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# Impact of Endometriosis on Fertility and Quality of Life among Women of Childbearing Age: A Comparative Hospital-Based Cross-Sectional Study in China and Rwanda

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## Abstract

**Background:** Endometriosis is associated with chronic pelvic pain, dysmenorrhea, and infertility, leading to substantial healthcare costs and diminished quality of life (QoL). While early diagnosis may improve outcomes, little is known about women's experiences across resource-diverse settings. This study compared the impact of endometriosis on fertility and QoL among women of reproductive age in China and Rwanda. **Methods:** A cross-sectional study was conducted from January to November 2025 in four hospitals across China and Rwanda. Women aged 18 - 45 years with surgically confirmed endometriosis were enrolled, excluding those with comorbidities affecting infertility or QoL. Data were collected using the validated 63-item Endometriosis Impact Questionnaire (EIQ). Multiple linear regression identified predictors of EIQ scores, and logistic regression assessed factors associated with self-reported infertility, using a 5% significance level. **Results:** Among 153 participants, 66.7% were from China; median age was 31 years (IQR: 25 - 39), and 47.7% had tertiary education. Median monthly income was higher in China than Rwanda ($674.8 vs $103.5; $p < 0.001$), while health insurance coverage was higher in Rwanda (84.3% vs 66.7%; $p = 0.022$). Of 113 sexually active women, 62.8% reported infertility, more frequently in China (74.3% vs 41.0%; $p < 0.001$). The overall median EIQ score was 43.3 (IQR 14.2 - 58.5), with no significant difference between countries across recall periods. However, Rwandan women reported lower impact in the fertility, sexual, and lifestyle domains ($p < 0.05$), while no differences were observed in physical, psychological, social, educational, or employment domains. After adjusting for confounders, country of residence

did not predict EIQ scores ($\beta$ = 4.5; p = 0.484), whereas secondary ($\beta$ = –13.6; p = 0.049) and tertiary education ($\beta$ = –17.0; p = 0.022) were associated with lower impact scores. Higher income was associated with reported infertility (aOR = 1.002; p = 0.034). Surgical management was common in both countries, but IVF and IUI were accessed only in China, where satisfaction with care was higher (median 4 vs 2). **Conclusion:** Endometriosis substantially impairs the QoL of women in both China and Rwanda, with no differences in overall impact between the two settings. However, domain-specific variations were observed, and higher education was associated with better QoL outcomes. Infertility was common, particularly among women with higher incomes, and advanced fertility treatments were accessible only in China, where satisfaction with care was also higher. These findings highlight the need to strengthen diagnostic capacity, expand fertility services, and improve comprehensive endometriosis care, especially in resource-limited settings.

## Keywords

Endometriosis, Fertility, Quality of Life, Reproductive Health, Endometriosis Impact Questionnaire

## 1. Background

Endometriosis is a chronic gynaecological condition characterised by the presence of endometrial tissue outside the uterus [1]. It is one of the most common gynaecological conditions affecting over 10% of women of reproductive age globally [2]. Because of its insidious onset, a substantial number of cases remain undiagnosed, and its epidemiology is said to be underreported [3]. Nonetheless, literature indicates that over 30% - 50% of the affected women experience infertility [4], while many others suffer chronic pelvic pain, dysmenorrhea, and dyspareunia, which affect their quality of life [5] [6].

Diagnostic delays remain a defining challenge, with studies reporting an average lag of 7 - 10 years between symptom onset and confirmed diagnosis [7] [8]. These delays often arise from nonspecific symptoms, normalisation of menstrual pain, and limited healthcare provider awareness [9]. Such barriers are particularly prevalent in low-resource settings like Rwanda, where specialised gynaecological services and advanced diagnostic technologies remain scarce. More industrialised countries, such as China, have better healthcare infrastructure, but disparities in timely diagnosis and treatment outcomes persist. Even where care is accessible, treatment options like surgery and hormonal therapy are often associated with varying success and may be accompanied by recurrence, side effects, or complications such as infertility and chronic pain [10]-[12].

