

RESEARCH ARTICLE

Global, regional, and national prevalence and trends of gynecological diseases among women of childbearing age from 1990 to 2021: An analysis of the global burden of disease study 2021

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Abstract

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Purpose

The global prevalence and trends of gynecological diseases (GDs) among women of childbearing age (WCBA) remain unclear and may be underestimated. This study aims to evaluate the prevalence of GDs at global, regional, and national levels and assess changes from 1990 to 2021.

Methods

Data on the annual prevalence of major GDs, including uterine fibroids, polycystic ovarian syndrome (PCOS), female infertility, endometriosis, genital prolapse, pre-menstrual syndrome (PMS), and other GDs, were obtained from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021. The study analyzed women aged 15–49 years across 204 countries and territories from 1990 to 2021. Estimated annual percentage changes (EAPC) in the age-standardized prevalence rate (ASPR) were calculated to quantify temporal trends, by age and socio-demographic index (SDI).

Results

In 2021, the global prevalence of GDs among WCBA was estimated at 1.21 billion cases, corresponding to a ASPR of 62,091.73 cases per 100,000 population (95% UI: 62,088.24 to 62,095.23). While the ASPR for GDs remained stable from 1990 to 2021 (EAPC = 0% [95% CI: -0.03 to 0.02]), the number of prevalent cases doubled

GBD study are publicly available at <https://www.healthdata.org/results/data-visualizations>.

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over the same period. In 2021, the most prevalent GD globally was PMS, followed by uterine fibroids, PCOS, and female infertility. Conditions such as uterine fibroids, PCOS, and female infertility showed a significant upward trend in ASPR over time. Additionally, the ASPR of most GDs generally decreased with rising SDI, except for PCOS, which exhibited an increasing trend with higher SDI. The prevalence of GDs also increased with age, peaking in the 40–44 years age group. However, a shift in the burden of GDs toward younger women was observed, with significant increases in prevalence rates for uterine fibroids, PCOS, female infertility, and PMS in women aged 20–29 years.

Conclusions

GDs among WCBA remain a global concern, underscoring the urgent need for targeted interventions, especially for younger populations and in regions with limited healthcare infrastructure. Prioritizing early intervention, addressing environmental risk factors, and removing barriers to healthcare access will mitigate the long-term impact of these conditions on women's health and overall well-being.

Introduction

Gynecological diseases (GDs)—including endometriosis, uterine fibroids, and female infertility—pose a significant but often overlooked threat to women's health worldwide [1–5]. Women of childbearing age (WCBA), defined as those aged 15–49, are especially vulnerable to these conditions [5]. For instance, endometriosis affects around 10% of WCBA globally, yet access to standardized and effective care remains limited [6]. These diseases not only impact reproductive health but also lead to substantial psychological and socioeconomic burdens [7–9]. Despite their serious health implications, most existing studies focus on individual conditions, specific populations [10–12], or all age groups combined [5], rather than addressing GDs specifically in WCBA.

The changing landscape of risk factors—such as delayed childbearing [13], increasing rates of metabolic syndrome [14,15], and greater exposure to environmental endocrine disruptors [16]—further highlights the need for a systematic assessment of trends over time [17]. In addition, the burden of GDs differs significantly across regions and socio-demographic groups, making it crucial to understand geographical disparities and temporal changes in prevalence [5]. As global attention to women's health grows [18], accurate and comprehensive data on GD prevalence are urgently needed.

Methodological inconsistencies and the often mild or asymptomatic nature of early-stage GDs contribute to their underestimation in routine health statistics [19,20]. The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021 provides a valuable opportunity to address these gaps by applying standardized case definitions, using the American College of Obstetricians and Gynecologists (ACOG) criteria where applicable [1]. This study aims to improve the epidemiological understanding of GDs by estimating their prevalence at global, regional, and national levels and analyzing trends over recent decades.

Methods

Overview

The estimates presented in this study were obtained from the GBD 2021 [1]. With each new release of the GBD, data are updated, and methodological improvements are implemented; therefore, estimates for the entire time series replace those from previous GBD cycles [21]. This section outlines the key methodological steps used in generating the estimates reported in this study. More detailed descriptions of the methods can be found in the Supporting information and the GBD 2021 methods appendices (<https://www.healthdata.org/gbd/methods-appendices-2021/gynaecological-diseases>).

The GBD 2021 study was approved by the Institutional Review Board committee at the University of Washington. Informed consent was waived due to the use of deidentified data (<https://www.healthdata.org/research-analysis/gbd>).

Definitions

All estimates in this study pertain to women of childbearing age (WCBA), defined as those aged 15–49 years according to World Health Organization (WHO) criteria [22,23]. The estimates are presented globally, by region, and across 5-year age groups (15–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45–49) for the years 1990–2021. Regional estimates are based on geographic classifications, including 21 GBD world regions (S1 Table in [S1 File](#)) and 204 countries or territories. Additionally, countries and territories were categorized into five quintiles based on the Socio-demographic Index (SDI): low, low-middle, middle, high-middle, and high (S2 Table in [S1 File](#)). The SDI is a composite measure of social development, calculated as the geometric mean of three standardized indicators: the total fertility rate among women under 25 years, the average years of schooling for individuals aged 15 and older, and lag-distributed income per capita [1]. All rates are reported per 100,000 people per year, with 95% uncertainty intervals (UIs) derived from the 25th and 975th values of 1,000 draws, which were propagated through each estimation step [1].

In the GBD 2021 study, GDs were defined using standardized diagnostic criteria, with the ACOG guidelines serving as the reference standard where applicable. The analysis focused on the prevalence of key GDs, including uterine fibroids, polycystic ovarian syndrome (PCOS), female infertility, endometriosis, genital prolapse, premenstrual syndrome (PMS), and a category of other GDs. The “other GDs” category encompasses conditions such as inflammatory disease of the cervix uteri, diseases of Bartholin’s gland, other inflammatory disorders of the vagina and vulva, vulvovaginal ulceration and inflammation, and non-inflammatory disorders of the ovary, fallopian tube, and broad ligament [1]. All diseases were classified according to the corresponding codes of International Classification of Diseases, 10th Revision (ICD-10), as adopted in the GBD study. A detailed mapping of these classifications is provided in S3 Table in [S1 File](#).

The GBD methodology integrates data from diverse sources—including vital registration, surveys, hospital records, and disease registries—using advanced statistical models such as DisMod-MR 2.1, a Bayesian meta-regression tool [1]. This tool enables the synthesis of heterogeneous data while adjusting for known biases and inconsistencies (e.g., differences in case definitions or reporting practices across countries and time periods). As part of the GBD estimation process, internal validation techniques are applied, including out-of-sample predictive validity checks and data quality scoring, to assess the robustness of model estimates.

Data source and data collection

The GBD, led by the Institute for Health Metrics and Evaluation (IHME), is a collaborative research initiative that estimates global trends in population, fertility, morbidity, and mortality [21]. GBD 2021 integrates a wide range of data sources, including surveys, censuses, vital statistics, and other health-related records, covering 204 countries and territories from 1990 to 2021. In GBD 2021, prevalence estimates for GDs were generated using the Bayesian meta-regression tool DisMod-MR 2.1. This modeling framework synthesizes data from population surveys, cohort studies, health system administrative records,

and registry microdata, ensuring internal consistency across different regions, age groups, and time periods [1]. To minimize the impact of data heterogeneity, standardization and calibration steps were applied during the estimation process.

This study utilized annual estimates of region-, country-, and age-specific prevalence numbers and rates for GDs among women aged 15–49 years from 1990 to 2021. These estimates were obtained from GBD 2021 through the Global Health Data Exchange (GHDx) query tool (<http://ghdx.healthdata.org/gbd-results-tool>).

