sjögren's Syndrome, Sicca syndrome

Abstract

Introduction: Endometriosis is among the most common obstetric and gynecologic diseases, correlated with multiple autoimmune diseases. Sjögren's syndrome is an autoimmune condition with a high prevalence among women. Hence, the purpose of the present study was to examine the relationship between endometriosis and the risk of Sjögren's syndrome.

Materials and Methods: Databases Cochrane, PubMed, Scopus, Web of Science, Embase, and Google Scholar search engine were used to search for articles published by November 27, 2025, using Medical Subject Headings (MeSH) keywords and their equivalents. Then, data were extracted using SPSS 19 software and analyzed with STATA 14. For this purpose, studies that utilized systematic review and meta-analysis methods were combined.

Results: Six studies were conducted on 163,656 women, and by combining them, we concluded that female patients with endometriosis faced a high risk of developing Sjögren's syndrome (OR: 2.38, 95% CI: 1.62-3.49). Additionally, women with endometriosis aged 30 to 39 (OR: 1.49, 95% CI: 1.36, 1.63), 40 to 49 (OR: 4.32, 95% CI: 3.67, 5.09), and 50 to 59 (OR: 1.26, 95% CI: 1.05, 1.52) were at increased risk of Sjögren's syndrome. Furthermore, endometriosis in the USA (OR: 1.26, 95% CI: 1.05, 1.52), Taiwan (OR: 1.46, 95% CI: 1.32, 1.62), Denmark (OR: 1.60, 95% CI: 1.29, 1.98), and Colombia (OR: 4.32, 95% CI: 3.67, 5.09) increased the risk of Sjögren's syndrome.

Conclusion: Women with endometriosis faced twice the risk of developing Sjögren's syndrome compared with other women, and among those with endometriosis, women aged between 30 and 39 years indicated a higher risk of developing Sjögren's syndrome. Besides, female patients with endometriosis in Colombia and the United States of America had the highest and lowest risks of Sjögren's syndrome, respectively.

Registration: This study has been compiled based on the PRISMA checklist, and its protocol was registered on the PROSPERO (ID: CRD420251248156) and Research Registry (UIN: reviewregistry2064) websites.



Citation: Khodarahmi S, Hossein Sarbazi A, Abutalebi Nasrabad S, Razavi A, Farajisani M, Zamanpour Z, Hamidi Madani Z, Ghaseminejad Kermani S, Amiri S, Boostan A. Association between endometriosis and Sjögren's syndrome; a systematic review and meta-analysis. Immunopathol Persa. 2026;x(x):e44025. DOI:10.34172/ipp.2026.44025.

Introduction

Endometriosis is a chronic inflammatory disease characterized by the presence of an extrauterine endometrium-like tissue (1). In fact, endometriosis is among the most common obstetric and gynecologic conditions (2), as approximately 10 to 15 percent of women around the world are diagnosed with endometriosis at reproductive age (3). On the other hand, about 66% percent of adolescent females with chronic pelvic pain or dysmenorrhea indicate evidence of

endometriosis (4). Since infertility is among the primary side effects of endometriosis, investigating this disease is of great importance (5).

According to numerous studies, endometriosis is associated with autoimmune disorders, malignancies, mental conditions, gastrointestinal, and cardiovascular diseases (6,7). On the other hand, about 8% of the world's population suffers from autoimmune diseases, and women account for 80% of the cases (8). Sjögren's syndrome is a rare

Key point

Female patients with endometriosis were exposed to twice the risk of Sjögren's syndrome than other women. Among women with endometriosis, those aged between 30 and 39 years indicated the highest risks of Sjögren's syndrome.

chronic and systemic autoimmune disorder, and women are more exposed to the risk of Sjögren's syndrome compared with men (9). This disease is characterized by Sicca syndrome and other systemic diseases (10), and its prevalence among adults ranges from 0.01% to more than 3% (11). Considering that various studies have reported different results regarding the relationship between endometriosis and the risk of Sjögren's syndrome (12, 13), the present investigation employed systematic review and meta-analysis techniques to provide an integrated and comprehensive synthesis of the evidence.

