

Global Trends in Endometriosis Burden, 1990–2021: A Sociodemographic Analysis Using GBD 2021 Data and Projections to 2036

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Background: Endometriosis is a chronic inflammatory disorder that significantly compromises women's health, typically manifesting as pelvic pain and/or infertility. This condition imposes a substantial burden on global healthcare systems.

Methods: This socioeconomic-demographic analysis utilized Global Burden of Disease (GBD) 2021 data encompassing worldwide endometriosis burden metrics from 1990–2021. Four principal indicators: Age-Standardized Prevalence Rate (ASPR), Age-Standardized Incidence Rate (ASIR), Estimated Annual Percent Change (EAPC) and Disability-Adjusted Life-Years (DALY) were interpreted, stratified by geographic region, Socio-demographic Index (SDI) and age distribution. The slope index of inequality (SII) and concentration index (CIX) were also calculated to quantify health inequalities. Advanced analytical approaches were also implemented including frontier analysis decomposition analysis and Bayesian age-period-cohort (BAPC) model.

Results: Based on the GBD 2021 data, this study systematically analyzed the global burden of endometriosis and its trends from 1990 to 2021. The results show that while the age-standardized prevalence and incidence rates have steadily declined (with estimated annual percentage changes of –1.02% and –1.00%, respectively), the total number of cases and DALY continued to rise due to population growth and aging. The burden of endometriosis was unevenly distributed geographically, with significantly higher burdens in low SDI regions. East Asia, South Asia, and Southeast Asia exhibited the highest age-standardized rates, while Eastern Europe was the only region showing a positive EAPC. Health inequality analysis revealed that although absolute disparities have narrowed, relative inequality has intensified in middle- and high SDI regions. Furthermore, the high incidence among adolescents (15–19 years) highlights this group as a key target for endometriosis prevention and control.

Conclusion: Through stratified analysis and long-term projection, this study reveals that although the age-standardized burden of endometriosis is declining globally, the absolute burden continues to grow due to demographic dynamics, with significant geographic and age-related disparities. Projections to 2036 indicate a further decline in the standardized burden, yet gaps persist across regions with different SDI levels, and relative inequality remains pronounced, particularly in middle- and high SDI regions. The findings underscore the need to prioritize adolescent populations and develop tailored prevention and management strategies for high-burden and vulnerable groups, alongside advancing diagnostic and therapeutic technologies, to achieve equitable reduction in the global burden of endometriosis.

Keywords: endometriosis, global burden of disease, sociodemographic analysis, epidemiology, projection

Introduction

Endometriosis, a chronic inflammatory disorder characterized by the ectopic growth of endometrial tissue, affects approximately 6–10% of women globally, with a particular impact on those of reproductive age.^{1–3} The condition is

associated with debilitating symptoms, including infertility, chronic pelvic pain, and psychological comorbidities such as anxiety and depression. Diagnostic challenges remain, primarily due to the nonspecific nature of its symptoms and the continued reliance on invasive procedures for confirmation,⁴ resulting in delayed treatment and management. According to the GBD 2021 data, an estimated 22 million women worldwide are affected by endometriosis, underscoring its substantial public health and socioeconomic impact.¹ Despite growing awareness, the disease continues to impose a significant global health burden.⁵

Multiple factors contribute to the risk of endometriosis, including age, geographic location, ethnicity, genetic predisposition, prior medical treatments, lifestyle habits, and body mass index (BMI).^{6,7} The GBD 2021 dataset, which integrates comprehensive global health records, provides a unique opportunity to perform in-depth analyses of endometriosis patterns and trends. However, prior GBD-based studies have not sufficiently explored the heterogeneity of the disease across countries, regions, and age cohorts. Many have primarily focused on complications, thereby offering only a partial understanding of the overall disease burden and often neglecting future projections.^{6,8,9} Hence, a comparative and stratified analysis across diverse populations is essential for a more accurate and forward-looking assessment of the global endometriosis burden.¹⁰

Recent advances in computing and artificial intelligence have significantly enhanced the capacity for large-scale data integration and analysis, allowing for the consolidation of patient health records across regions and healthcare systems.¹¹ These technologies offer valuable opportunities to deepen our understanding of endometriosis pathogenesis, optimize treatment strategies, and improve patient outcomes, despite ongoing challenges in implementation.

In this study, we leveraged the R programming language and advanced statistical techniques to assess global trends in the burden of endometriosis from 1990 to 2021 and to project future trends through 2036. Key epidemiological indicators—including ASPR, ASIR, and EAPC—were analyzed across geographic regions, age groups, and SDI strata. In addition, we integrated two complementary analytical approaches: the Health Inequality Indicator (SII and CIX), and the Bayesian Age-Period-Cohort (BAPC) model. Specifically, the former (SII and CIX) was employed to quantitatively evaluate absolute and relative inequalities in endometriosis burden across different Socio-Demographic Index (SDI) regions, while the latter (BAPC model) was used to project future disease burden by simultaneously accounting for age, period, and cohort effects. Our objective was to systematically characterize the distribution and dynamic changes of endometriosis burden from multiple dimensions—including temporal, spatial, and socioeconomic aspects—thereby providing policy-relevant evidence to support the advancement of early diagnosis in global women's health, the development of context-specific strategies, and the optimization of health resource allocation.