Statistical analysis

This study calculated the age-standardized prevalence rate (ASPR) of GDs per 100,000 population employing the following formula:

$$\text{ASPR} = \frac{\sum_{i=1}^A a_i w_i}{\sum_{i=1}^A w_i} \times 100,000$$

In this formula, a_i represents the age-specific rate for the i^{th} age subgroup, while w_i denotes the corresponding population count for that age subgroup i , sourced from the GBD Study Population Estimates (1950–2021) [24]. A represents the total number of age groups. The global age-standardized population used for these calculations was obtained from the World Standards database, developed by the WHO (<https://seer.cancer.gov/stdpopulations/world.who.html>). ASPR is the prevalence rate of a condition standardized to a global age structure to allow for comparisons across populations with different age distributions [25].

To assess temporal trends in the prevalence of infertility, we calculated the estimated annual percentage change (EAPC) in the ASPR [26]. EAPC is a summary measure used to quantify the average annual change in age-standardized rates over a specified period, derived from a log-linear regression model [27]. This was done by fitting a regression model to the natural logarithm of the ASPR, expressed as $y = \alpha + \beta x + \varepsilon$, where $y = \ln(\text{ASPR})$ and x represents the calendar year. The EAPC was then computed using the formula $100 \times (\exp(\beta) - 1)$, with the corresponding 95% confidence interval (CI) derived from the linear regression model. An ASPR was considered to show an increasing or decreasing trend over time if the EAPC and its corresponding 95% CI were entirely above or below zero, respectively. If the 95% CI included zero, the change in ASPR was regarded as statistically insignificant.

Additionally, a Locally Weighted Scatterplot Smoothing (LOWESS) model was used to examine the correlation between the ASPR and the SDI across 21 regions [28]. LOWESS is a non-parametric regression technique that fits a smooth curve through the data points, allowing for visualization of potential nonlinear trends without assuming a specific model structure [29]. Spearman correlation analyses were conducted to calculate the correlation coefficient (r) and corresponding p -values, assessing the strength and significance of the relationship between ASPR and SDI.

All statistical analyses and mapping were performed using R software, version 4.2.3 (R Foundation for Statistical Computing), with significance set at $P < 0.05$.

Ethics approval and consent to participate

The GBD 2021 study was approved by the Institutional Review Board committee at the University of Washington. Informed consent was waived due to the use of deidentified data (<https://www.healthdata.org/research-analysis/gbd>).

Results

The prevalence of overall GDs

Globally, an estimated 1.21 billion prevalent cases of GDs among WCBA were reported in 2021, corresponding to an ASPR of 62,091.73 cases per 100,000 population (95% UI: 62,088.24 to 62,095.23) (Table 1). Among the 21 GBD regions, North Africa and the Middle East had the highest ASPR (70,779.89; 95% UI: 70,766.79 to 70,792.99), while South

Table 1. The global prevalence of gynecological diseases among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years.

Characteristics	1990		2021		1990–2021	
	Number of cases (Millions)	Age-standardized rate per 100,000 population (95% UI)	Number of cases (Millions)	Age-standardized rate per 100,000 population (95% UI)	Percentage change in absolute number (%)	Estimated annual percentage changes (95% CI)
Global	797.24	61465.62 (61461.29 to 61469.96)	1211.53	62091.73 (62088.24 to 62095.23)	51.96	0 (-0.03 to 0.02)
Socio-demographic index						
High	135.99	59434.76 (59424.75 to 59444.77)	150.68	60445.48 (60435.72 to 60455.25)	10.8	0.03 (0 to 0.07)
High-middle	170.37	62292.96 (62283.52 to 62302.41)	192.01	60967.85 (60959.05 to 60976.65)	12.7	-0.14 (-0.18 to -0.11)
Middle	260.87	60846.11 (60838.5 to 60853.71)	385.01	61651.2 (61645.03 to 61657.37)	47.59	0 (-0.03 to 0.02)
Low-middle	164.05	63258.39 (63248.44 to 63268.34)	319.35	64212.15 (64205.07 to 64219.24)	94.66	0.03 (0.02 to 0.05)
Low	65.24	62657.05 (62641.29 to 62672.81)	163.57	63468.3 (63458.27 to 63478.34)	150.7	0.04 (0.03 to 0.05)
Cause						
Uterine fibroids	48.08	4137.13 (4135.95 to 4138.31)	85.18	4352.34 (4351.41 to 4353.26)	77.16	0.15 (0.12 to 0.18)
Polycystic ovarian syndrome	34.81	2637.38 (2636.49 to 2638.27)	65.77	3372.56 (3371.75 to 3373.38)	88.95	0.73 (0.7 to 0.77)
Female infertility	59.69	4630.6 (4629.42 to 4631.78)	110.09	5636.81 (5635.76 to 5637.86)	84.44	0.69 (0.52 to 0.86)
Endometriosis	19.08	1466.85 (1466.18 to 1467.52)	21.05	1077.83 (1077.37 to 1078.29)	10.28	-1.03 (-1.08 to -0.98)
Genital prolapse	22.99	2076.14 (2075.29 to 2077)	32.02	1634.39 (1633.82 to 1634.96)	39.29	-0.96 (-1.04 to -0.88)
Premenstrual syndrome	593.8	45110.81 (45107.12 to 45114.49)	889.97	45637.68 (45634.68 to 45640.68)	49.88	0.01 (-0.01 to 0.03)
Other gynecological diseases	258.71	21150.47 (21147.87 to 21153.08)	400.68	20492.62 (20490.61 to 20494.62)	54.88	-0.22 (-0.28 to -0.15)
Age group (years)						
15–19	98.81	38668.32 (27868.77 to 53436.55)	117.91	38830.68 (28166.47 to 53561.76)	19.33	0 (-0.03 to 0.02)
20–24	124.9	51161.1 (39527.5 to 62534.61)	160.17	54525.06 (42391.28 to 66676.86)	28.24	0.16 (0.13 to 0.19)
25–29	130.82	59437.28 (49130.68 to 69608.01)	179.03	61523.52 (50768.29 to 71685.06)	36.85	0.07 (0.05 to 0.09)
30–34	127.78	67215.51 (56104.53 to 78224.69)	202.22	67648.29 (56222.15 to 79338.92)	58.25	0 (-0.02 to 0.02)
35–39	131.28	75687.25 (65970.5 to 84752.56)	211.38	76088.31 (66533.03 to 85395.85)	61.01	-0.01 (-0.03 to 0.02)
40–44	108.51	77383.5 (67474.07 to 85863.19)	191.53	77199.86 (67362.31 to 85711.91)	76.5	-0.05 (-0.08 to -0.02)
45–49	75.13	66020.61 (57607.51 to 75437.31)	149.3	63359.63 (54931.02 to 73353.73)	98.72	-0.2 (-0.23 to -0.16)
GBD regions						
High-income Asia Pacific	26.03	56723.22 (56701.35 to 56745.1)	21.69	55851.42 (55827.13 to 55875.73)	-16.66	-0.11 (-0.19 to -0.04)
Central Asia	9.62	60105.26 (60065.59 to 60144.95)	14.79	60358.38 (60327.53 to 60389.25)	53.71	0.01 (0 to 0.02)
East Asia	189.17	58540.29 (58531.74 to 58548.84)	192.68	56712.17 (56703.94 to 56720.4)	1.85	-0.23 (-0.29 to -0.17)
South Asia	158.06	64627.48 (64617.17 to 64637.78)	321.52	65798.91 (65791.68 to 65806.13)	103.42	0.05 (0.04 to 0.07)
Southeast Asia	67.15	57618.39 (57604.19 to 57632.6)	107.35	58424.14 (58413.08 to 58435.19)	59.86	0.04 (0.04 to 0.05)
Australasia	3.27	60673.58 (60607.69 to 60739.51)	4.39	59739.13 (59682.83 to 59795.47)	34.38	-0.05 (-0.05 to -0.04)
Caribbean	5.45	60852.48 (60800.33 to 60904.67)	7.33	61038.18 (60993.99 to 61082.39)	34.55	0 (0 to 0.01)

(Continued)

Table 1. (Continued)