Materials and Methods

The study adhered to the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (14), and its protocol was registered at the PROSPERO (International Prospective Register of Systematic Reviews) and Research Registry websites.

Search strategy

Embase, Web of Science, Scopus, PubMed, Cochrane databases, and Google Scholar search engine were searched with the keywords Medical Subject Headings (MeSH) until November 27, 2025. Boolean Operators (AND, OR) were used to combine the keywords. No language, time, or location restrictions were applied while searching for resources. A manual search was also conducted independently. Then the PECO criteria were determined as follows. *Population*: Articles designed with the aim of association between endometriosis and the risk of Sjögren's syndrome. *Exposure*: Women with endometriosis. *Comparison*: Healthy Women. *Outcomes*: Risk of Sjögren's syndrome.

Inclusion and exclusion criteria

Articles designed with the aim of association between endometriosis and risk of Sjögren's syndrome entered the systematic review and meta-analysis process. However, reviews, studies with low-qualitative scores, studies that were conducted on women with Sjögren's syndrome and examined the risk of women developing endometriosis, duplicate studies, studies that qualitatively assessed the association between Sjögren's syndrome and endometriosis, systematic reviews, studies that assessed the prevalence of Sjögren's syndrome in women with endometriosis or meta-analysis, and those that did not provide our required data were excluded.

Quality assessment

Study quality was appraised through the Newcastle-

Ottawa Scale, which awards a maximum of one star per item, except for the comparability criterion. Overall scores ranged from zero to ten, where zero reflected the poorest quality and ten represented the highest. Studies achieving fewer than seven stars were categorized as low-quality (15).

Data extraction

Two authors were assigned to extract data. The extracted data included the following: sample size, location, year, first author, design, time of study, mean age, etc. Then, the third researcher addressed the discrepancies.

Statistical analysis

We used the logarithmic forms of odds ratio (OR), hazard ratio (HR), risk ratio (RR), and standardized incidence ratio (SIR) in the analysis and combined the findings from all studies. Heterogeneity was assessed with the statistic, and a random-effects model was applied to pool the data. Analyses were conducted in STATA 14, and *P* values less than 0.05 were considered statistically significant.

Results

A total of 113 studies were identified through database searches and Google Scholar. Following the removal of 52 duplicates, abstract screening led to the exclusion of 5 studies lacking full-text availability. Another 24 studies were excluded because they did not provide the necessary data for analysis. Of the 32 articles assessed in the subsequent stage, 26 failed to satisfy the predefined exclusion criteria, resulting in 6 studies being included in the final review (Figure 1).

Six studies with a total of 163656 female participants were examined. Table 1 presents basic information reported by the studies.

The risk of Sjögren's syndrome in women with endometriosis was significantly high (OR: 2.38, 95% CI: 1.62, 3.49), and women with endometriosis were exposed to higher risks of Sjögren's syndrome (Figure 2).

The risk of developing Sjögren's syndrome in women with endometriosis in different countries varied. As endometriosis incidence significantly increased the risk of Sjögren's syndrome in women from the USA (OR: 1.26, 95% CI: 1.05, 1.52), Taiwan (OR: 1.46, 95% CI: 1.32, 1.62), Denmark (OR: 1.60, 95% CI: 1.29, 1.98), and Colombia (OR: 4.32, 95% CI: 3.67, 5.09) (Figure 3).

Both in cohort and case-control studies, women who developed endometriosis faced higher risks of Sjögren's syndrome. As the risk of Sjögren's syndrome among women with endometriosis in cohort and case-control studies was (OR: 2.58, 95% CI: 1.72, 3.88) and (OR: 1.26, 95% CI: 1.05, 1.52), respectively (Figure 4).