Methods

Data Source

All data utilized in this study were obtained from the GBD 2021 using the GBD Results Tool available on the Institute for Health Metrics and Evaluation (IHME) website (<http://ghdx.healthdata.org/>). The detailed processes of the GBD study and the estimation of the burden in GBD have been published.¹² GBD 2021 provides estimates for the incidence, prevalence, Years Lived with Disability (YLD), Years of Life Lost (YLL), and Disability-Adjusted Life Years (DALY) for 371 diseases and injuries. Since GBD 2019, the GBD location hierarchy has included all WHO member states, and GBD 2021 has provided estimates for 204 countries and regions, which are further divided into 21 regions and 7 super regions, with countries and regions categorized into 5 different levels on the basis of the SDI.

We selected DALY as the analytical indicator. DALY, which are calculated by summing YLD and YLL, are stratified by location, age, sex, year, and cause. DALY could reflect the loss of life and quality of life due to diseases, providing a comprehensive assessment of the disease burden and enabling analysis of health inequalities. DALY were defined according to the GBD framework as the sum of YLDs and YLLs, with endometriosis-related DALY being largely driven by modeled YLD estimates due to minimal mortality. In addition to analyzing the entire female population, we specifically selected data for 8 age groups within the 15–55 range from the GBD for analysis, encompassing 204 countries and regions, 21 GBD regions, and regions classified according to different SDI levels.

Statistical Analysis

We used the EAPC to assess the trend of a particular indicator (such as the ASR values for incidence rate, prevalence rate, or disability-adjusted life years) over a specific time period. This value reflects the rate of increase or decrease of the indicator. The ASR is calculated per 100,000 individuals via the following formula:

$$ASR = \frac{\sum_{i=1}^N a_i w_i}{\sum_{i=1}^N w_i} \times 100,000$$

(a_i : the age-standardized rate for the i th age group; W_i : the number of individuals within the same age group according to the GBD 2021 standard population. N : the total number of age groups).

We performed linear regression analysis with year as the independent variable and the natural logarithm of ASR as the dependent variable to obtain the regression coefficient β . By substituting the regression coefficient β into the formula for calculating the EAPC, we obtained the EAPC value.¹³ If the EAPC and its 95% CI were above or below zero, respectively, we determined that the ASR exhibited an increasing or decreasing trend over time. Therefore,

$$Y = \alpha + \beta X + e$$

$$EAPC = 100 \times (e^{\beta} - 1)$$

(Y : natural logarithm of the age-standardized rate (ASR); X : calendar year; α : intercept; β : slope).

Inequality Analysis

To assess socioeconomic inequalities in endometriosis burden, this study employed the SII and the CIX, as recommended by the WHO.¹⁴ Inequality analyses were conducted separately for incidence, prevalence, and DALY. For each outcome, the dependent health indicator was the ASR, which was strictly age-standardized prior to inequality regression analyses to eliminate confounding effects arising from differences in population age structure across countries and regions. Countries and regions ($n = 204$) were ranked according to the SDI, a composite indicator reflecting income per capita, educational attainment, and fertility rate, which served as the socioeconomic position variable. The SII was estimated using weighted regression of ASR on the relative SDI rank, while the CIX was calculated by relating the cumulative proportion of ASR for incidence, prevalence, and DALY to the cumulative population distribution ranked by SDI, corresponding to the area under the concentration curve.

Both inequality indices were population-weighted, with country- and region-specific population sizes used as weights to ensure that estimates appropriately reflected population distribution and to enhance the stability and comparability of the results over time.

BAPC Model

Future trends in the burden of endometriosis were projected using a BAPC model.¹⁵ The model assumes a Poisson likelihood for disease burden counts. To address the inherent collinearity among age, period, and cohort effects and to ensure smooth temporal trends, second-order random walk (RW2) priors were applied to the period and cohort components.

Model fitting was conducted using the Integrated Nested Laplace Approximation (INLA) approach as implemented in the BAPC R package. All point estimates are presented as posterior medians, and uncertainty is quantified using 95% Bayesian credible intervals (95% CI). Projection intervals (95% CI) were derived from the posterior predictive distribution, thereby accounting for both parameter uncertainty and residual variability.

Temporal autocorrelation was explicitly modeled through the RW2 priors, which impose smoothness and serial dependence across adjacent time periods. The analysis was performed at the global aggregate level, and no hierarchical structure was specified to model cross-country dependence; this limitation is acknowledged in the Discussion.

Statement

This study utilized publicly available data from the GBD database, which included anonymous and aggregated population-level information, and was an ecological observation study based on the country/region level. Since only deidentified secondary data were used, with no individual-level details, this research was exempt from institutional review board (IRB) approval by the Tongji Hospital Tongji Medical College of HUST ethics committee.

Role of the Funding Source

The study funders had no role in the study design, data collection, data analysis, data interpretation, or writing of the manuscript.

Results

Global Burden of Endometriosis

This study analyzed prevalence, incidence, age-standardized prevalence rate (ASPR), age-standardized incidence rate (ASIR), and estimated annual percentage change (EAPC) to characterize the global burden of endometriosis. Overall, although the absolute number of cases increased over time, both ASPR and ASIR showed clear downward trends at the global level (Table 1 and Figure 1).