These challenges present a substantial toll on the overall physical, social, mental, and psychological well-being of women, thus negatively affecting the overall quality of life (QoL). Studies have indicated that patients with endometriosis re-

port higher rates of anxiety, depression, and social isolation than their peers [13], [14]. The burden also has economic implications due to lost productivity and costs associated with healthcare [15]. However, evidence shows that early, holistic management can substantially improve women's well-being and productivity [16] [17].

Although substantial research has been conducted on endometriosis globally, there remains a paucity of comparative studies examining the condition across diverse socio-cultural and healthcare settings. Rwanda and China provide unique contexts for such a study, given their contrasting healthcare systems, population demographics, and cultural attitudes toward reproductive health. This study was therefore conducted to address the gap by comparing the impact of endometriosis on fertility and quality of life in women of childbearing age in Rwanda and China. The study also explored fertility challenges, treatment options, and women's perceptions of treatment effectiveness across these contrasting settings. Understanding these disparities is crucial for tailored interventions and policy recommendations to improve care for women globally. In addition to existing literature, this study sheds more light on how healthcare systems, cultural attitudes, and socio-economic factors shape the experiences of women with endometriosis.

## 2. Methods

### 2.1. Study Design and Settings

This was a quantitative cross-sectional study conducted across two economically diverse settings in China and Rwanda from January to November 2025. In each country, two facilities were purposively selected based on the diagnostic capacity and availability of a gynaecology outpatient clinic where participants could be sampled. In China, these facilities included The First People's Hospital of Jingzhou (FPHJ) and Jingzhou Central Hospital (JCH), while in Rwanda, University Teaching Hospital of Kigali (CHUK) and King Faisal Hospital, Rwanda (KFHR) were selected.

China is a fast-growing upper-middle-income country located in East Asia, with a total land area of approximately 9.6 million square kilometres and a population exceeding 1.4 billion people. The country has a tiered healthcare system comprising primary, secondary, and tertiary levels, with tertiary hospitals serving as regional or national referral centres offering specialised and technologically advanced care. The present study was conducted in Jingzhou City, located in Hubei Province, Central China. Jingzhou has a population of over 5.5 million people and is a rapidly developing urban area with expanding industrial and educational infrastructure. Both FPHJ and JCH are tertiary-level referral and teaching hospitals affiliated with Yangtze University. These facilities provide a wide range of specialist services, including advanced gynaecological and reproductive health care, and are equipped with modern diagnostic technologies such as laparoscopic surgery, magnetic resonance imaging (MRI), and assisted reproductive technologies (ART). China's health system operates through a mixed model, combining government

subsidies, social health insurance, and out-of-pocket payments.

In contrast, Rwanda is a landlocked low-income country located in East Africa. It is a small country covering 10,169 square miles on the ground with an estimated population size of 14 million people. The public health sector in Rwanda is organised into three levels (peripheral, intermediate and central) with each level having defined technical and administrative platforms. The peripheral level is at the district level, consisting of the district health offices with a district hospital, and primary health care facilities. These refer their patients to the national referral hospitals, including CHUK (public), and KFHR (private not-for-profit), supervised at the central level. Rwanda follows a universal healthcare model, which provides low-cost community-based health insurance through the *mutuelles de santé* [18]. This scheme allows residents to pay premiums tailored to their socio-economic class to ensure that each citizen has access to medical care. Both CHUK and KFH offer advanced diagnostic services, including MRI, but advanced ART services are still limited.

### 2.2. Study Participant

Participants were recruited from outpatient gynaecology clinics at the selected hospitals. Women were eligible for recruitment if they were of reproductive age, 18 - 45 years, with a confirmed surgical diagnosis of endometriosis, and willing to offer consent. Women with a history of other chronic gynaecological conditions that may affect fertility (uterine fibroids, polycystic ovarian syndrome, primary ovarian insufficiency and chronic pelvic inflammatory disease) or any serious comorbidities that may adversely affect the quality of life (such as multiple sclerosis, schizophrenia, severe anxiety disorders, type 1 diabetes mellitus and conditions causing physical disabilities) were not included in this study.

### 2.3. Sample Size and Sampling Procedure

Based on the primary objective of comparing the impact of endometriosis between the two countries, the sample size needed to detect a mean difference in scores of at least 5 with a standard deviation of 15 was calculated, with a power of 80% and a 5% margin of error. A sample size of 142 per country was obtained.