Women with endometriosis aged 30 to 39 years (OR: 1.49, 95% CI: 1.36, 1.63), 40 to 49 (OR: 4.32, 95% CI: 3.67, 5.09), and 50 to 59 years (OR: 1.26, 95% CI: 1.05, 1.52) were exposed to the risk of Sjögren's syndrome (Figure 5). In all three groups, developing endometriosis increased

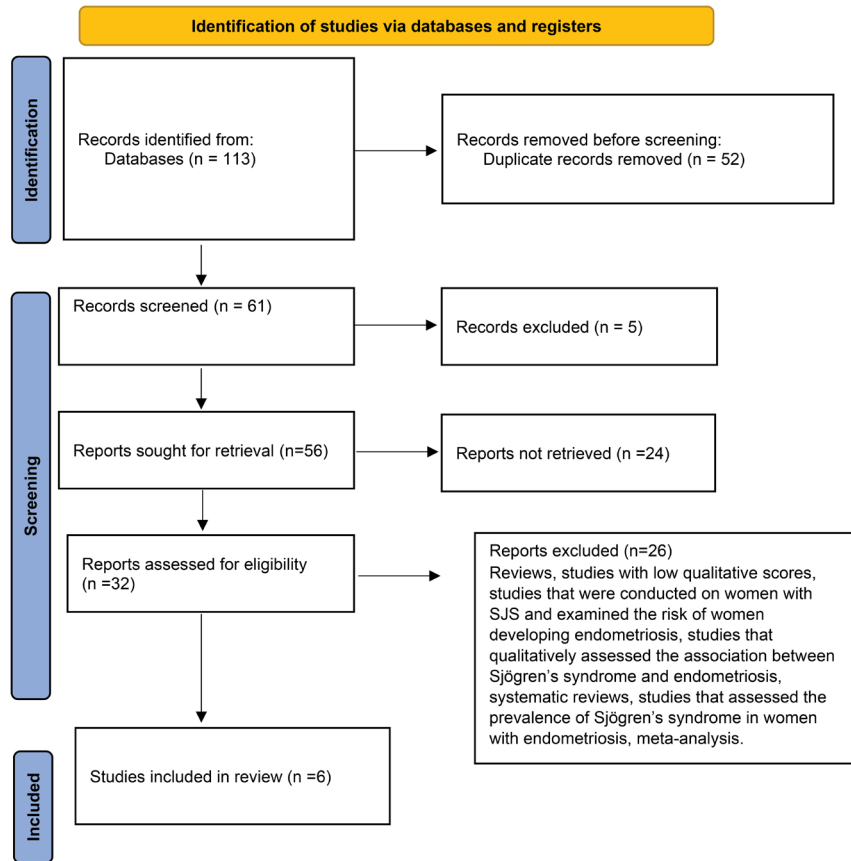


Figure 1. PRISMA flow diagram of the study selection.

the risk of Sjögren's syndrome. However, women aged 40 to 49 years faced higher risks of Sjögren's syndrome compared with other women (Figure 5).

Figure 6 demonstrates that publication bias was not significant ($P=0.778$). Accordingly, the search for resources was comprehensive, and all studies, both supporting and opposing the hypothesis suggesting a positive correlation between endometriosis and Sjögren's syndrome were examined.

Discussion

Generally, endometriosis increases the risk of Sjögren's syndrome. Additionally, women with endometriosis in every age group were exposed to risks of developing Sjögren's syndrome, and the age group 40 to 49 indicated the highest risk. Regarding nationality, it can be stated that women with endometriosis in the United States faced lower risks, and those in Colombia indicated higher risks of developing Sjögren's syndrome than other women.

Table 1. Baseline characteristics of included studies

First author, year	Location	Design	Time of study	Sample size (total)	Mean age (total)	Sample size (women with endometriosis)	Mean age (women with endometriosis)	Sample size (comparison group)	Mean age (comparison group)
Aziz M, 2025 (Phase 1-CCA) (13)	Columbia	Cohort	2010–2017	1144	NR	734	47.1	410	47.1
Aziz M, 2025 (Phase 2-CCA) (13)	Columbia	Cohort	2010–2017	640	NR	417	46.88	223	46.88
Aziz M, 2025 (Phase 1-MDCD) (13)	Columbia	Cohort	2010–2017	165	NR	116	41.71	49	41.71
Aziz M, 2025 (Phase 2-MDCD) (13)	Columbia	Cohort	2010–2017	90	NR	61	40.88	29	40.88
Ma KS, 2024 (16)	Taiwan	Cohort	1998-2013	31894	NR	15947	38.8	15947	38.9
Chao YH, 2022 (17)	Taiwan	Cohort	2000-2012	73665	NR	14733	38.9	58932	38.9
McCoy SS, 2022 (18)	USA	Case-Control	1990-2019	2183	NR	546	55	1637	55.2
Nielsen NM, 2011 (19)	Denmark	Cohort	1977–2007	37661	38.6	NR	NR	NR	NR
Ma K, 2020 (12)	Taiwan	Cohort	1999-2013	16214	38.8	NR	NR	NR	NR

NR: Not reported.