Specifically, the global number of prevalent cases increased from 19.87 million (95% UI: 13.59–27.69 million) in 1990 to 22.28 million (95% UI: 15.52–30.41 million) in 2021. In contrast, ASPR declined from 757.10 per 100,000 population (95% UI: 515.25–1046.13) to 556.98 per 100,000 population (95% UI: 388.85–764.05), with an EAPC of -1.02 (95% UI: -1.07 – -0.97), indicating a sustained decrease in age-standardized prevalence. Similarly, although the absolute number of incident cases increased slightly over the study period, ASIR declined from 119.65 per 100,000 population (95% UI: 83.51–160.46) to 88.52 per 100,000 population (95% UI: 62.53–119.55), with an EAPC of -1.00 (95% UI: -1.05 – -0.95) (Table 1).

The relatively stable and overlapping 95% uncertainty intervals across the study period suggest that the observed declines in ASPR and ASIR are robust, while the remaining variability reflects heterogeneity in data availability and modeling inputs across regions.

The accompanying uncertainty intervals indicate moderate variability around these estimates, reflecting differences in data availability and model inputs across regions. Notably, a modest decline in absolute case numbers was observed during the most recent two years, coinciding with continued decreases in ASPR and ASIR (Figure 1).

Beyond prevalence and incidence, global DALY attributable to endometriosis increased from 1990 to 2021, highlighting the persistent impact of the disease on population health and quality of life (Figure 1).

Regional Burden of Endometriosis

Since disease diagnosis and treatment are closely linked to economic development, we analyzed burden variations across different SDI regions. In 2021, middle-SDI and low-middle-SDI regions exhibited relatively higher prevalence and incidence, whereas high-SDI regions showed the lowest levels (Table 1 and Figure 1). Over time, although absolute case numbers continued to rise in low-SDI regions, ASPR and ASIR declined across all SDI categories, with the most pronounced decreases observed in low- and low-middle-SDI regions (Figure 1). Uncertainty intervals were generally wider in low-SDI regions, consistent with more limited availability of primary epidemiological data and greater reliance on modeled estimates.

Across the 21 GBD regions, South Asia recorded the highest prevalence and incidence in 2021, with an estimated 5.87 million prevalent cases (95% UI: 4.08–8.16 million) and 0.94 million incident cases (95% UI: 0.64–1.27 million) (Figure 2). East Asia, South Asia, and Southeast Asia contributed the largest absolute numbers of cases, whereas higher age-standardized rates were observed in Oceania, Eastern Europe, and parts of sub-Saharan Africa. The regional distribution of DALY followed a similar pattern, with the highest absolute DALY burden observed in South Asia, East Asia, and Southeast Asia, and the highest DALY ASR in Oceania, Eastern Europe, and western sub-Saharan Africa (Figure 2 and Figure S1).

Table 1 Global and Different SDI Regions' Trends in Endometriosis Burden: Prevalence, Incidence, and Disability-Adjusted Life years (1990–2021)

Location	1990		2021		EAPC_95% CI
	Number	ASR	Number	ASR	
Prevalence					
Global	19,869,195.64(27,689,588.83–13,585,884.07)	757.10(1,046.13–515.25)	22,275,015.21(30,413,692.29–15,517,370.14)	556.98(764.05–388.85)	–1.02(–1.07–0.97)
High SDI	2,784,337.01(3,854,247.10–1,915,308.08)	591.69(822.65–406.00)	2,495,271.47(3,262,340.75–1,833,038.39)	475.97(633.32–342.41)	–0.85(–0.94–0.75)
High-middle SDI	3,627,103.19(5,057,553.42–2,458,061.40)	647.74(898.58–443.17)	3,410,962.02(4,531,701.10–2,438,367.97)	513.77(689.66–363.98)	–0.71(–0.82–0.61)
Middle SDI	5,892,115.28(8,218,402.98–4,009,510.66)	689.96(949.68–474.18)	6,549,196.08(8,977,659.72–4,601,954.22)	506.23(696.05–354.30)	–1.04(–1.12–0.96)
Low-middle SDI	5,225,146.81(7,273,719.93–3,586,094.30)	1,003.92(1,388.39–682.93)	6,091,634.17(8,492,311.47–4,217,968.90)	603.63(842.37–417.71)	–1.67(–1.7–1.64)
Low SDI	2,324,260.43(3,234,297.21–1,591,304.57)	1,100.52(1,516.08–747.35)	3,710,059.28(5,179,969.38–2,512,292.30)	714.86(987.94–485.20)	–1.4(–1.48–1.32)
Incidence					
Global	3,330,200.05(4,506,991.03–2,308,562.78)	119.65(160.46–83.51)	3,447,125.88(4,611,504.04–2,436,259.34)	88.52(119.55–62.53)	–1(–1.05–0.95)
High SDI	437,908.40(594,891.80–305,803.83)	96.29(130.57–67.24)	358,019.31(467,063.87–260,638.68)	75.36(99.16–54.15)	–0.92(–1–0.85)
High-middle SDI	593,606.46(799,094.74–412,142.39)	103.91(141.10–72.48)	488,882.81(647,892.55–353,410.31)	83.07(110.49–59.41)	–0.72(–0.82–0.61)
Middle SDI	1,049,820.76(1,440,143.62–715,023.66)	112.28(151.13–77.47)	1,008,051.89(1,348,856.70–709,012.13)	82.40(111.20–58.07)	–1.04(–1.13–0.96)
Low-middle SDI	863,042.96(1,197,108.62–596,983.02)	149.46(200.14–105.18)	981,567.48(1,336,891.22–680,611.46)	94.13(127.29–65.77)	–1.5(–1.52–1.47)
Low SDI	383,153.46(531,723.73–264,537.69)	160.33(215.31–112.71)	607,883.49(848,818.03–420,339.21)	103.56(141.06–72.04)	–1.41(–1.46–1.35)
Disability-adjusted life years					
Global	1,829,342.18(2,864,709.25–1,033,446.30)	69.60(109.37–39.69)	2,049,472.65(3,133,967.05–1,195,196.69)	51.27(78.43–29.87)	–1.01(–1.06–0.96)
High SDI	257,028.00(414,122.47–147,395.69)	54.64(87.39–31.28)	229,427.53(353,693.03–137,203.34)	43.84(66.59–26.40)	–0.85(–0.94–0.75)
High-middle SDI	336,144.33(528,327.48–190,136.20)	59.97(94.60–34.12)	315,055.96(494,011.49–187,389.68)	47.57(72.59–28.31)	–0.71(–0.81–0.61)
Middle SDI	545,386.07(849,542.69–307,243.63)	63.72(99.89–36.43)	604,489.61(930,568.19–355,896.42)	46.77(71.92–27.46)	–1.03(–1.11–0.95)
Low-middle SDI	477,781.48(742,839.43–274,691.78)	91.57(142.99–52.82)	558,844.61(868,538.54–322,799.82)	55.32(85.34–32.22)	–1.65(–1.68–1.62)
Low SDI	211,503.15(329,228.93–120,622.49)	99.87(154.88–57.28)	340,006.78(529,367.03–193,823.53)	65.33(100.53–37.51)	–1.37(–1.45–1.29)