Characteristics	1990		2021		1990–2021	
	Number of cases (Millions)	Age-standardized rate per 100,000 population (95% UI)	Number of cases (Millions)	Age-standardized rate per 100,000 population (95% UI)	Percentage change in absolute number (%)	Estimated annual percentage changes (95% CI)
Central Europe	17.85	57614.53 (57587.73 to 57641.35)	15.2	57206.52 (57176.9 to 57236.16)	-14.84	-0.02 (-0.05 to 0)
Eastern Europe	38.24	68143.62 (68121.87 to 68165.36)	34.53	68189.3 (68165.66 to 68212.95)	-9.7	-0.01 (-0.02 to -0.01)
Western Europe	65.79	68339.59 (68323.05 to 68356.14)	63.65	66643.17 (66626.55 to 66659.79)	-3.26	-0.09 (-0.09 to -0.08)
Andean Latin America	5.71	63343.7 (63489.89 to 63597.55)	11.27	64813.03 (64775.12 to 64850.96)	97.3	0.06 (0.05 to 0.06)
Central Latin America	24.4	61279.73 (61254.47 to 61305)	42.16	61918.1 (61899.4 to 61936.8)	72.8	0.03 (0.02 to 0.04)
Southern Latin America	7.3	59972.29 (59928.64 to 60015.98)	10.52	59786.57 (59750.41 to 59822.75)	44.17	-0.03 (-0.04 to -0.02)
Tropical Latin America	23.67	60891.43 (60866.4 to 60916.47)	36.9	59981.3 (59961.88 to 60000.73)	55.87	-0.09 (-0.11 to -0.08)
North Africa and Middle East	50.53	70395.98 (70375.89 to 70416.06)	112.46	70779.89 (70766.79 to 70792.99)	122.58	0 (-0.01 to 0.01)
High-income North America	39.82	52827.14 (52810.65 to 52843.63)	48.12	56500.05 (56484.04 to 56516.06)	20.85	0.2 (0.13 to 0.27)
Oceania	0.8	54130.31 (54007.82 to 54253.05)	1.85	54277.23 (54198.37 to 54356.19)	130.43	0.01 (0 to 0.02)
Central Sub-Saharan Africa	7.2	63225.61 (63177.47 to 63273.77)	19.55	64196.44 (64167.11 to 64225.77)	171.63	0.04 (0.01 to 0.06)
Eastern Sub-Saharan Africa	24.65	62167.93 (62142.07 to 62193.81)	63.32	63253.37 (63237.18 to 63269.57)	156.9	0.06 (0.05 to 0.07)
Southern Sub-Saharan Africa	8.21	66313.92 (66266.79 to 66361.08)	14.18	65917.23 (65882.77 to 65951.71)	72.72	-0.01 (-0.02 to 0.01)
Western Sub-Saharan Africa	24.34	61480.14 (61454.45 to 61505.83)	68.07	61694.34 (61679.16 to 61709.54)	179.63	0 (-0.02 to 0.02)

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Asia recorded the highest number of prevalent cases, reaching 321.52 million ([Fig 1A](#) and [1C](#)). At the national level, Iran had the highest ASPR (72,483.08; 95% UI: 72,448.66 to 72,517.51), followed by Turkey (71,747.88; 95% UI: 71,712.42 to 71,783.35) ([Fig 2A](#)).

Between 1990 and 2021, the global number of prevalent cases increased by 51.96%, while the ASPR remained stable ($EAPC=0$; 95% CI: -0.03 to 0.02) ([Table 1](#)). At the regional level, the most significant ASPR increase was observed in High-income North America, with an average annual rise of 0.2% (95% CI: 0.13 to 0.27) ([Fig 1B](#)). Among the 204 countries and territories analyzed, 106 exhibited an increasing ASPR trend ([Fig 3A](#), S4 Table in [S1 File](#)), with Taiwan experiencing the most pronounced rise ($EAPC=0.3$; 95% CI: 0.23 to 0.37), followed by the Philippines ($EAPC=0.28$ [95%CI: 0.22 to 0.34]).

The prevalence of specific GDs

In 2021, the global number of prevalent cases among WCBA was estimated at 85.18 million for uterine fibroids, 65.77 million for PCOS, 110.09 million for female infertility, 21.05 million for endometriosis, 32.02 million for genital prolapse, 889.97 million for PMS, and 400.68 million for other GDs ([Table 1](#)). Correspondingly, their ASPR per 100,000 population were as follows: uterine fibroids, 4,352.34 (95% UI: 4,351.41 to 4,353.26); PCOS, 3,372.56 (95% UI: 3,371.75 to 3,373.38); female infertility, 5,636.81 (95% UI: 5,635.76 to 5,637.86); endometriosis, 1,077.83 (95% UI: 1,077.37 to 1,078.29); genital prolapse, 1,634.39 (95% UI: 1,633.82 to 1,634.96); PMS, 45,637.68 (95% UI: 45,634.68 to 45,640.68); and other GDs, 20,492.62 (95% UI: 20,490.61–20,494.62). Additionally, PMS accounted for the highest proportion of all prevalent cases of GDs across the 21 GBD regions, except for North Africa and the Middle East ([Fig 1D](#)). From 1990 to 2021, the global ASPR for uterine fibroids, PCOS, and female infertility showed an increasing trend. In contrast, the global ASPR for endometriosis, genital prolapse, and other GDs declined, while the global ASPR for PMS remained stable ([Table 1](#)).

In 2021, regionally, the highest ASPR per 100,000 population for each GDs was reported as follows: uterine fibroids in Eastern Europe (10268.73 [95% UI: 10260.39 to 10277.07]) ([S5 Table in S1 File](#)), PCOS in High-income Asia Pacific (10140.46 [95% UI: 10130.07 to 10150.87]) ([S6 Table in S1 File](#)), female infertility in East Asia (8420.38 [95% UI: 8417.34 to 8423.42]) ([S7 Table in S1 File](#)), endometriosis in Oceania (1921.6 [95% UI: 1906.74 to 1936.56]) ([S8 Table in S1 File](#)), genital prolapse in Tropical Latin America (3614.03 [95% UI: 3609.37 to 3618.71]) ([S9 Table in S1 File](#)), PMS in South Asia (50420.87 [95% UI: 50414.57 to 50427.18]) ([S10 Table in S1 File](#)), and other GDs in North Africa and the Middle East (48113.93 [95% UI: 48103.11 to 48124.76]) ([S11 Table in S1 File](#)). From 1990 to 2021, among the 21 regions, the highest ASPR were observed in Tropical Latin America for uterine fibroids ($EAPC=1.21$ [95% CI: 1.12 to 1.31]), Southeast Asia for PCOS ($EAPC=2.3$ [95% CI: 2.19 to 2.4]), Andean Latin America for female infertility ($EAPC=8.21$ [95% CI: 6.69 to 9.76]), Eastern Europe for endometriosis ($EAPC=0.33$ [95% CI: 0.15 to 0.5]), Eastern Europe for genital prolapse ($EAPC=0.68$ [95% CI: 0.28 to 1.09]), High-income North America for PMS ($EAPC=0.53$ [95% CI: 0.45 to 0.62]), and Eastern Sub-Saharan Africa for other gynecological diseases ($EAPC=0.03$ [95% CI: 0.01 to 0.04]).