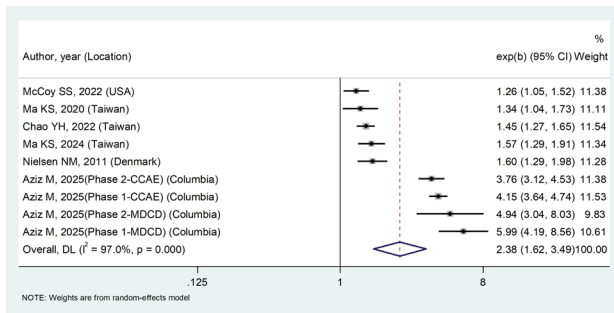


Figure 2. Forest plot showing the association between endometriosis and risk of Sjögren's syndrome.

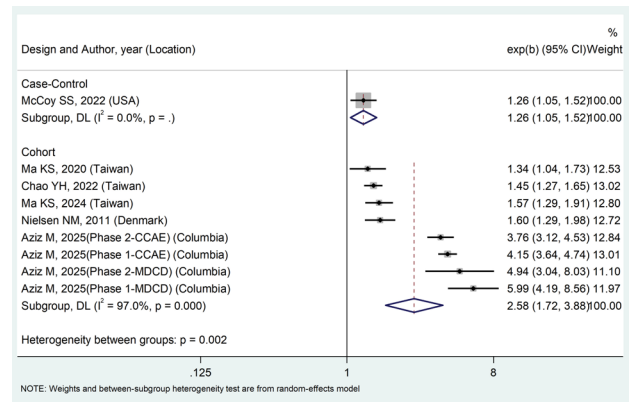


Figure 4. Forest plot showing the association between endometriosis and risk of Sjögren's syndrome by study design.

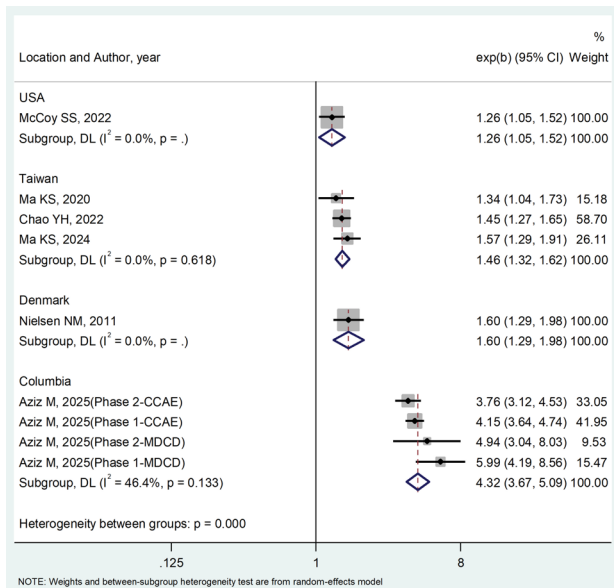


Figure 3. Forest plot showing the association between endometriosis and risk of Sjögren's syndrome by location.

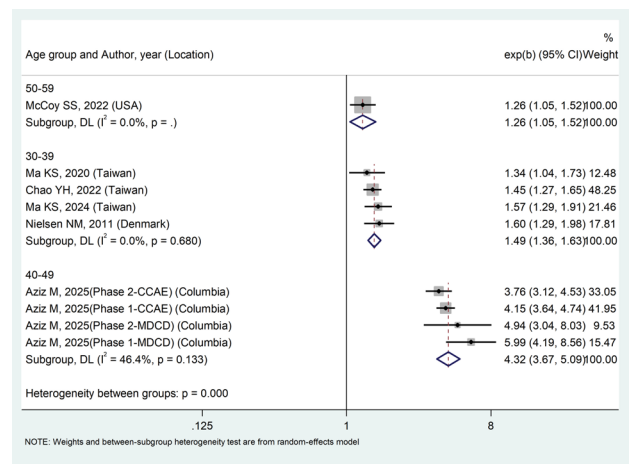


Figure 5. Forest plot showing the association between endometriosis and risk of Sjögren's syndrome by age group.