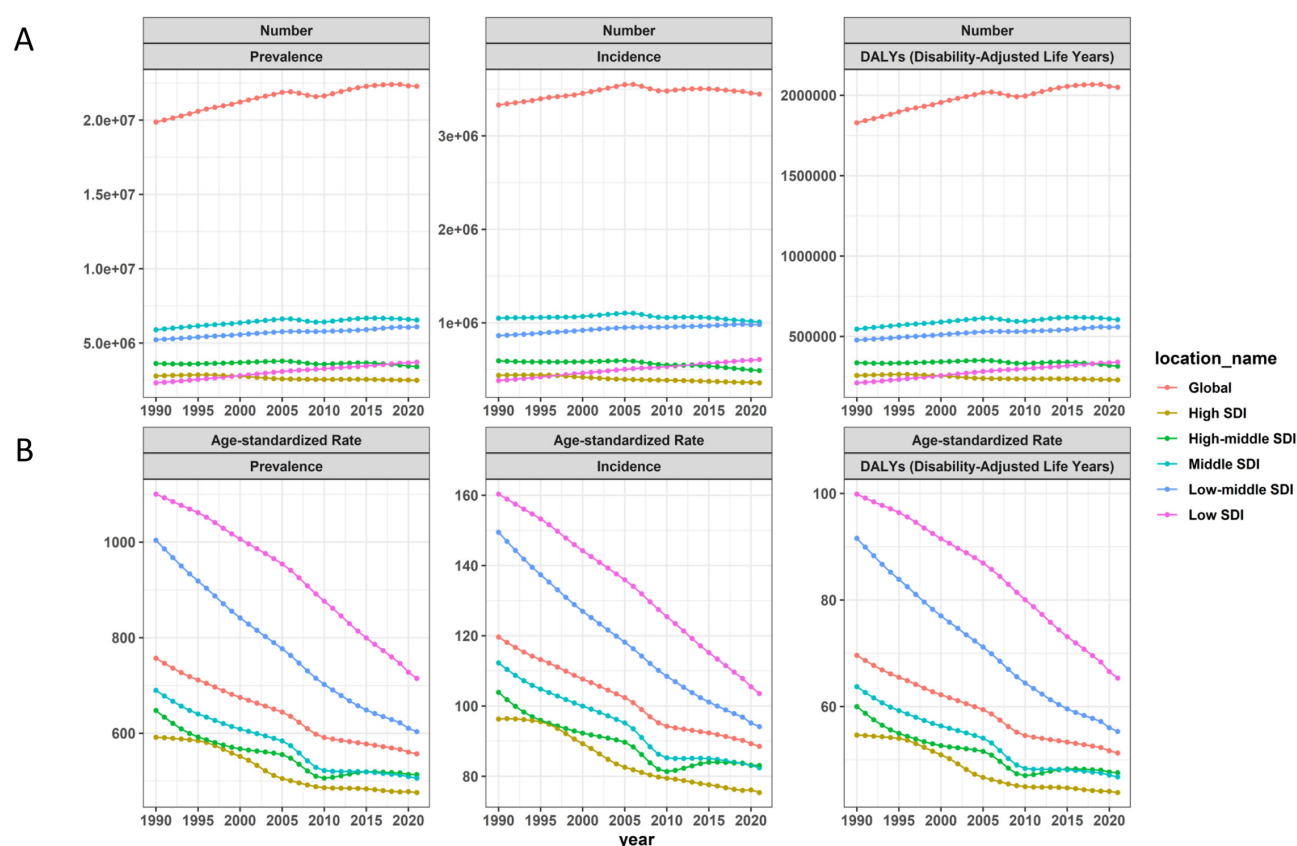


Figure 1 Trends in the prevalence, incidence and DALY of endometriosis from 1990–2021. **(A)** Numbers of prevalence, incidence and DALY. **(B)** ASR of prevalence, incidence and DALY.

