Knowledge and awareness of endometriosis among women in Southwest China: a cross-sectional study

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Abstract

Background Endometriosis is a prevalent yet under-recognized gynecological condition that significantly impacts women's quality of life. Despite its burden, data on the knowledge and awareness of endometriosis among women in Southwest China remain limited.

Objective This study aimed to assess the level of knowledge and awareness of endometriosis among women in Southwest China and identify factors associated with good knowledge.

Methods A cross-sectional study was conducted from February to April 2024, involving 724 women aged 18 years and older. Data were collected using a structured questionnaire encompassing sociodemographic characteristics, reproductive and medical history, healthcare utilization, and knowledge of endometriosis. Participants were categorized as having "good" knowledge if they scored ≥ 60% on the knowledge assessment. Descriptive statistics, univariate analyses, and multivariable logistic regression were employed to identify factors associated with good knowledge. A supplementary table was included to present the adjusted odds ratios (AORs) from logistic regression.

Results The mean age of participants was 32.8 years (SD = 9.4). Overall, 69.0% of participants were aware of endometriosis, but knowledge of specific symptoms, such as painful bowel movements (34.5%) and heavy menstrual bleeding (40.1%), was limited. Factors significantly associated with good knowledge included younger age (26–45 years, AOR: 1.75, 95% CI: 1.23–2.50, $p < 0.001$), higher education (master's degree or above, AOR: 3.10, 95% CI: 1.80–5.30, $p < 0.001$), being actively employed (AOR: 2.10, 95% CI: 1.40–3.10, $p < 0.001$), and recent pelvic or vaginal ultrasound (< 3 months, AOR: 2.30, 95% CI: 1.50–3.60, $p < 0.001$). Conversely, a history of abortion was negatively associated with good knowledge (AOR: 0.40, 95% CI: 0.25–0.60, $p < 0.001$).

Conclusions Despite moderate overall awareness of endometriosis, significant gaps in knowledge of symptoms and treatments persist among women in Southwest China. Targeted educational interventions focusing on less-educated, older, and less medically-engaged populations are necessary to improve awareness and reduce delays in diagnosis and treatment.

Keywords Endometriosis, Knowledge, Awareness, Southwest China, Women's health, Cross-Sectional study

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Introduction

Endometriosis is a chronic gynecological condition characterized by the presence of endometrial-like tissue outside the uterine cavity, causing inflammation, adhesions, and scarring. Affecting approximately 10% of reproductive-aged women worldwide, endometriosis is associated with debilitating pelvic pain, infertility, and significant impairments in quality of life [1]. Despite its high prevalence and substantial burden on healthcare systems, delays in diagnosis remain a critical issue, with an average delay of 7–10 years from symptom onset to definitive diagnosis [2]. These delays are partly attributed to limited awareness and understanding of the disease among women and healthcare providers [3].

Knowledge and awareness of endometriosis are essential for early detection and timely intervention. Previous studies have shown that women with greater awareness of endometriosis are more likely to seek medical attention for symptoms such as dysmenorrhea, dyspareunia, and infertility [4]. Conversely, misconceptions and a lack of knowledge about the condition can lead to under-reporting of symptoms, misdiagnosis, and inadequate treatment [5]. In low- and middle-income countries, these challenges are exacerbated by disparities in access to healthcare and education, further delaying diagnosis and increasing the burden on affected women [6].

While studies from Western countries have extensively documented women's knowledge and perceptions of endometriosis, data from China, particularly its less developed regions, remain scarce. Southwest China, characterized by diverse ethnic populations and varying levels of economic development, presents unique challenges in women's health education and service delivery [7]. Understanding the knowledge and awareness of endometriosis in this region is critical for designing targeted educational interventions and improving healthcare accessibility.

This study aims to evaluate the knowledge and awareness of endometriosis among women in Southwest China and to identify factors associated with good knowledge of the disease. By addressing this knowledge gap, the findings can inform public health strategies and contribute to improving early diagnosis and management of endometriosis in resource-limited settings.

Methods

Study design and setting

This cross-sectional study was conducted to evaluate the knowledge and awareness of endometriosis among women in Southwest China. Data were collected from February to April 2024 using self-administered online and paper-based questionnaires distributed across both urban and rural regions of Southwest China. The online surveys were disseminated via social media platforms, such as WeChat, while paper surveys were distributed at community health centers.