In a cohort study by Aziz et al, findings revealed that the risk of developing Sjögren's syndrome in women with endometriosis was higher than in other female groups (OR: 4.15, 95% CI: 3.43, 5.03) (13). In another cohort study by Ma et al, results showed that women with endometriosis were at a significantly higher risk of developing primary Sjögren's syndrome than those without endometriosis (HR: 1.57, 95% CI: 1.29, 1.91) (16). Based on the results of a cohort study by Chao et al, women with endometriosis had higher rates of Sjögren's syndrome than those without endometriosis (HR: 1.45, 95% CI: 1.27, 1.65) (17). The results of the mentioned studies were consistent with the findings of the present study, as our meta-analysis combining cohort studies concluded that endometriosis was a risk factor for Sjögren's syndrome.

In the next section, we review several observational studies that confirm the results of the present study, indicating that endometriosis increases the risk of autoimmune diseases, including Sjögren's syndrome. For instance, Jess et al in a cohort study demonstrated that women with endometriosis were exposed to higher risks

of diseases including ulcerative colitis (SIR: 1.5, 95% CI: 1.3, 1.7), Crohn's disease (SIR: 1.6, 95% CI: 1.3, 2.0), and inflammatory bowel disease (SIR: 1.5, 95% CI: 1.4, 1.7) (20). According to the results of a cohort study by Xue et al, patients with endometriosis (HR: 1.75, 95% CI: 1.27, 2.41) and autoimmune diseases (HR: 6.99, 95% CI: 2.84, 17.21) faced significantly higher risks of rheumatoid arthritis (21). Nevertheless, the aforementioned studies did not match our research in terms of study type.

Tang et al conducted a meta-analysis on the association between endometriosis and the risk of rheumatoid arthritis, systemic lupus erythematosus, and Sjögren's syndrome, and demonstrated that endometriosis increased the risk of Sjögren's syndrome (RR: 1.49, 95% CI: 1.34, 1.66) (22). In another meta-analysis by Shigeshi et al, which aimed to examine the relationship between endometriosis and autoimmune diseases, results revealed that endometriosis increased the risk of autoimmune diseases, including Sjögren's syndrome (OR: 1.76, 95% CI: 1.39, 2.21), SLE, rheumatoid arthritis, and multiple sclerosis (23). According to the results of a meta-analysis by Ferrari-Souza et al,

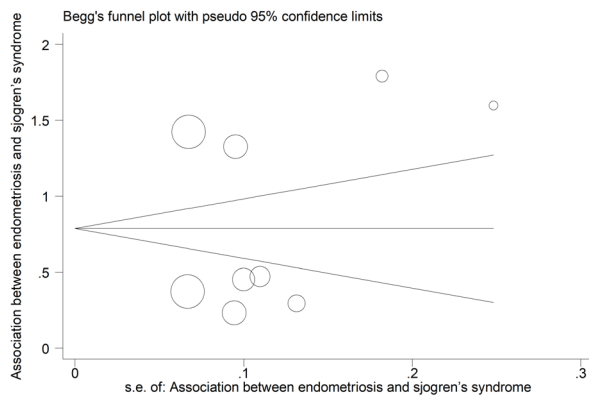


Figure 6. Diagram of publication bias.

endometriosis was a serious risk factor for developing systemic lupus erythematosus (RR: 2.47, 95% CI: 1.33, 4.59) (24). The results of the mentioned meta-analysis were consistent with the findings of the present study. These meta-analyses indicated that generally, endometriosis increases the risk of autoimmune disorders in women, including Sjögren's syndrome. Accordingly, by preventing women from developing endometriosis or controlling and treating female patients with endometriosis, we can significantly reduce the occurrence rate of autoimmune disorders among women.