Among the 204 countries and territories, the highest ASPR per 100,000 population for each GDs in 2021 were as follows: Latvia for uterine fibroids (11729.95 [95% UI: 11630.98 to 11829.72]) ([Fig 2B](#), S12 Table in [S1 File](#)), Italy for PCOS (15308.01 [95% UI: 15285.15 to 15330.9]) ([Fig 2C](#), S13 Table in [S1 File](#)), Central African Republic for female infertility (11739.3 [95% UI: 11678.7 to 11800.17]) ([Fig 2D](#), S14 Table in [S1 File](#)), Niger for endometriosis (2520.75 [95% UI: 2505.72 to 2535.86]) ([Fig 2E](#), S15 Table in [S1 File](#)), Paraguay for genital prolapse (4480.37 [95% UI: 4448.92 to 4512]) ([Fig 2F](#), S16 Table in [S1 File](#)), Pakistan for PMS (51547.67 [95% UI: 51529.23 to 51566.12]) ([Fig 2G](#), S17 Table in [S1 File](#)), and Yemen for other gynecological diseases (49967.45 [95% UI: 49915.67 to 50019.28]) ([Fig 2H](#), S18 Table in [S1 File](#)). Between 1990 and 2021, the fastest increases in ASPR were observed in Brazil for uterine fibroids ($EAPC=1.23$ [95% CI: 1.14 to 1.33]) ([Fig 3B](#)), Maldives for PCOS ($EAPC=3.39$ [95% CI: 3.11 to 3.66]) ([Fig 3C](#)), Ecuador for female infertility ($EAPC=9.35$ [95% CI: 7.3 to 11.44]) ([Fig 3D](#)), Iceland for endometriosis ($EAPC=1.19$ [95% CI: 0.92 to 1.46])

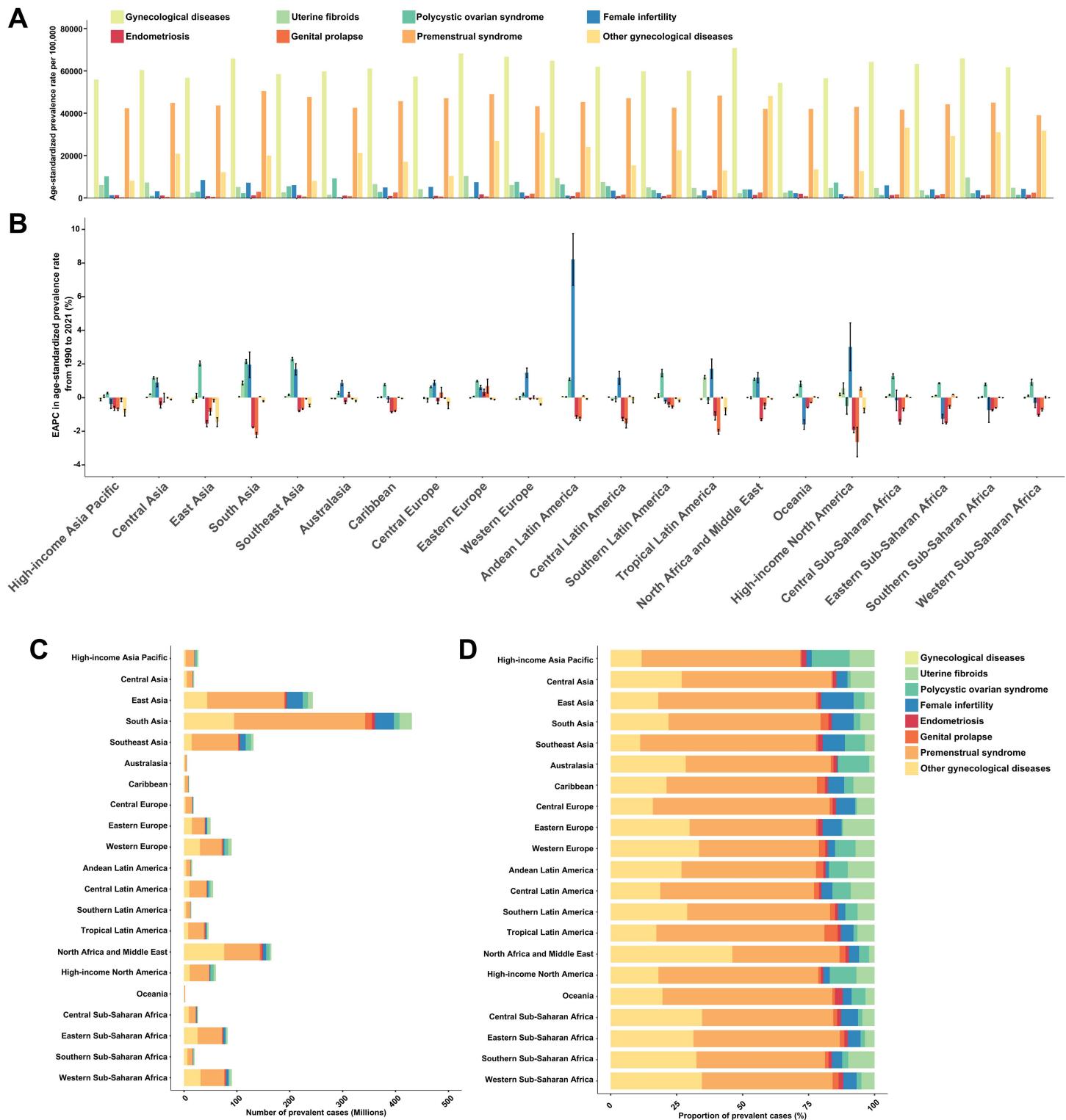


Fig 1. Prevalence of gynecological diseases (GDs) among women of childbearing age in 2021, along with their changes from 1990 to 2021, and the contribution of each GD to the overall prevalence, by 21 GBD regions. (A) Age-standardized prevalence rate of GDs in 2021. (B) Estimated annual percentage changes in the age-standardized prevalence rate of GDs from 1990 to 2021. (C) Number of prevalent cases of GDs in 2021. (D) Proportions of prevalent cases attributed to each GD in 2021. GBD=Global Burden of Diseases, Injuries, and Risk Factors Study.

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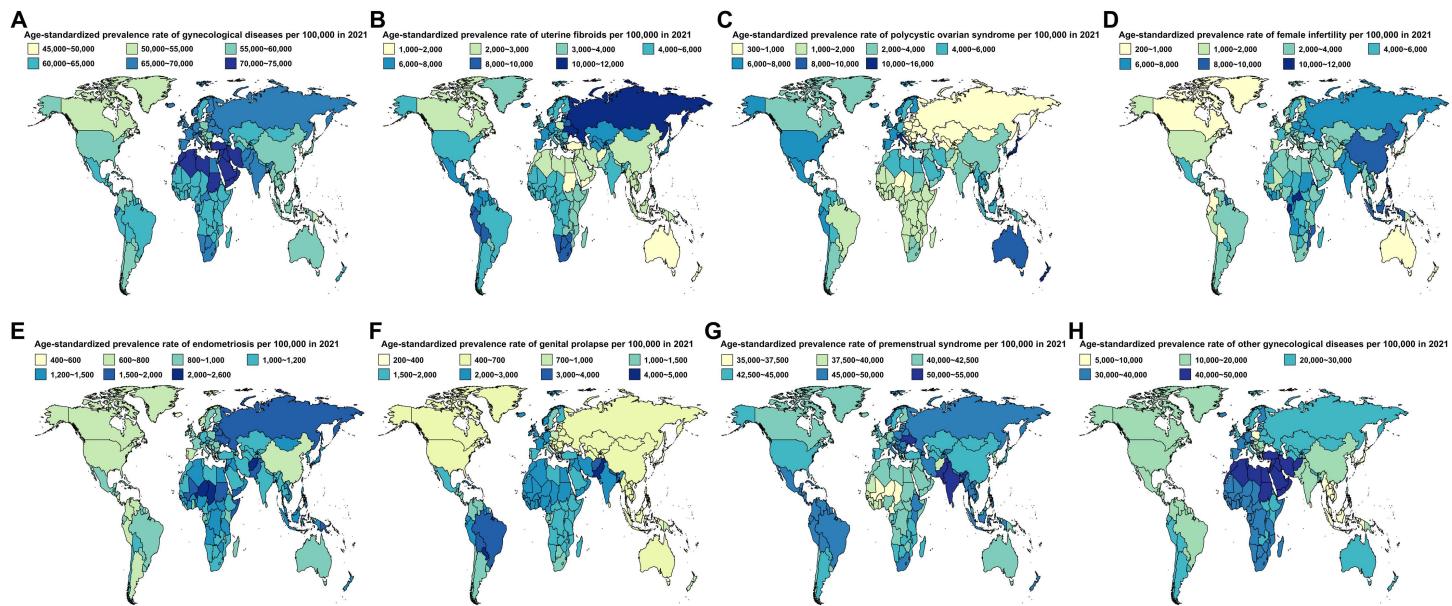


Fig 2. Age-standardized prevalence rates of gynecological diseases across 204 countries and territories in 2021. (A) Overall gynecological diseases. (B) Uterine fibroids. (C) Polycystic ovarian syndrome. (D) Female infertility. (E) Endometriosis. (F) Genital prolapses. (G) Premenstrual syndrome. (H) Other gynecological diseases.