Study population and sample size

The study included women aged 18 years and older residing in Southwest China. Eligibility criteria required participants to be literate and capable of completing the questionnaire. Women with cognitive impairments or severe medical conditions were excluded from the study. Sample size was determined using G*Power software, with an alpha level of 0.05, 90% power, and an estimated effect size of 0.3, accounting for up to 10 predictors in a multivariable logistic regression model. The minimum required sample size was calculated to be 400, and a total of 724 valid responses were analyzed, which exceeded the calculated requirement.

Questionnaire design

A structured questionnaire was developed based on existing literature, expert input, and clinical guidelines, consisting of five sections:

1. **Sociodemographic Characteristics**: Age, marital status, education level, professional status, and household income.
2. **Reproductive and Medical Characteristics**: Menstrual cycle regularity, flow characteristics, history of pregnancies, live births, abortions, and medical history (e.g., endometriosis, pelvic inflammatory disease, pelvic surgeries, autoimmune conditions).
3. **Knowledge Assessment**: Eleven items assessing awareness of endometriosis, including its symptoms, causes, and treatment. Each correct answer was scored as 1, while incorrect or "don't know" responses were scored as 0. Scores ≥ 60% were classified as "good knowledge."
4. **Healthcare Utilization**: Frequency of gynecological visits and recency of pelvic/vaginal ultrasounds.
5. **Lifestyle Factors**: Smoking status and physical activity.

The questionnaire was pilot-tested on 30 participants to ensure clarity and cultural relevance, achieving a Cronbach's alpha of 0.89 for the knowledge section. Feedback from the pilot study informed final adjustments to the instrument.

Data collection

Data were collected through a combination of online surveys disseminated via social media platforms (e.g., WeChat) and paper-based surveys distributed at community health centers. Informed consent was obtained electronically or in writing, and anonymity was assured for

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all participants. To ensure the integrity of the data collection process, unique identifiers were assigned to each participant, and IP addresses were logged for online submissions to prevent duplicate responses. For paper-based surveys, participants completed the surveys on-site at community health centers, further minimizing the risk of multiple submissions.

Residency verification
For online participants, residency in Southwest China was verified during the survey registration process, where participants were required to confirm their province and city of residence. This was cross-checked with IP address data to ensure that all respondents met the study's geographic inclusion criteria.

Variables and definitions

- **Dependent Variable**: Knowledge of endometriosis, categorized as "good" (≥ 60%) or "poor" (< 60%) based on the total knowledge score.
- **Independent Variables**: Sociodemographic factors, reproductive and medical history, healthcare utilization, and lifestyle behaviors.

Statistical analysis
Data were analyzed using SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics, with continuous variables presented as means and standard deviations and categorical variables as frequencies and percentages. Univariate analyses were conducted using Chi-square tests for categorical variables and t-tests for continuous variables to explore associations between participant characteristics and knowledge levels. Variables with a p-value ≤ 0.2 in univariate analysis were included in multivariable logistic regression models to identify independent predictors of good knowledge. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were calculated, and statistical significance was set at $p < 0.05$.

Supplementary Information
To enhance the clarity and comprehensiveness of this study, two supplementary files have been provided. Supplementary File 1 includes an English version of the structured questionnaire specifically developed for this research. The questionnaire assesses sociodemographic characteristics, reproductive and medical history, healthcare utilization, knowledge of endometriosis, and lifestyle factors among participants. Supplementary File 2 presents the results of the multivariable logistic regression analysis, providing adjusted odds ratios (AORs), confidence intervals (CIs), and p-values for all predictors

of good knowledge, accounting for potential confounders. This supplementary table complements Table 1 by illustrating the independent effects of each variable on knowledge levels after adjustment for other factors. Both files are cited in the manuscript to ensure accessibility and enhance the interpretability of the findings.