Conclusion

Female patients with endometriosis were exposed to twice the risk of Sjögren's syndrome than other women, and among women with endometriosis, those aged between 30 and 39 indicated the highest risks of Sjögren's syndrome. Furthermore, women with endometriosis in Colombia and the United States of America had the highest and lowest risks of Sjögren's syndrome, respectively. Accordingly, it can be stated that 40 to 49-year-old Colombian women were exposed to higher risks of Sjögren's syndrome than other women with endometriosis. However, considering the limited number of studies examined, it is recommended to conduct additional research on this subject.

Limitations of the study

The number of studies in the case-control and cohort groups was not balanced. Most studies did not specify the type of Sjögren's syndrome (primary or secondary); therefore, it was not possible to investigate the association between endometriosis and Sjögren's syndrome risk by Sjögren's syndrome type. The number of studies was limited. Half of the examined studies were conducted in Taiwan; accordingly, the studies were evenly distributed in various geographical locations.

Acknowledgments

The authors would like to thank Hosein Mardanparvar (Guissu Research Corporation) and Diana Sarokhani for guidance and editing of the manuscript registration on the PROSPERO and Research Registry websites.

Authors' contribution

Conceptualization: Shiva Khodarahmi and Amirmohammad Razavi.
Data curation: Aynaz Boostan and Sara Abutalebi Nasrabad.
Formal analysis: Zahra Hamidi Madani and Zeinab Zamanpour.
Investigation: Shiva Khodarahmi and Maryam Farajisani.
Methodology: Armaghan Hossein Sarbazi and Sara Abutalebi Nasrabad.
Project administration: Aynaz Boostan, Sana Amiri, and Armaghan Hossein Sarbazi.
Supervision: All authors.
Validation: Maryam Farajisani and Zeinab Zamanpour.
Visualization: Sara Ghaseminejad Kermani and Amirmohammad Razavi.
Writing—original draft: All authors.
Writing—review and editing: All authors.

Ethical issues

This study has been compiled based on the PRISMA checklist, and its protocol was registered on the PROSPERO website (ID: [CRD420251248156](https://www.crd420251248156)) and the Research Registry website (Unique Identifying Number (UIN) [reviewregistry2064](https://www.reviewregistry2064)). Besides, ethical issues (including plagiarism, data fabrication, and double publication) have been completely observed by the authors.

Competing interests

The authors declare that they have no competing interests.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors utilized [Grammarly](#) and [Copilot](#) to refine grammar points and language style in writing. Subsequently, the authors thoroughly reviewed and edited the content as necessary, assuming full responsibility for the publication's content.

Funding/Support

None.

References

- Zondervan K, Becker C, Missmer S. Endometriosis. *N Engl J Med.* 2020;382:1244-56. doi: 10.1056/NEJMra1810764
- Bulun S, Yilmaz B, Sison C, Miyazaki K, Bernardi L, Liu S, et al. Endometriosis. *Endocr Rev.* 2018;40:1048-79. doi: 10.1210/er.2018-00242
- Giudice L, Kao L. Endometriosis. *Lancet.* 2004;364:1789-99. doi: 10.1016/S0140-6736(04)17403-5
- Taylor H, Kotlyar A, Flores V. Endometriosis is a chronic systemic disease: clinical challenges and novel innovations. *Lancet.* 2021;397:839-52. doi: 10.1016/S0140-6736(21)00389-5
- Prescott J, Farland L, Tobias D, Gaskins A, Spiegelman D, Chavarro J, et al. A prospective cohort study of endometriosis and subsequent risk of infertility. *Hum Reprod.* 2016;31:1475-82. doi: 10.1093/humrep/dew085
- Koller D, Pathak G, Wendt F, Tylee D, Levey D, Overstreet C, et al. Epidemiologic and genetic associations of endometriosis with depression, anxiety, and eating disorders. *JAMA Netw Open.* 2023;6:e2251214. doi: 10.1001/jamanetworkopen.2022.51214
- Parazzini F, Esposito G, Tozzi L, Noli S, Bianchi S. Epidemiology of endometriosis and its comorbidities. *Eur J Obstet Gynecol Reprod Biol.* 2017;209:3-7. doi: 10.1016/j.ejogrb.2016.04.021
- National Institutes of Health. About the Office of Autoimmune Disease Research (OADR-ORWH). 2025. <http://orwh.od.nih.gov/OADR-ORWH>.
- Mariette X, Criswell L. Primary Sjögren's syndrome. *N Engl J*