Notably, Eastern Europe was the only region in which EAPCs for both prevalence and incidence were positive, accompanied by a positive EAPC for DALY, indicating a continuing increase in disease burden in this region ([Figure S2](#)).

National Burden of Endometriosis

At the national level, India and China accounted for the largest absolute burden of endometriosis worldwide. In 2021, both countries ranked highest in terms of prevalent and incident cases, largely reflecting population size rather than increased age-standardized risk ([Tables S1](#) and [S2](#)). Consistently, India and China also ranked among the countries with the highest absolute numbers of DALY ([Figure 2](#) and [Table S2](#)). Despite overall declining trends in ASPR and ASIR in both countries, China exhibited relatively low age-standardized levels globally, whereas India remained comparatively higher, indicating substantial cross-national heterogeneity in age-standardized burden despite similar population scale.

Globally, Niger and the Solomon Islands showed the highest ASPR and ASIR, while Iceland, Portugal, and the United States exhibited the lowest levels ([Table S3](#) and [Figure S3](#)). Across the 204 countries and territories analyzed, only a small proportion demonstrated increasing trends in prevalence or incidence, and these were predominantly high-income countries. Among them, Iceland and Sweden showed the most pronounced increases, whereas Yemen and Nepal experienced the largest declines in age-standardized rates ([Table S3](#) and [Figure S3](#)).

Burden Across Age Groups

Since endometriosis predominantly affects women of reproductive age (15–55 years), we analyzed its burden across eight age groups. In 2021, the prevalence was highest in the 25–29 age group, while the incidence peaked at ages 20–24. Notably, the 15–19 age group had the second highest incidence but the lowest prevalence.

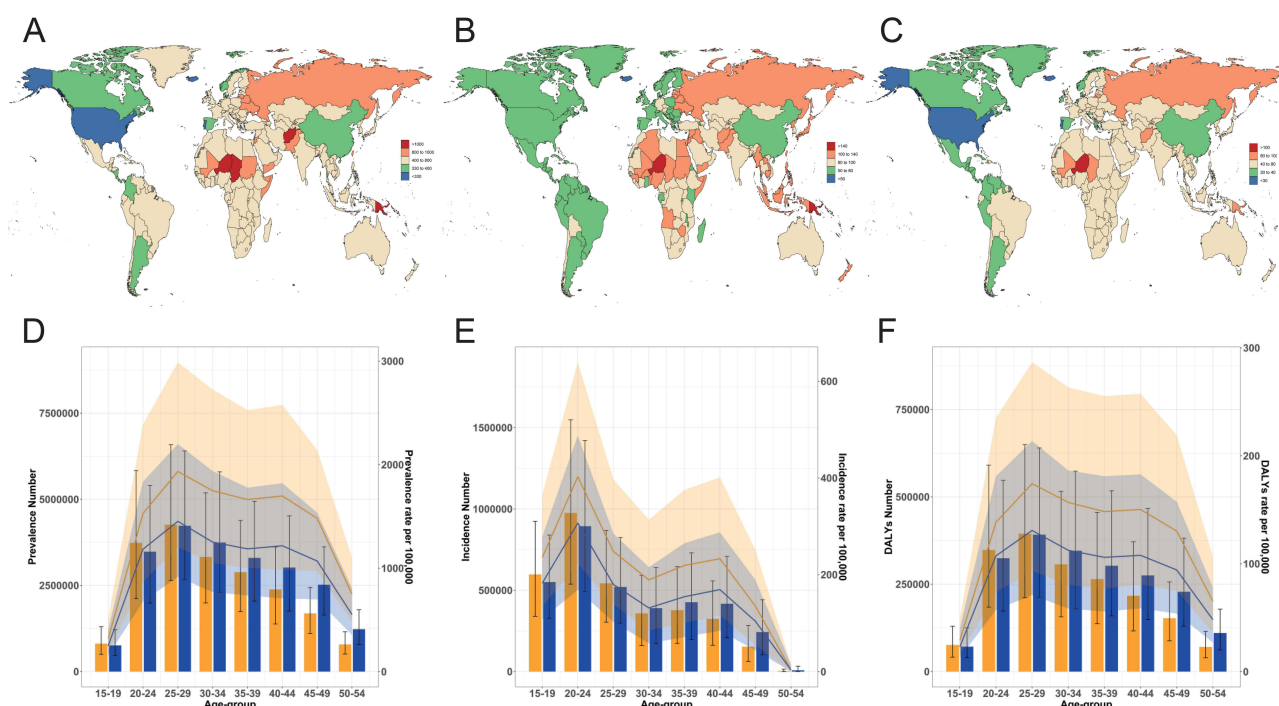


Figure 2 The global disease burden of endometriosis in 204 countries and territories. (A) ASR of prevalence. (B) ASR of incidence. (C) ASR of DALY. Comparison of the number and ASR of prevalence, incidence and DALY across different age groups. (D) Prevalence. (E) Incidence. (F) DALY.

Across age groups, prevalence and incidence trends mirrored case numbers and were consistently lower in 2021 than in 1990 (Figure 2). DALY followed similar trends, with the 20–24, 25–29, and 30–34 age groups experiencing the greatest impact on quality of life and life expectancy (Figure 2).

Global Inequality Analysis of Endometriosis

We also conducted a health inequality analysis to assess disparities in disease burden. The SII indicated that absolute inequalities in prevalence, incidence, and DALY decreased from 1990 to 2021, reflecting global improvements in healthcare access (Figure 3).