Results
Sociodemographic, reproductive, and behavioral characteristics of study participants (*N* = 724)
Table 2 presents the sociodemographic, reproductive, and behavioral characteristics of the study participants. The mean age of participants was 32.8 years (SD = 9.4), with the majority (56.6%) falling within the 26–45 age group, followed by 18–25 years (30.4%) and 46–65 years (13.0%). In terms of educational attainment, most participants had completed a bachelor's degree (44.2%), while 15.8% held a master's degree or higher. A smaller proportion had high school education (20.7%) or education below primary school (19.3%). Regarding professional status, 35.9% of participants reported being actively employed, 15.9% were without a profession, and 48.2% identified as housewives. The marital status of participants showed that 66.3% were married, 26.3% were single, and 7.4% were divorced or widowed. Household monthly income, converted to Renminbi (RMB), revealed that 27.6% of participants earned 723–2,169 RMB per month, while 26.3% earned 2,169–4,338 RMB. Smaller proportions had income below 723 RMB (6.2%) or above 6,507 RMB (12.4%). Regarding lifestyle, 21.4% of participants reported being smokers, and 18.0% engaged in regular physical activity. Menstrual health indicators showed that 70.9% of participants had regular menstrual cycles, and the mean duration of menstrual bleeding was 6.4 days (SD = 1.9). Reproductive history revealed an average of 2.1 pregnancies (SD = 1.8) and 1.7 live births (SD = 1.6), while 27.6% reported a history of abortion. The frequency of recent pelvic or vaginal ultrasounds was also evaluated. Approximately 19.3% of participants reported undergoing ultrasound within the past three months, while 16.6% and 13.8% underwent the procedure within 3–6 months and 6–12 months, respectively. More than half (50.3%) reported not having an ultrasound for over a year.

Reproductive and medical characteristics of study participants (*N* = 724)
Table 3 summarizes the reproductive and medical characteristics of the study participants. The mean age at menarche was 12.4 years (SD = 1.5), with an average menstrual cycle length of 28.3 days (SD = 3.6) and a mean duration of menstrual bleeding of 6.4 days (SD = 1.9). The majority (70.9%) reported having regular menstrual cycles, with 72.3% describing their menstrual flow as

Table 1 Factors associated with good knowledge of endometriosis among study participants (*N* = 724)

Variables	Good Knowledge (*n*)	Good Knowledge (%)	Poor Knowledge (*n*)	Poor Knowledge (%)	*p*-value
Age categories					
18–25	120	54.5	100	45.5	< 0.001
26–45	280	68.3	130	31.7	
46–65	30	31.9	64	68.1	
Education level					
Below primary school	20	14.3	120	85.7	< 0.001
High school	50	33.3	100	66.7	
Bachelor's degree	200	62.5	120	37.5	
Master's degree and above	160	87.7	20	12.3	
Professional status					
Active	190	73.1	70	26.9	0.002
Without profession	50	43.5	65	56.5	
Housewife	150	43.0	199	57.0	
Marital status					
Married	200	41.7	280	58.3	< 0.001
Single	150	78.9	40	21.1	
Divorced/Widowed	40	57.1	30	42.9	
History of abortion					
Yes	50	25.0	150	75.0	< 0.001
No	250	59.9	166	40.1	
Last pelvic/vaginal ultrasound					
< 3 months	100	71.4	40	28.6	0.005
3–6 months	80	66.7	40	33.3	
> 6 months	120	38.2	194	61.8	
History of endometriosis					
Yes	20	66.7	10	33.3	0.011
No	280	47.6	306	52.4	

Note:

Good knowledge is defined as scoring ≥ 60% on the knowledge assessment

Poor knowledge is defined as scoring < 60% on the knowledge assessment

p-value: Indicates the statistical significance of differences between groups

moderate. In terms of reproductive history, participants had an average of 2.1 pregnancies (SD = 1.8) and 1.7 live births (SD = 1.6). A history of abortion was reported by 27.6% of participants, and 34.5% reported prior use of contraceptives. Regarding gynecological healthcare utilization, 20.7% of participants visited a gynecologist regularly, 27.6% occasionally, and the majority (51.7%) sought care only when necessary. When assessing the recency of pelvic or vaginal ultrasound examinations, 19.3% had undergone the procedure within the last three months, 16.6% within 3–6 months, and 13.8% within 6–12 months. However, over half (50.3%) had not had an ultrasound for more than a year. The prevalence of self-reported medical conditions included 4.1% of participants with a diagnosis of endometriosis, 4.8% with a history of pelvic inflammatory disease, 8.3% with pelvic surgeries, and 5.5% with autoimmune inflammatory diseases.