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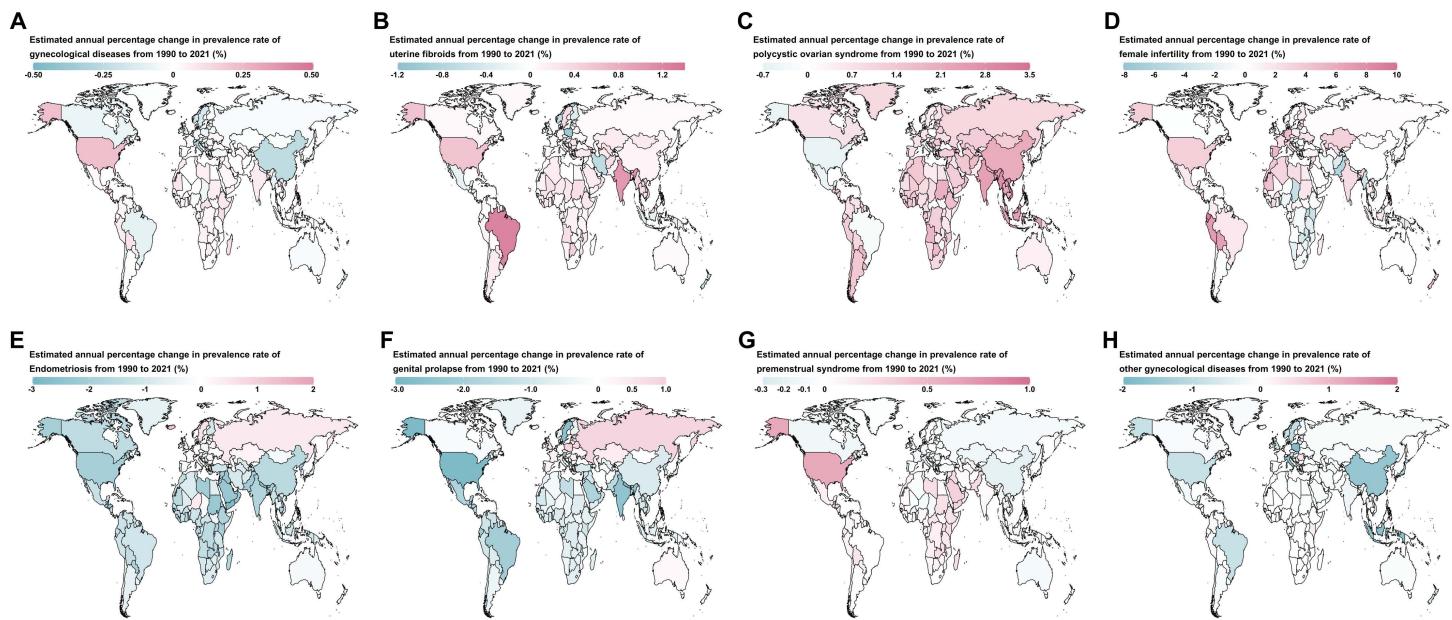


Fig 3. Estimated annual percentage change in age-standardized prevalence rates of gynecological diseases across 204 countries and territories in 2021. (A) Overall gynecological diseases. (B) Uterine fibroids. (C) Polycystic ovarian syndrome. (D) Female infertility. (E) Endometriosis. (F) Genital prolapses. (G) Premenstrual syndrome. (H) Other gynecological diseases.

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(Fig 3E), Russia for genital prolapse (EAPC = 0.88 [95% CI: 0.45 to 1.31]) (Fig 3F), United States for PMS (EAPC = 0.61 [95% CI: 0.52 to 0.71]) (Fig 3G), and Taiwan for other gynecological diseases (EAPC = 1.18 [95% CI: 0.87 to 1.5]) (Fig 3H).

The correlation between ASPR of GDs and SDI

At the regional level, the ASPR of overall GDs remained stable with increasing SDI initially, but began to decline when the SDI reached 0.55 (Fig 4A). Between 1990 and 2021, regions such as North Africa and the Middle East, Eastern Europe, and Western Europe showed higher-than-expected ASPRs for GDs based on their SDI.

For specific GDs, the ASPR of uterine fibroids and PMS both initially increased with rising SDI but began to decline once the SDI reached 0.60 (Fig 4B and 4G). In contrast, the ASPR for PCOS increased exponentially with higher SDI (Fig 4C). However, the ASPRs for female infertility, endometriosis, genital prolapse, and other GDs all showed a decreasing trend as SDI increased (Fig 4D, 4E, 4F, and 4H).

Age-patterns in the prevalence of GDs

Among WCBA, the prevalence rate of overall GDs generally increased with age, peaking in the 40–44 years age group (Fig 5A). Interestingly, for women aged 15–19 and 20–24 years, regions with a middle SDI had the highest prevalence rate of overall GDs. In contrast, for women aged 25–29 and 30–34 years, the highest prevalence rate was observed in