During the study period, at least two study contact persons were identified at each study site in China and Rwanda. These contact persons were stationed at their respective gynaecological clinics on clinic days and were responsible for screening, consenting and interviewing of study participants. Participants were screened consecutively against a set of eligibility criteria and, upon fulfilment, a questionnaire was administered.

### 2.4. Data Collection and Measurements

Data was collected using a validated 63-item Endometriosis Impact Questionnaire (EIQ). In Rwanda, the study contact persons were trained to use the English version during interviews without the need for translation, while in China, the tool

was first translated into Chinese, and it was self-administered. This tool captured data on the burdens experienced by women over three recall periods: the last 12 months, 1 to 5 years ago, and more than 5 years ago. The EIQ uses a 5-point Likert scale scored as follows: Not at all = 0, A little = 1, Somewhat = 2, Quite a lot = 3, Very much = 4 and Not applicable = 9. The original tool defines six distinct domains of quality of life, including physical-psychosocial (33 items), fertility (3 items), sexual (7 items), employment (11 items), educational (6 items), and lifestyle (3 items). In this study, the first domain (physical-psychosocial) was further divided into physical (13 items), psychological (16 items) and social (4 items) domains, giving rise to a total of eight domains for a comprehensive assessment. Each domain contributes equally to the maximum score, and the overall score is calculated by adding all applicable scores across the three recall periods. The total score for each domain is calculated as the mean of the three recall periods. The scores are then rescaled to 0 - 100, with 0 indicating the minimum possible impact and 100 the maximum possible impact [19].

The final data collection tool was designed to capture additional information on sociodemographic characteristics and appropriate reproductive health, such as a history of self-reported infertility. In this study, infertility was defined as history of delayed or difficulty in conception as reported by the participant, who was a sexually active woman of reproductive age. The data collection tools in English and Chinese were converted into electronic forms using Kobo Toolbox (Cambridge, MA, USA).

## 2.5. Data Management and Analysis

Upon completion of data collection, datasets were extracted from Kobo Toolbox and imported into Microsoft Excel for cleaning. The Chinese dataset was first back-translated with the help of the Google translation tool. After translation, both Chinese and Rwandan datasets were merged to complete the cleaning process. Before analysis, each participant's responses to the 63-item EIQ were reviewed, and total scores were systematically calculated as described in the previous subsection. To facilitate a balanced comparison, a participant's periodic score was calculated only if 50% of the items in the domain were answered, in line with the original developer's recommendation [19]. The overall, periodic and domain scores were subsequently transformed to a 0 - 100 scale using the formula:

$$\text{Transformed Total score} = \frac{\text{Sum of scores of applicable items}}{\left(\text{Number of items answered} \times 4\right)} \times 100$$

Additionally, the monthly income reported by participants was converted into US dollars (USD) to allow for comparison across participants from both countries. Conversion was completed using the prevailing dollar rate on November 1, 2025, on the Oanda Corporate Smarter Services platform [20]. The exchange rates were 1 Rwandan Franc (RWF) = 0.00069 USD and 1 Chinese Yuan Renminbi (CNY) = 0.14059 USD.

Descriptive statistics were used to summarise sociodemographic and clinical characteristics, using medians and interquartile ranges (IQRs), while group comparison was completed by use of the Mann-Whitney U test for continuous variables, and the Chi-square test or Fisher's exact test (for variables consisting of frequencies less than 10) for categorical variables. Continuous variables were assessed for normality using visual inspection (histogram with normal overlay and kernel density plots) and statistical tests (Shapiro-Wilk and skewness-kurtosis tests). To identify predictors of EIQ scores, the multiple linear regression model was used, while logistic regression was employed to examine factors associated with infertility. Model assumptions were verified, multicollinearity assessed (mean VIF = 2.33), and significance set at $p < 0.05$. Results were presented with 95% confidence intervals. Data were analysed using Stata 15.0 (StataCorp, College Station, TX, USA).

## 3. Results

Over the study period (January-November 2025), a total of 161 women with endometriosis were identified in the gynaecology outpatient clinics in China and Rwanda (Figure 1). Of these, 8 (5.0%) women in China refused to consent, yielding a total of 153 participants who completed the interviews and whose results were analysed.