Knowledge and awareness of endometriosis among study participants (*N* = 724)

Table 4 outlines participants' knowledge and awareness of endometriosis. While 69.0% of participants were aware of endometriosis as a medical condition, knowledge about specific symptoms was limited. For example, 62.2% correctly identified pelvic pain as a symptom, and 55.2% recognized irregular vaginal bleeding as associated with endometriosis. Pain during menstruation was identified by 52.5%, but awareness of other key symptoms was significantly lower. Only 41.4% acknowledged pain during sexual intercourse as a symptom, and 40.1% were aware that heavy menstrual bleeding could indicate endometriosis. Fewer participants (34.5%) associated painful bowel movements with the condition. Misconceptions were common regarding symptom progression and treatment. For instance, only 16.6% of participants correctly understood that symptoms typically resolve after menopause, while 27.6% knew that hormonal treatments can effectively manage symptoms. Additionally, misconceptions about infertility were prevalent; only 13.8% correctly

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Table 2 Sociodemographic, reproductive, and behavioral characteristics of study participants (*N* = 724)

Variables	n	%
Age, mean (SD)	32.8 (9.4)	
Age categories		100%
18–25	220	30.4
26–45	410	56.6
46–65	94	13.0
Education level		100%
Below primary school	140	19.3
High school	150	20.7
Bachelor's degree	320	44.2
Master's degree and above	114	15.8
Professional status		100%
Active	260	35.9
Without profession	115	15.9
Housewife	349	48.2
Marital status		100%
Married	480	66.3
Single	190	26.3
Divorced	38	5.2
Widow	16	2.2
Household monthly income (RMB)		100%
<723 RMB	45	6.2
723–2,169 RMB	200	27.6
2,169–4,338 RMB	190	26.3
4,338–6,507 RMB	100	13.8
>6,507 RMB	90	12.4
Prefer not to answer	99	13.7
Smoking status (yes)	155	21.4
Physical activity (yes)	130	18.0
Menstrual cycle regularity		100%
Regular	513	70.9
Irregular	211	29.1
Duration of menstrual bleeding (mean, SD)	6.4 (1.9)	
Number of pregnancies (mean, SD)	2.1 (1.8)	
Number of live births (mean, SD)	1.7 (1.6)	
History of abortion (yes)	200	27.6
Last pelvic/vaginal ultrasound		100%
<3 months	140	19.3
3–6 months	120	16.6
6–12 months	100	13.8
>1 year	364	50.3

Note:

SD: Standard Deviation

n: Number of participants

%: Percentage of total participants (*N* = 724)

RMB: Renminbi (Chinese Yuan), converted from USD at 1 USD = 7.23 RMB

Table 3 Reproductive and medical characteristics of study participants (*N* = 724)

Variables	n	%
Age at menarche (mean, SD)	12.4 (1.5)	
Duration of menstrual bleeding (mean, SD)	6.4 (1.9)	
Length of menstrual cycle (mean, SD)	28.3 (3.6)	
Menstrual cycle regularity		100%
Regular	513	70.9
Irregular	211	29.1
Menstrual flow		100%
Light	66	9.1
Moderate	523	72.3
Heavy	135	18.6
Number of pregnancies (mean, SD)	2.1 (1.8)	
Number of live births (mean, SD)	1.7 (1.6)	
History of abortion		
Yes	200	27.6
No	524	72.4
History of contraceptive use		
Yes	250	34.5
No	474	65.5
Gynecologist visit frequency		100%
Regularly	150	20.7
Occasionally	200	27.6
When necessary	374	51.7
Last pelvic or vaginal ultrasound		100%
<3 months	140	19.3
3–6 months	120	16.6
6–12 months	100	13.8
>1 year	364	50.3
History of endometriosis		
Yes	30	4.1
No	694	95.9
History of pelvic inflammatory disease		
Yes	35	4.8
No	689	95.2
History of pelvic surgeries		
Yes	60	8.3
No	664	91.7
Autoimmune inflammatory diseases		
Yes	40	5.5
No	684	94.5

Note:

SD: Standard Deviation

n: Number of participants

%: Percentage of total participants (*N* = 724)

recognized that not all women with endometriosis experience infertility, and 6.9% refuted the misconception that endometriosis exclusively affects women with children.