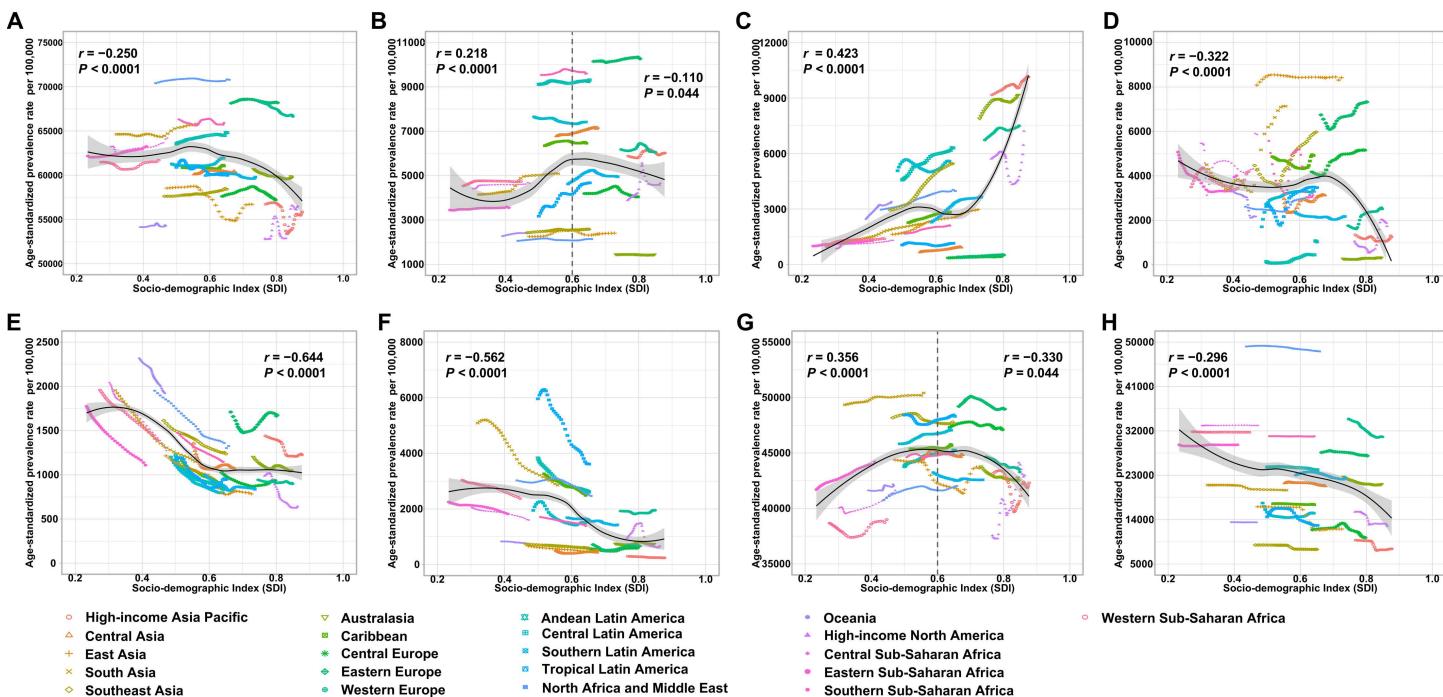


Fig 4. Age-standardized prevalence rates of gynecological diseases across 21 GBD regions, by SDI, from 1990 to 2021. (A) Overall gynecological diseases. (B) Uterine fibroids. (C) Polycystic ovarian syndrome. (D) Female infertility. (E) Endometriosis. (F) Genital prolapses. (G) Premenstrual syndrome. (H) Other gynecological diseases. The solid line represents the expected values based on SDI and prevalence rates across all locations. Each region is represented by 32 points, showing the observed age-standardized prevalence rate for each year from 1990 to 2021. The shaded area indicates the 95% confidence interval (CI) of the expected values. Points above the solid line indicate a higher-than-expected prevalence, while those below the line represent a lower-than-expected prevalence. GBD = Global Burden of Diseases, Injuries, and Risk Factors Study. SDI = Socio-demographic Index.

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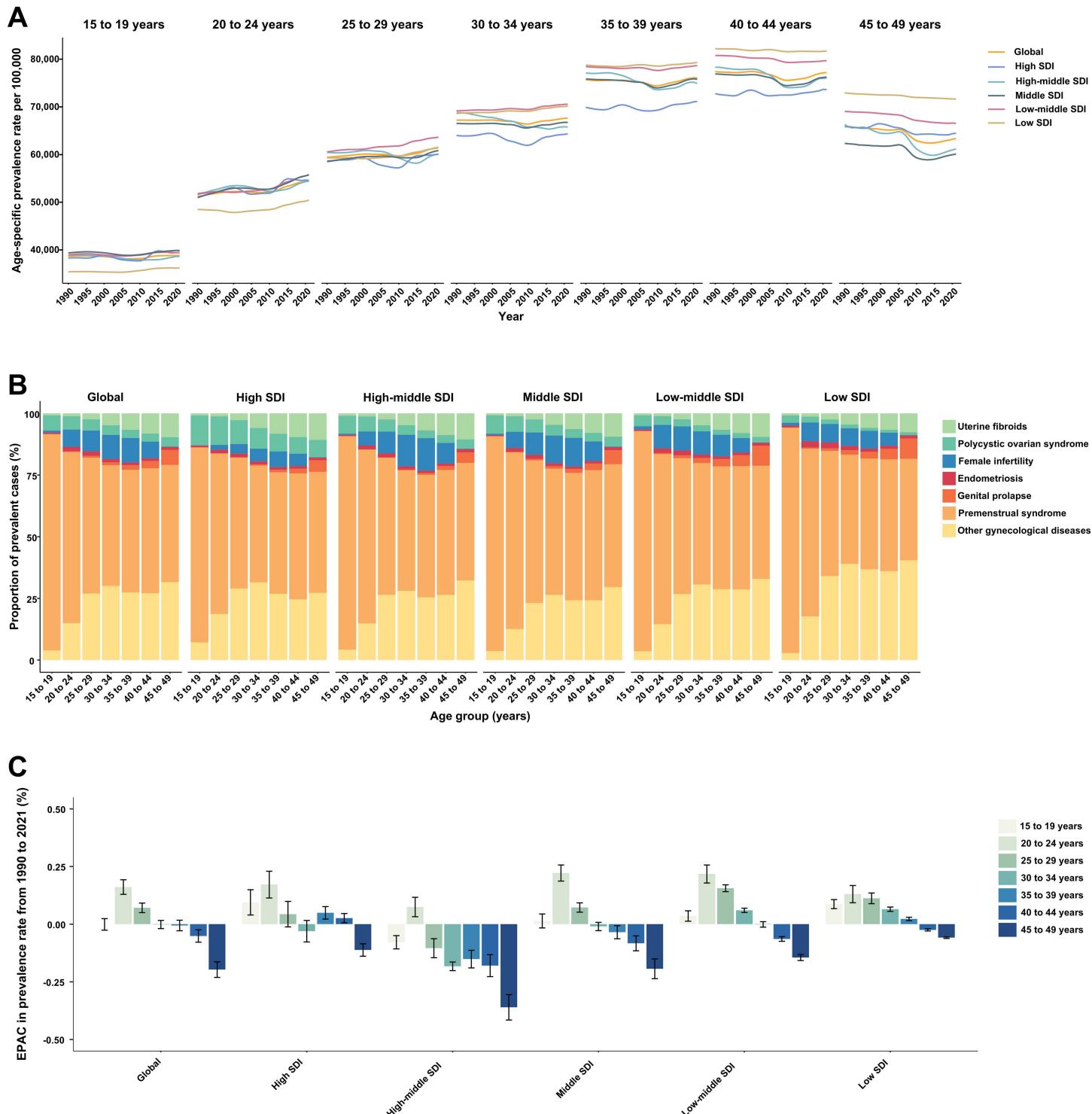


Fig 5. Prevalence and trends of gynecological diseases (GDs) among women of childbearing age, by age group and SDI. (A) Prevalence rates of GDs globally and across the 5 SDI regions from 1990 to 2021, stratified by age group. **(B)** Proportions of prevalent cases attributed to each GD within each age group across the globe and the 5 SDI regions in 2021. **(C)** Estimated annual percentage changes in the prevalence rate of GDs from 1990 to 2021, categorized by age group and SDI. SDI = Socio-demographic index.

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low-middle-SDI regions. For women aged 35–39, 40–44, and 45–49 years, the highest prevalence rates were found in low-SDI regions. Globally, as well as across the five SDI quintiles, the contribution of PMS and PCOS to overall GDs decreased with age, whereas the contribution of uterine fibroids increased with age (Fig 5B).

From 1990 to 2021, the most significant increase in prevalence rates for overall GDs occurred in the 20–24 years age group, while the largest decrease was observed in the 45–49 years age group (Fig 5C). These trends indicate that the burden of GDs is increasingly affecting younger WCBA. Specifically, the fastest increase in prevalence rates was seen for uterine fibroids in women aged 40–44 years, PCOS in women aged 15–19 years, female infertility in women aged 25–29 years, PMS in women aged 20–24 years, and other GDs in women aged 15–19 years (Fig 6). In contrast, the prevalence rates of endometriosis and genital prolapse either decreased or remained stable across all age groups among women of childbearing age (Fig 6D and 6E).

Discussion

This study offers a comprehensive analysis of the global prevalence and temporal trends of GDs among WCBA, using data from the GBD 2021. The key findings are as follows: First, ASPR of GDs remained stable, but the total number of GD cases increased by 51.96% from 1990 to 2021, reflecting population growth and aging. Second, (PMS was the most prevalent GD globally, followed by uterine fibroids, PCOS, and female infertility. Third, the ASPR of uterine fibroids, PCOS, and female infertility increased over time, particularly in low- and low-middle SDI regions, while rates for endometriosis, genital prolapse, and PMS remained stable or declined. Fourth, the association between GD prevalence and SDI showed a threshold effect: prevalence remained stable up to a certain SDI level, then declined with higher SDI. Fifth, uterine fibroids and PMS increased initially but plateaued in middle-SDI regions, whereas female infertility, endometriosis, and genital prolapse showed a consistent decline with rising SDI. Finally, GD prevalence peaked in the 40–44 age group, but a concerning shift toward younger women (ages 20–29) was observed, particularly for uterine fibroids, PCOS, female infertility, and PMS. These findings underscore the growing and uneven burden of GDs worldwide and highlight the urgent need for targeted public health strategies to address age- and region-specific disparities in women's reproductive health.