However, the CIX showed that relative health inequalities increased, favoring wealthier populations. The Lorenz curve revealed reduced disparities in lower SDI regions, while inequalities worsened in the middle- and high-SDI regions. These findings suggest that while absolute health disparities declined, relative inequalities intensified, particularly in high SDI regions (Figure 3 and Table S4).

Frontier and Decomposition Analysis

To identify countries with the greatest potential for improving endometriosis management, we conducted a frontier analysis of the SDI alongside age-standardized prevalence, incidence, and DALY. Our findings indicate substantial heterogeneity in endometriosis burden across countries and SDI levels. Most low SDI regions, including Papua New Guinea and the Solomon Islands, exhibited relatively higher modeled burden compared with countries at similar SDI levels, whereas some exceptions, such as Liberia, showed comparatively lower age-standardized rates within the low SDI group. In addition, several higher SDI regions, including Tokelau, Lithuania, and Taiwan Province of China, also demonstrated notable modeled burdens, suggesting that reductions in endometriosis burden are not limited to low SDI settings (Figure S4).

Through a decomposition analysis spanning 1990–2021, we assessed the contributions of aging, epidemiological changes, and population growth to endometriosis burden. The results show that population growth accounted for approximately 389.8% of the increased disease burden, with its impact being consistent across prevalence, incidence,

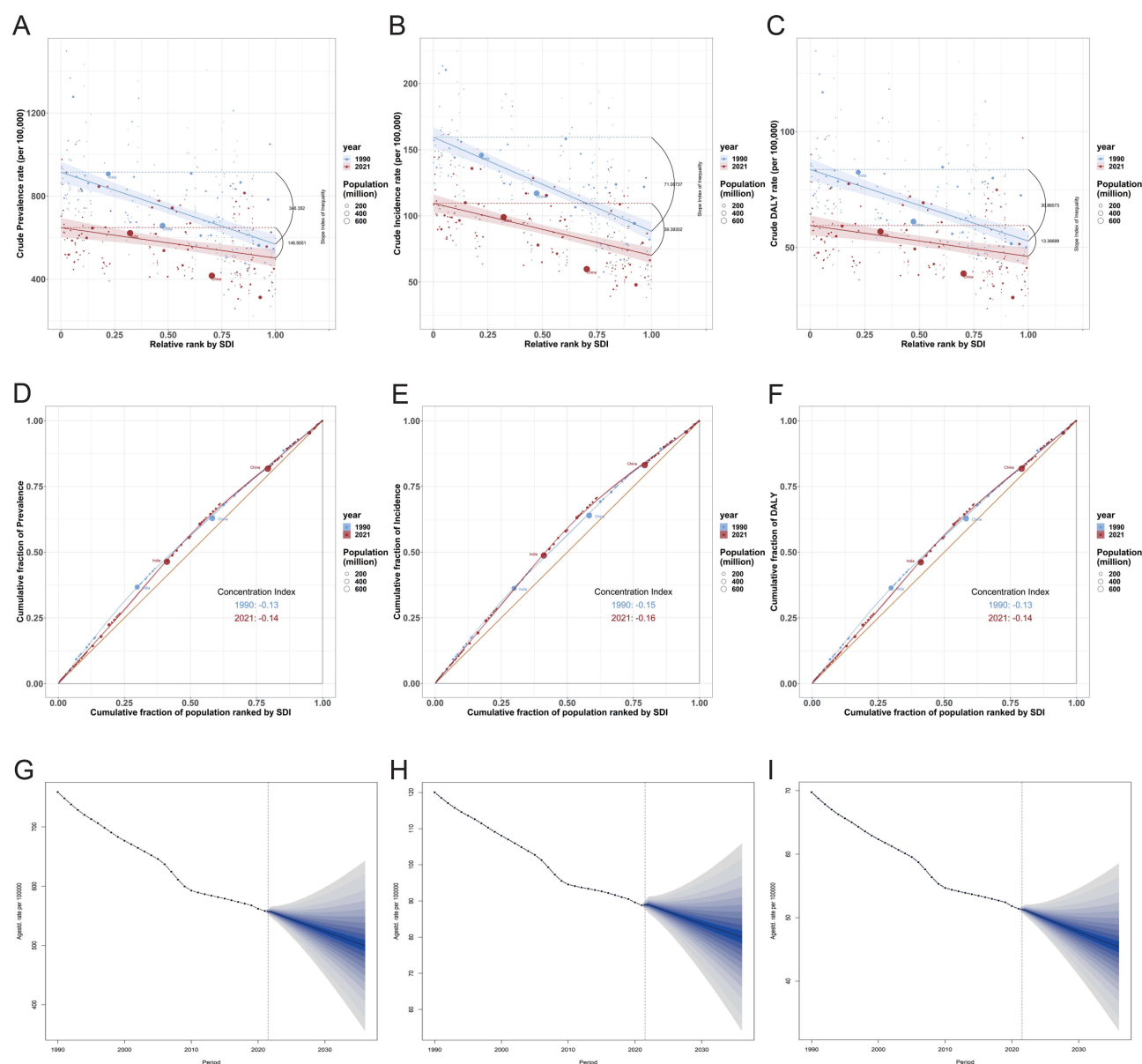


Figure 3 Country/territory-level crude prevalence (A), incidence (B), and DALY rates (C) plotted against relative SDI rank. Point size denotes population. Lines show population-weighted fits with 95% uncertainty bands; SII is annotated. Concentration curves for prevalence (D), incidence (E), and DALY (F) with corresponding concentration index (CIX); the diagonal indicates equality. Trends and projections of age-standardized rates, 1990–2021 and 2022–2036. (G) prevalence, (H) incidence, and (I) DALY rates (per 100,000).

and DALY. Aging contributed positively to the increase in prevalence (+12.5%) but had minimal or slightly negative effects on incidence (<0%) (Figure S5).