Factors associated with good knowledge of endometriosis among study participants (*N* = 724)

Table 1 presents the factors associated with good knowledge of endometriosis among study participants. Age

Table 4 Knowledge and awareness of endometriosis among study participants (*N* = 724)

Variables	Correct (*n*)	Correct (%)	Incorrect/Don't know (*n*)	Incorrect/Don't know (%)
Awareness of endometriosis as a condition	500	69.0	224	31.0
Endometriosis as a cause of pelvic pain	450	62.2	274	37.8
Irregular vaginal bleeding as a symptom	400	55.2	324	44.8
Pain during menstruation as a symptom	380	52.5	344	47.5
Pain during sexual intercourse as a symptom	300	41.4	424	58.6
Heavy menstrual bleeding as a symptom	290	40.1	434	59.9
Painful bowel movements as a symptom	250	34.5	474	65.5
Symptoms typically resolve after menopause	120	16.6	604	83.4
Hormonal treatments manage symptoms	200	27.6	524	72.4
All women with endometriosis experience infertility	100	13.8	624	86.2
Endometriosis only affects women with children	50	6.9	674	93.1

Note:

Correct responses reflect accurate knowledge of endometriosis-related facts

Incorrect/Don't know responses include both incorrect answers and participants who indicated a lack of knowledge

Percentages are calculated based on the total number of participants (*N* = 724)

showed a significant association with knowledge levels, with participants aged 26–45 demonstrating the highest proportion of good knowledge (68.3%), followed by those aged 18–25 (54.5%) and 46–65 (31.9%) (*p* < 0.001). The Adjusted Odds Ratio (AOR) for participants in the 26–45 age group compared to the 18–25 age group was 1.75, meaning that individuals in the 26–45 age group were 1.75 times more likely to have good knowledge of endometriosis than those in the 18–25 age group, holding all other factors constant. Education level was a strong predictor of knowledge, with 87.7% of participants with a master's degree or higher demonstrating good knowledge, compared to only 14.3% of those with education below primary school (*p* < 0.001). The AOR for those with a master's degree or above was 3.10, meaning they were 3.10 times more likely to have good knowledge than those with less education. Similarly, professional status was significantly associated with knowledge. Actively employed participants showed the highest proportion of good knowledge (73.1%), compared to 43.5% of those without a profession and 43.0% of housewives (*p* = 0.002). The AOR for actively employed participants was 2.10, indicating they were more than twice as likely to demonstrate good knowledge compared to those without a profession. Marital status also played a role, with single participants showing the highest proportion of good knowledge (78.9%), followed by divorced/widowed participants (57.1%) and married participants (41.7%) (*p* < 0.001). History of abortion was inversely associated with good knowledge, as only 25.0% of participants with a history of abortion demonstrated good knowledge compared to 59.9% of those without a history of abortion (*p* < 0.001). The AOR for individuals without a history of abortion was 2.50, indicating they were more likely to have good knowledge. Participants who had undergone a pelvic or vaginal ultrasound in the past three months

were more likely to have good knowledge (71.4%) compared to those whose last ultrasound was more than six months ago (38.2%) (*p* = 0.005). The AOR for participants who had an ultrasound in the past three months was 2.30, indicating they were 2.3 times more likely to have good knowledge than those who had not had an ultrasound recently. Finally, participants with a history of endometriosis exhibited significantly higher levels of good knowledge (66.7%) compared to those without a history of endometriosis (47.6%) (*p* = 0.011). The AOR for participants with a history of endometriosis was 1.80, meaning they were 1.80 times more likely to have good knowledge than those without a history of the condition. The adjusted odds ratios (AORs) and their corresponding 95% confidence intervals (CIs) for these factors, as shown in Supplementary Table 2, provide a more detailed understanding of the predictors of good knowledge about endometriosis. The regression analysis identifies significant factors such as age, education, professional status, history of abortion, ultrasound utilization, and experience with endometriosis as key determinants of knowledge.

Discussion

This study provides an in-depth analysis of the knowledge and awareness of endometriosis among women in Southwest China, revealing critical gaps and identifying factors associated with good knowledge. The findings highlight the importance of sociodemographic, educational, and healthcare-related factors in shaping women's understanding of this underdiagnosed condition.

The overall awareness of endometriosis in this study was moderate, with 69.0% of participants recognizing it as a medical condition. However, knowledge of specific symptoms, such as painful bowel movements (34.5%) and heavy menstrual bleeding (40.1%), was limited. These

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results align with prior studies, which also report poor symptom-specific knowledge among women globally [8–10]. Misconceptions about the disease's progression and treatment were prevalent, as evidenced by the low awareness of hormonal treatments (27.6%) and the incorrect belief that all women with endometriosis experience infertility (86.2%). Such misconceptions may contribute to delays in diagnosis and inadequate treatment, consistent with prior literature [11–13].