Temporal trend of overall GDs

Notably, although the global ASPR of GDs remained relatively stable from 1990 to 2021, the absolute number of prevalent cases increased substantially. This divergence is largely attributable to global population growth and shifts in age structure, particularly the expansion of the population of WCBA in low- and middle-income countries [30]. ASPR adjusts for changes in population age composition and allows for valid comparisons over time and across regions, serving as an indicator of true changes in disease risk [25]. In contrast, absolute case numbers are directly influenced by demographic trends, including increases in total population size and aging. As reported by the GBD 2021 study, such demographic shifts continue to drive the rising burden of non-fatal conditions worldwide, even when age-standardized rates appear stable or decline [31]. Therefore, our findings underscore the importance of considering both absolute and relative measures when interpreting disease burden and formulating policy responses for women's reproductive health.

Temporal trend of specific GDs

Premenstrual syndrome. Our results show that PMS affected 45.6% of WCBA worldwide in 2021, aligning with previous reports indicating that PMS impacts nearly half of reproductive women globally [32]. The prevalence rate among WCBA was significantly higher compared to the general female population (27.9%) [10]. Additionally, PMS accounted for the largest proportion of GDs in most regions, with the number of prevalent cases nearly doubling from 1990 to 2021, despite the ASPR remained stable over this period. The stable ASPR for PMS suggests that, although the absolute number of cases has likely increased due to population growth, the prevalence rate of PMS relative to age has not changed significantly. Notably, the pathophysiology of PMS is primarily linked to cyclical hormonal fluctuations

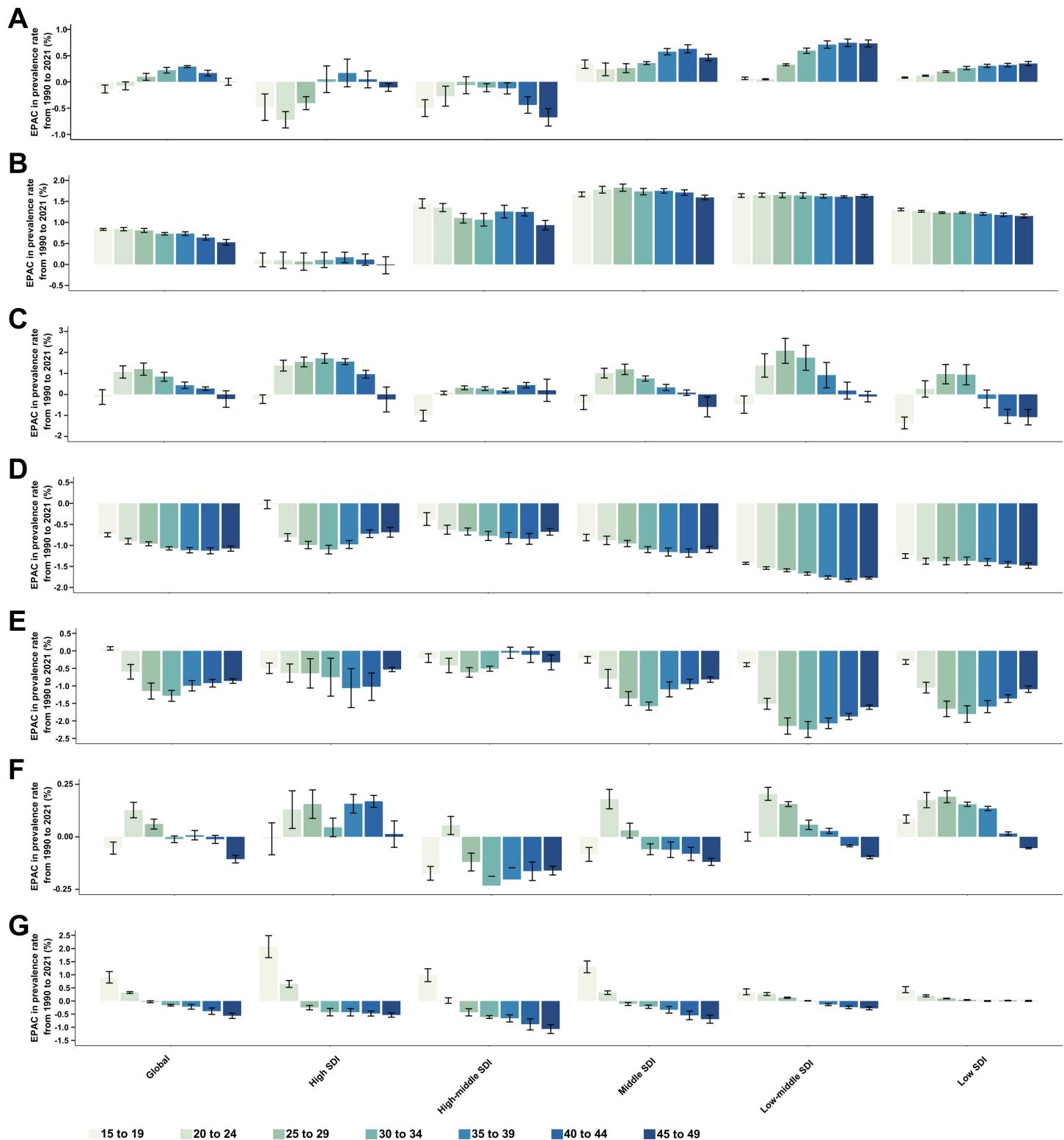


Fig 6. Estimated annual percentage changes in the prevalence rate of specific gynecological diseases from 1990 to 2021, categorized by age group and SDI. (A) Uterine fibroids. (B) Polycystic ovarian syndrome. (C) Female infertility. (D) Endometriosis. (E) Genital prolapses. (F) Premenstrual syndrome. (G) Other gynecological diseases. SDI = Socio-demographic index.

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rather than modifiable risk factors such as smoking or obesity [33]. Although lifestyle and environmental factors like diet, physical activity, and stress levels have evolved over the past decades, these changes may have influenced the severity of PMS symptoms rather than its overall prevalence [34–36]. Addressing these modifiable risk factors through weight management, smoking cessation, and lifestyle changes could potentially help alleviate PMS symptoms and improve women's overall reproductive health.

Polycystic ovarian syndrome. PCOS is the most common endocrine disorder among WCBA, affecting approximately 10–18% of this population [37]. Among major GDs, PCOS showed the fastest increase in ASPR, particularly in middle- and low-middle-SDI regions, including East, South, and Southeast Asia. Several studies from these areas confirm this rising trend. For example, two national surveys in China showed that the prevalence of PCOS among women aged 20–44 increased by two-thirds between 2010 and 2020 [38]. A similar increase has been observed in India [39]. This rise may be partially attributed to lifestyle changes associated with urbanization, such as diets high in processed foods, reduced physical activity, and increased stress [40]. These factors are associated with higher rates of metabolic disorders, particularly insulin resistance—a key feature of PCOS [41]. Demographic changes, including delayed childbearing and increased reproductive health challenges among career-oriented women, may also contribute to the upward trend in PCOS prevalence [42,43]. Since PCOS is closely associated with infertility [44], these trends may be compounding its impact. Our findings, along with prior studies, also highlight a rising prevalence of female infertility, especially in high-SDI regions, where the increase has been most rapid [4,45]. Notably, ASPR for PCOS tends to rise with increasing SDI levels. While high-SDI regions may show higher rates due to better detection and healthcare access, underdiagnosis may still be common in low-SDI regions due to limited healthcare availability [46].