Future Forecasts of the Global Burden of Endometriosis

To support policymakers in making informed decisions, we projected global trends in endometriosis burden from 2021 to 2036. The ASPR is expected to decrease from 556.98 cases per 100,000 people (2021) to 499.63 cases per 100,000 (2036). Similarly, the ASIR is projected to decline to 80 cases per 100,000 by 2036 (Figure 3 and Table S5). The DALY rate is also anticipated to decrease, reaching 45.38 cases per 100,000 by 2036.

These trends collectively suggest that advancements in diagnosis and treatment will likely contribute to a reduction in disease burden, improving outcomes for patients globally.

Discussion

Endometriosis remains a significant public health challenge for women worldwide, imposing a substantial socioeconomic burden. This study comprehensively analyzed the global endometriosis burden showing a declining trend and projected a continued reduction in the future up to 2036 based on GBD 2021 data, offering a stratified and multi-faceted understanding of endometriosis distribution and dynamics worldwide. The results uncovered significantly higher disease burden in the low SDI and developing regions. Notably, adolescent endometriosis has emerged as a significant health concern due to its high incidence rates. This study uniquely incorporates inequality analysis and future predictions based on GBD data, providing a critical reference for global health policymakers.

We observed a paradoxical pattern in which age-standardized prevalence and incidence rates declined steadily (EAPCs of -1.02% and -1.00% per year, respectively), while the absolute number of cases and DALY increased over time. This divergence reflects the well-recognized distinction between age-standardized rates and absolute burden diagnostic modalities, the latter being strongly influenced by population growth and population ageing.

Within the GBD framework, temporal changes in modeled estimates may also be influenced by variations in case ascertainment and disease management, including advances in diagnostic technologies (eg, high-resolution imaging)^{16,17} and therapeutic options (eg, GnRH antagonists).¹⁸ However, these factors should be interpreted as contextual influences rather than direct causal drivers of burden trends, and they do not negate the dominant contribution of demographic change to increases in absolute case numbers and DALY.

Our research also revealed significant regional variations of endometriosis burden. The observed discrepancy of epidemiological indicators across different SDI regions might be likely driven by high detection rate due to advancements in medical technology within low-to-middle SDI settings and the globally pervasive population aging trend in the past decades. The highest ASR of East Asia, South Asia, and Southeast Asia may primarily due to their large populations, lower economic development and inferior medical conditions.⁷ Additionally, it has been reported that Asian women may have a higher prevalence of endometriosis compared to white women.¹⁹ Our research further indicates that Eastern Europe was the only region with a positive EAPC in ASIR during the study period—deviating from the overall declining trend observed globally and across other regions. This pattern may partially reflect recent increases in attention to endometriosis in Eastern Europe, as well as improvements in diagnostic and reporting capacities (eg, advancements in imaging examinations, laparoscopy, and medical record registration), rather than indicating a true elevation in the inherent risk of the disease itself. Our research further indicates that Eastern Europe was the only region with a positive EAPC in ASIR during the study period—deviating from the overall declining trend observed globally and across other regions. This pattern may partially reflect recent increases in attention to endometriosis in Eastern Europe, as well as improvements in diagnostic and reporting capacities (eg, advancements in imaging examinations, laparoscopy, and medical record registration), rather than indicating a true elevation in the inherent risk of the disease itself.²⁰ Besides, India and China shoulder the heaviest global burden of endometriosis. This characteristic is not only attributable to their large population bases but may also be associated with factors including inequitable access to medical resources and medications, limited diagnostic opportunities, and shifts in demographic structures.

Additionally, our study conducted a health inequality analysis, which has seldom been included in previous GBD studies. Our results implied shifting disparities by the SII and CIX in endometriosis burden from 1990 to 2021. While economic disparities narrowed globally, it improved significantly in the low SDI regions due to public health interventions, though further investment is needed. Conversely, relative inequalities increased in middle- and high SDI regions, underscoring the strong dependence of healthcare quality on economic development. The WHO's 2024 report highlighted global health improvements, but disparities persist.²¹ Comprehensive health systems and targeted policymaker action are required to address these gaps, which highlights that medical technology and economic assistance are imperative for low- and middle-income countries.

Remarkably, our study presented that prevalent cases and DALY are highest in those aged 25–29 years, whereas the incidence peaks in those aged 20–24 years. Both of the two age groups are of reproductive age, which is consistent with the impact of endometriosis on women of reproductive age. Notably, the adolescents, 15–19 age group, ranks second in incidence, aligning with previous research showing two-thirds of adult endometriosis patients reported symptoms before

age 20.²² However, it should be emphasized that global rates of medical consultation and diagnosis among adolescents remain suboptimal. The GBD estimates for this demographic relied primarily on model-based inference and limited empirical data. Hence, these age-specific disease onset patterns warranted cautious interpretation and were not to be construed as precise reflections of actual incidence rates. Nevertheless, these results still highlight the critical importance of optimizing endometriosis care for adolescents to foster their holistic well-being. But adolescent endometriosis management remains particularly challenging due to factors such as heightened stigma sensitivity, limitations in physical/imaging examinations, and evidence gaps regarding drugs that maintain low estrogen levels use in this population.²³ These barriers underscore the urgent need for comprehensive upgrades in both physiological and psychological management approaches for adolescent patients. Therefore, early diagnosis in adolescents is crucial to alleviating the long-term burden.