- Med. 2018;378:931-9. doi: 10.1056/NEJMcp1702514
10. Yao Y, Ma J, Chang C, Xu T, Gao C, Gershwin M, et al. Immunobiology of T cells in Sjögren's syndrome. *Clin Rev Allergy Immunol.* 2021;60:111-31. doi: 10.1007/s12016-020-08793-7
 11. Maciel G, Crowson C, Matteson E, Cornec D. Prevalence of Primary Sjögren's Syndrome in a US Population-Based Cohort. *Arthritis Care Res (Hoboken).* 2017;69:1612-6. doi: 10.1002/acr.23173
 12. Ma K. Endometriosis increases the risk for Sjögren syndrome: A nationwide prospective cohort study. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2020;129:e192-3. doi: 10.1016/j.oooo.2019.07.044.
 13. Aziz M, Beaton M, Aziz M, Opoku-Anane J, Elhadad N. Endometriosis and autoimmunity: a large-scale case-control study of endometriosis and 10 distinct autoimmune diseases. *NPJ Womens Health.* 2025;3:36. doi: 10.1038/s44294-025-00086-8
 14. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev J.* 2015;4:1e9. doi: 10.1186/2046-4053-4-1.
 15. Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. *Eur J Epidemiol.* 2010;25:603e5.
 16. Ma K, Wang L, Sasamoto N, Wang Y, Wei J, Einarsson J, et al. Endometriosis and Sjögren's syndrome: bidirectional associations in population-based 15-year retrospective cohorts. *Acta Obstet Gynecol Scand.* 2024;103:2070-80. doi: 10.1111/aogs.14909
 17. Chao Y, Liu C, Pan Y, Yen F, Chiou J, Wei J. Association between endometriosis and subsequent risk of Sjögren's Syndrome: a nationwide population-based cohort study. *Front Immunol.* 2022;13:845944. doi: 10.3389/fimmu.2022.845944
 18. McCoy S, Hetzel S, VanWormer J, Bartels C. Sex hormones, body mass index, and related comorbidities associated with developing Sjögren's disease: a nested case-control study. *Clin Rheumatol.* 2022;41:3065-74. doi: 10.1007/s10067-022-06226-8
 19. Nielsen N, Jørgensen K, Pedersen B, Rostgaard K, Frisch M. The co-occurrence of endometriosis with multiple sclerosis, systemic lupus erythematosus and Sjögren syndrome. *Hum Reprod.* 2011;26:1555-9. doi: 10.1093/humrep/der105
 20. Jess T, Frisch M, Jørgensen K, Pedersen B, Nielsen N. Increased risk of inflammatory bowel disease in women with endometriosis: a nationwide Danish cohort study. *Gut.* 2012;61:1279-83. doi: 10.1136/gutjnl-2011-301095
 21. Xue Y, You L, Ting H, Chen Y, Sheng Z, Xie Y, et al. Increased risk of rheumatoid arthritis among patients with endometriosis: a nationwide population-based cohort study. *Rheumatology (Oxford).* 2021;60:3326-33. doi: 10.1093/rheumatology/keaa784
 22. Tang T, Zhong Y, Xu S, Yu H. Causal effects of endometriosis on SLE, RA and SS risk: evidence from meta-analysis and Mendelian randomization. *BMC Pregnancy Childbirth.* 2024;24:162. doi: 10.1186/s12884-024-06347-9
 23. Shigeshi N, Kvaskoff M, Kirtley S, Feng Q, Fang H, Knight J, et al. The association between endometriosis and autoimmune diseases: a systematic review and meta-analysis. *Hum Reprod Update.* 2019;25:486-503. doi: 10.1093/humupd/dmz014
 24. Ferrari-Souza J, Pedrotti M, Moretto E, Farenzena L, Crippa L, Cunha-Filho J. Endometriosis and systemic lupus erythematosus: systematic review and meta-analysis. *Reprod Sci.* 2023;30:997-1005. doi: 10.1007/s43032-022-01045-3