Uterine fibroids. From 1990 to 2021, we also observed an overall global increase in the ASPR of uterine fibroids. However, this trend varied by development level: rates decreased in high- and high-middle-SDI regions, while increasing in middle-, low-middle-, and low-SDI regions. In high-SDI regions, widespread use of advanced diagnostic tools (e.g., ultrasound, MRI) and access to minimally invasive treatments (e.g., laparoscopic myomectomy, uterine artery embolization) may contribute to reducing long-term prevalence [47–50]. Additionally, hormonal therapies and intrauterine devices (IUDs) are commonly used to manage or suppress fibroid growth [51]. In contrast, limited access to these diagnostic and therapeutic options in lower-SDI regions may lead to persistent or recurrent fibroids, increasing disease burden [52,53]. Urbanization in developing regions has also brought lifestyle shifts—such as sedentary behavior, processed diets, and rising obesity—that are recognized risk factors for fibroids [54]. While historically higher fertility rates in low-SDI areas offered some protection, declining birth rates may reduce this effect [55,56]. Moreover, growing exposure to environmental toxins (e.g., phthalates, pesticides) in industrializing areas may interfere with hormonal regulation and promote fibroid development [57].

Endometriosis. From 1990 to 2021, the ASPR of endometriosis declined globally and in most GBD regions, except in Eastern Europe. This overall decrease likely reflects improvements in healthcare access, diagnostic accuracy, and preventive care [58]. In contrast, the upward trend in Eastern Europe may be attributed to several region-specific challenges. Following post-Soviet industrialization, weak environmental regulations led to high exposure to endocrine-disrupting chemicals—such as polycyclic aromatic hydrocarbons—which have been linked to the development of endometriosis [59]. The economic upheavals of the 1990s also disrupted funding for women's health services, reducing access to diagnostic tools and treatments [60]. Additionally, the migration of skilled gynecologists and radiologists to Western Europe further strained local healthcare systems, resulting in poorer quality care [61]. Lifestyle factors such as high rates of smoking, alcohol use, and industrial pollution further contribute to hormonal imbalances and inflammation, both of which are associated with endometriosis [62,63]. Cultural attitudes in some Eastern European countries may also play a role, as societal norms that downplay menstrual or pelvic pain can lead to delayed diagnosis and untreated cases [64]. Notably, endometriosis is a complex, chronic condition associated not only with reproductive health concerns such as infertility and dysmenorrhea, but also with a wide range of non-reproductive symptoms, including chronic pelvic pain,

gastrointestinal disturbances, fatigue, and dyspareunia [65]. These symptoms significantly impair physical, emotional, sexual, and social well-being, and contribute to a substantial disease burden that extends beyond fertility-related issues.

Genital prolapse. The epidemiological trends of genital prolapse closely resemble those of endometriosis. Advances in minimally invasive surgical techniques, such as laparoscopic or robotic-assisted pelvic surgery, have led to significant improvements in both surgical outcomes and recovery times for women with genital prolapse [66]. Improved imaging tools such as pelvic ultrasound and MRI have enhanced early detection and more accurate assessment of prolapse severity, allowing for timely and effective interventions [67]. The development of urogynecology as a specialized field has also expanded access to expert care in regions with stronger healthcare infrastructure [68]. Efforts to improve maternal health—especially in preventing childbirth-related injuries that contribute to pelvic floor dysfunction—have helped reduce prolapse rates [69]. Measures such as minimizing prolonged labor, limiting unnecessary episiotomies, and managing traumatic deliveries have played a key role. Additionally, promoting postnatal pelvic floor exercises, such as Kegel exercises, may further lower the risk and severity of prolapse [70]. As rates of vaginal delivery decline in countries with effective family planning, the incidence of pelvic organ prolapse is likely to continue decreasing [71].

Implications for younger women

This study emphasizes that the high and persistent burden of gynecological diseases among WCBA calls for urgent policy attention [72]. Health systems, particularly in low- and middle-income countries, should prioritize the integration of gynecological diseases prevention, early detection, and treatment services into primary and reproductive health care programs [73,74]. Targeted screening, affordable access to diagnostics and medications, and public awareness campaigns could help reduce diagnostic delays and treatment gaps. Furthermore, policy-makers should allocate sufficient resources to women's health, establish standardized care pathways for common gynecological diseases such as PCOS, endometriosis, and uterine fibroids, and promote research and data monitoring to inform evidence-based interventions [75].

The prevalence of GDs among WCBA increases with age; however, the most significant rise from 1990 to 2021 was observed in younger age groups. Specifically, uterine fibroids, PCOS, female infertility, and PMS were most prevalent in women aged 20–29 years. Considering the observed increasing burden of GDs among younger women, particularly in low- and middle-SDI regions, targeted public health strategies are urgently needed. In these regions, improving access to primary gynecological care—through investments in community-level services, early screening programs, and health insurance coverage—can facilitate timely diagnosis and management [76]. School- and university-based reproductive health education should be implemented to improve awareness, reduce stigma, and encourage early health-seeking behaviors among adolescent and young adult women [77]. In high-SDI settings, age-appropriate interventions should prioritize modifiable risk factors such as obesity, sedentary behavior, and delayed childbearing [78]. Preventive measures, including lifestyle counseling and routine screening for hormonal and reproductive disorders, should be integrated into women's health services starting in early adulthood.

Limitations

The current study has several limitations. First, many gynecological diseases, such as endometriosis, PCOS, and uterine fibroids, often present with mild or nonspecific symptoms in their early stages and may go undiagnosed for long periods [79,80]. As a result, the true burden of these conditions is likely underestimated, especially in settings with limited access to gynecological care or routine screening. Second, there are substantial regional disparities in data availability and quality. In particular, low-SDI countries frequently lack comprehensive surveillance systems and high-quality administrative health records, resulting in large data gaps [81]. Although the GBD 2021 study uses robust Bayesian modeling methods (e.g., DisMod-MR 2.1) to generate estimates in data-sparse regions, the accuracy of these modeled outputs depends on the availability and representativeness of the primary data [1]. Inconsistencies in diagnostic criteria, coding practices, and reporting standards across countries may further affect the comparability of results [82]. Therefore, while our study

provides a comprehensive overview of GD burden globally, the estimates—particularly in low-resource settings—should be interpreted with caution.

Conclusion

In conclusion, GDs continue to impose a substantial and increasing health burden on WCBA worldwide, with significant disparities observed across regions and socio-demographic levels. Policymakers and healthcare systems must prioritize the development of accessible, equitable, and culturally sensitive services, especially in low- and middle-income regions where access remains limited. Enhancing public awareness, expanding routine screening programs, and investing in women's health research are critical steps toward mitigating this burden. Strengthening primary care and referral systems for timely intervention can play a pivotal role in improving outcomes and quality of life.

Supporting information

S1 File. S1 Table. 21 GBD world regions and 204 countries and territories within each region. S2 Table. Socio-demographic Index (SDI) quintiles for 204 countries and territories estimated in GBD 2021. S3 Table. Case definitions and mapping of International Classification of Diseases (ICD) codes to gynecological diseases in GBD 2021. S4 Table. The global prevalence of gynecological diseases among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years, by country and territories. S5 Table. The global prevalence of uterine fibroids among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years. S6 Table. The global prevalence of polycystic ovarian syndrome among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years. S7 Table. The global prevalence of female infertility among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years. S8 Table. The global prevalence of endometriosis among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years. S9 Table. The global prevalence of genital prolapses among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years. S10 Table. The global prevalence of premenstrual syndrome among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years. S11 Table. The global prevalence of other gynecological diseases among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years. S12 Table. The global prevalence of uterine fibroids among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years, by country and territories. S13 Table. The global prevalence of polycystic ovarian syndrome among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years, by country and territories. S14 Table. The global prevalence of female infertility among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years, by country and territories. S15 Table. The global prevalence of endometriosis among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years, by country and territories. S16 Table. The global prevalence of genital prolapses among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years, by country and territories. S17 Table. The global prevalence of premenstrual syndrome among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years, by country and territories. S18 Table. The global prevalence of other gynecological diseases among women aged 15–49 years in 1990 and 2021, along with the trends and changes observed between these years, by country and territories.

(PDF)

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