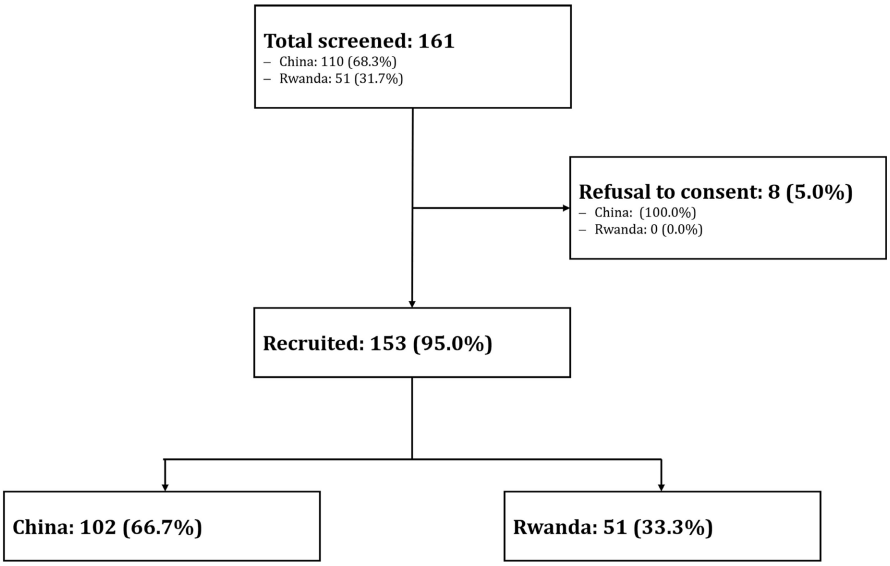


Figure 1. Study recruitment.

### 3.1. Characteristics of Study Participants

Of the 153 women who participated in the study, 102 (66.7%) were from China (Table 1). The median age was 31 years (interquartile range (IQR): 25 - 39), with Chinese women significantly younger than their Rwandan counterparts (30 vs 35 years; $p = 0.009$).

Marked differences were observed in marital status; about two-thirds of Rwan-

dan women (68.6%) were married compared with only 36.3% of Chinese participants ($p < 0.001$). Conversely, widowed status was more frequent among Chinese women (12.7%) and absent in Rwanda. Additionally, educational attainment differed significantly, China having more women with tertiary education compared to Rwanda (51.0% vs 41.2%, $p = 0.005$). Almost half of all participants (47.7%) had completed tertiary education. Employment rates were higher in China (85.3%) than in Rwanda (64.7%) ($p = 0.004$), despite a greater proportion of Chinese participants living in rural areas (62.7%) compared to Rwandans (47.1%). Household income varied markedly between countries (median = $674.8 in China vs $103.5 in Rwanda; $p < 0.001$). However, health insurance coverage was more common in Rwanda (84.3%) than in China (66.7%) ($p = 0.022$).

Regarding reproductive history, out of the 153 women in this study, 73.9% were sexually active, with no difference between countries ($p = 0.603$). However, self-reported infertility was more frequent among Chinese participants than Rwandans (74.3% vs 41.0%; $p < 0.001$). In both countries, about 60% of women who reported infertility, also reported having accessed treatment ($p > 0.999$) (Table 1).

Table 1. Characteristics of study participants, N = 153.

| Variable | Overall | Country of residence | | p-value[a] |
|---|---|---|---|---|
| | | China (n = 102) | Rwanda (n = 51) | |
| **Age in years, median (interquartile range)** | 31 (25, 39) | 30 (24, 36) | 35 (28, 42) | 0.009 |
| **Marital Status** | | | | |
| Married | 72 (47.1) | 37 (36.3) | 35 (68.6) | <0.001 |
| Single | 50 (32.7) | 38 (37.3) | 12 (23.5) | |
| Divorced | 18 (11.8) | 14 (13.7) | 4 (7.8) | |
| Widowed | 13 (8.5) | 13 (12.7) | 0 (0.0) | |
| **Level of education** | | | | |
| Primary | 24 (17.7) | 15 (14.7) | 9 (17.6) | 0.005 |
| Secondary | 56 (36.6) | 35 (34.3) | 21 (41.2) | |
| Tertiary | 73 (47.7) | 52 (51.0) | 21 (41.2) | |
| **Employment status** | | | | |
| Employed | 120 (78.4) | 87 (85.3) | 33 (64.7) | 0.004 |
| Not employed | 33 (21.6) | 15 (14.7) | 18 (35.3) | |
| **Residence type** | | | | |
| Rural | 88 (57.5) | 64 (62.7) | 24 (47.1) | 0.064 |
| Urban | 65 (42.5) | 38 (37.3) | 27 (52.9) | |
| **Monthly income (USD)** | 421.8 (103.5, 702.9) | 674.8 (421.8, 843.5) | 103.5 (3.5, 186.3) | <0.001 |
| **Has insurance coverage** | | | | |
| Yes | 111 (72.5) | 68 (66.7) | 43 (84.3) | 0.022 |
| No | 42 (27.5) | 34 (33.3) | 8 (15.7) | |