Our frontier analysis identified countries with the potential to reduce endometriosis burden based on SDI levels. The significant improvement opportunities were observed in low SDI regions. Interestingly, compared to countries with similar SDI levels, Liberia's disease burden has become relatively light, possibly due to targeted health interventions such as the 2018–2023 HSR project.²⁴ High SDI regions also exhibited gaps between expected and actual burden levels, highlighting resource allocation imbalances. It is required for both international support for low SDI regions and better distribution of resources within high SDI areas to address the disparities.

Our decomposition analysis implied that population growth was the primary driver of increasing endometriosis burden. Notably, aging was positively associated with incidence. This find further emphasized the importance of early diagnosis and intervention in younger patients to reduce the global burden.²³

Finally, we forecasted the future trends in endometriosis burden from 2022 to 2036. Our projections showed that the ASR for prevalence, incidence, and EAPC will continue to decline, with a greater reduction compared to previous trends. This expected improvement is likely due to advances in diagnostic and therapeutic techniques and changes in demographic structure. Increased awareness and understanding of endometriosis pathogenesis and progression may further accelerate this downward trend. Emerging developments—such as novel non-invasive diagnostic biomarkers,⁴ non-hormonal pharmacological agents, and targeted therapies against inflammatory pathways²⁵—might drive additional burden reduction in the future.

There are several limitations to this study. Although the GBD database provides a valuable and comprehensive resource for analyzing global disease burden, it relies heavily on modeled estimates derived from available datasets, which may not fully capture the nuances of real-world clinical conditions. This modeling approach, while robust, limits the generalizability of findings, particularly in regions with limited or inconsistent health data reporting.

Although the GBD framework provides a comprehensive and internally consistent platform for comparing disease burden across countries and over time, its estimates rely partly on modeled data, particularly in regions where primary epidemiological information on endometriosis is scarce. In low-SDI and developing regions, limited access to gynecological care, underdiagnosis, and sparse population-based data necessitate a greater reliance on statistical modeling and cross-regional information borrowing, as described in the GBD methodological framework.^{26,27} As a result, uncertainty intervals tend to be wider in these settings, reflecting increased estimation uncertainty and the potential for modeling bias. Accordingly, burden estimates for low-SDI regions should be interpreted with caution.

Additionally, due to the heterogeneous nature of endometriosis, this study was unable to differentiate between clinical subtypes (eg, superficial peritoneal lesions, ovarian endometriomas, deep infiltrating endometriosis) or identify symptomatic versus asymptomatic (occult) cases. GBD estimates may therefore underrepresent disease prevalence, especially among individuals who remain undiagnosed due to subtle or non-specific symptoms.

Moreover, the dataset does not account for patient-level data such as disease stage, severity, or treatment history, further constraining the granularity of our analysis. Future research should aim to integrate longitudinal data from clinical registries and electronic medical records to capture a more accurate and comprehensive picture of endometriosis burden, phenotypic diversity, and treatment outcomes across populations.

Conclusion

To understand the epidemiology of endometriosis, we analyzed GBD 2021 data to assess current trends and forecast future burden. While global prevalence and incidence rates have declined, the absolute number of cases continues to rise, especially in the low SDI regions where limited resources hinder improvements in diagnosis and treatment. In the short term, awareness campaigns may offer the most immediate benefit. Notably, the 15–19 age group ranks second in incidence, highlighting a need for adolescent-focused diagnostic and treatment strategies. From a policy perspective, these findings align closely with Sustainable Development Goal 3,²⁸ underscoring the importance of strengthening reproductive health services and reducing sociodemographic disparities. In this context, region-specific approaches that integrate health education, medical innovation, and policy support may be necessary to address the diverse needs of populations affected by endometriosis.

Abbreviations

GBD, Global Burden of Disease; ASPR, Age-Standardized Prevalence Rate; ASIR, Age-Standardized Incidence Rate; DALY, Disability-Adjusted Life Years; SDI, Socio-demographic Index; SII, Slope Index of Inequality; CIX, Concentration Index; BAPC, Bayesian age-period-cohort; CI, Confidence Interval; UI, Uncertainty Interval; EAPC, Estimated annual percentage change; YLD, Years Lived with Disability; YLL, Years Lived with Lost; INLA, Integrated Nested Laplace Approximation; IRB, Institutional Review Board; IHME, Institute for Health Metrics and Evaluation.

Data Sharing Statement

Data used in the analyses can be obtained from the Global Health Data Exchange Global Burden of Disease Results Tool (<https://vizhub.healthdata.org/gbd-results/>). And the data used in this study can be downloaded from the GBD database or obtained from the corresponding author Wenwen Wang.

Ethics Approval and Consent to Participate

The study did not require ethics approval and consent to participate because it used publicly available data without primary data collection.

Consent for Publication

All authors have reviewed and approved the final manuscript and consent to its publication.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that there are no conflicts of interest in this work.

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