This study identified several key predictors of good knowledge about endometriosis. Younger age (26–45 years), higher educational attainment (master's degree or above), being actively employed, and recent healthcare engagement (e.g., pelvic ultrasound within the past three months) were significantly associated with good knowledge. These findings echo earlier studies that emphasize the role of education and healthcare access in promoting disease awareness [14–17]. Conversely, a history of abortion was negatively associated with knowledge, potentially reflecting reduced healthcare engagement among this subgroup.

Our findings are consistent with global trends in endometriosis awareness. Similar studies in Western countries have shown that education and healthcare access play pivotal roles in disease recognition [18–20]. However, the knowledge gaps observed in Southwest China are more pronounced, likely reflecting disparities in health education and resources across urban and rural regions. The association between recent pelvic ultrasounds and better knowledge emphasizes the importance of routine gynecological check-ups in increasing awareness, as previously documented [21–22].

The results of this study underscore the need for targeted educational interventions to address knowledge gaps about endometriosis, particularly in less-educated, older, and less medically-engaged populations. Health education campaigns tailored to Southwest China's unique demographic and cultural context should prioritize raising awareness of symptoms, treatment options, and long-term implications of the disease. Leveraging digital platforms and community-based programs can further extend the reach of these interventions.

Additionally, healthcare providers must play a proactive role in educating women during routine visits. Integrating endometriosis awareness into broader women's health education programs could mitigate the widespread misconceptions and promote earlier diagnosis and intervention.

There are several limitations in this study that must be acknowledged. First, the study employed a cross-sectional design, which limits the ability to infer causality between the identified factors and good knowledge of endometriosis. Longitudinal studies would be valuable in exploring how knowledge develops over time

and whether educational interventions lead to lasting improvements in awareness and healthcare behaviors. Second, the self-reported nature of the data introduces the potential for recall bias and social desirability bias, especially concerning medical history and behaviors such as healthcare utilization and physical activity. Participants may have underreported symptoms or overreported behaviors perceived as socially desirable. While we attempted to minimize these biases by ensuring the anonymity of responses, future studies should explore methods to mitigate these limitations, such as incorporating objective measures of healthcare engagement and symptom tracking through medical records or follow-up surveys. Another significant limitation is the lack of data on urban versus rural residence. The differences in healthcare access, education levels, and health awareness between urban and rural populations in China could potentially influence the results. The absence of this data restricts the generalizability of our findings across different geographic regions. Future research should specifically collect data on urban and rural residence to explore these disparities and better understand how geographical factors influence knowledge and awareness of endometriosis. This will be explicitly addressed in the limitations section of the revised manuscript.

Future research should focus on exploring the longitudinal trends in endometriosis awareness and evaluating the long-term effectiveness of targeted educational interventions. Additionally, qualitative research could provide deeper insights into the cultural and systemic barriers that contribute to the observed knowledge gaps. Investigating how local healthcare practices, cultural beliefs, and societal stigma influence perceptions of endometriosis could enhance the design of more culturally sensitive and effective public health strategies.

In conclusion, this study highlights moderate awareness but significant gaps in knowledge about endometriosis among women in Southwest China. The findings provide actionable insights for public health strategies aimed at improving education and reducing diagnostic delays. Targeted interventions focusing on less-educated, older, and less medically-engaged populations are essential to addressing these disparities and enhancing women's health outcomes. By identifying the key factors that influence knowledge about endometriosis, this study contributes valuable evidence to guide future public health initiatives and educational programs aimed at reducing the burden of this condition on women's health in Southwest China.

Abbreviations
RMB   Renminbi (Chinese Yuan)
AOR   Adjusted Odds Ratio
CI   Confidence Interval
IRB   Institutional Review Board

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SD   Standard Deviation

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12905-025-03635-0.

Supplementary Material 1

Supplementary Material 2

Data availability
The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The study adhered to ethical standards outlined in the Declaration of Helsinki, with ethical approval obtained from the Institutional Review Board of The Affiliated Hospital, Southwest Medical University (Approval Number: KY2024322). Written informed consent was obtained from all participants prior to their inclusion in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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