Continued

| | | | | |
|---|---|---|---|---|
| **Sexually active** | | | | |
| Yes | 113 (73.9) | 74 (72.5) | 39 (76.5) | 0.603 |
| No | 40 (26.1) | 28 (27.5) | 12 (23.5) | |
| **Reported history of infertility** | | | | |
| Yes | 71 (62.8) | 55 (74.3) | 16 (41.0) | <0.001 |
| No | 42 (37.2) | 19 (25.7) | 23 (59.0) | |
| **Received fertility treatment** | | | | |
| Yes | 43 (38.1) | 33 (60.0) | 10 (62.5) | >0.999 |
| No | 28 (24.8) | 22 (40.0) | 6 (37.5) | |

USD = United States Dollar. [a]The p-values were estimated with Chi-square or Exact Fisher's test for categorical variables and Mann-Whitney U test for continuous variables.

### 3.2. Impact of Endometriosis on the Quality of Life among Study Participants

The overall median EIQ impact score was 43.3 (IQR 14.2 - 58.5), with no significant difference between countries (p = 0.549). Likewise, there was no statistical difference across the three recall periods, that is, median = 47.3 (24.6 - 63.2), p = 0.328 for less than 12 months period, median = 42.5 (15.9 - 60.9), p = 0.411 for 1 - 5 years period and median = 0 (0.0 - 50.9), p = 0.215 for more than 5 years period (Table 2).

Table 2. Endometriosis Impact Scores for the different recall periods among study participants in China and Rwanda, N = 153.

| Recall period | Overall | Country of residence | | p-value |
|---|---|---|---|---|
| | | China (n = 102) | Rwanda (n = 51) | |
| Overall (median (IQR)) | 43.3 (14.2, 58.5) | 43.5 (20.1, 55.9) | 43.3 (8.1, 65.9) | 0.549 |
| Less than 12 months (median (IQR)) | 47.3 (24.6, 63.2) | 47.6 (29.4, 59.9) | 40.5 (10.9, 69.1) | 0.328 |
| 1 - 5 years (median (IQR)) | 42.5 (15.9, 60.9) | 41.6 (19.8, 56.1) | 46.1 (10.9, 63.9) | 0.411 |
| More than 5 years (median (IQR)) | 0 (0.0, 50.9) | 0 (0.0, 52.6) | 0 (0.0, 45.6) | 0.215 |

IQR = Interquartile range.

However, as shown in Figure 2, significant differences in the impact of endometriosis on some domains were observed across countries, including sexual (median score 23.8 vs 45.3, p = 0.016), fertility (median score 19.4 vs 61.8, p = 0.005) and lifestyle (median score 0 vs 0, p = 0.001). There was no statistical difference in the impact on the physical, psychological, social, educational and employment domains.

After adjusting for demographic and reproductive factors, country of residence was not significantly associated with EIQ scores ($\beta$ = 4.5, 95% CI: −8.2,17.1; p = 0.484). Age, marital status, employment, income, and insurance coverage were also non-significant (Table 3). However, education level emerged as a significant

independent predictor. Compared with women with primary level education, those with secondary education ($\beta$ = −13.6; 95% CI: −27.1, −0.1; p = 0.049) and tertiary education ($\beta$ = −17.0; 95% CI: −31.5, −2.5; p = 0.022) reported significantly lower impact scores, indicating less impairment of quality of life.

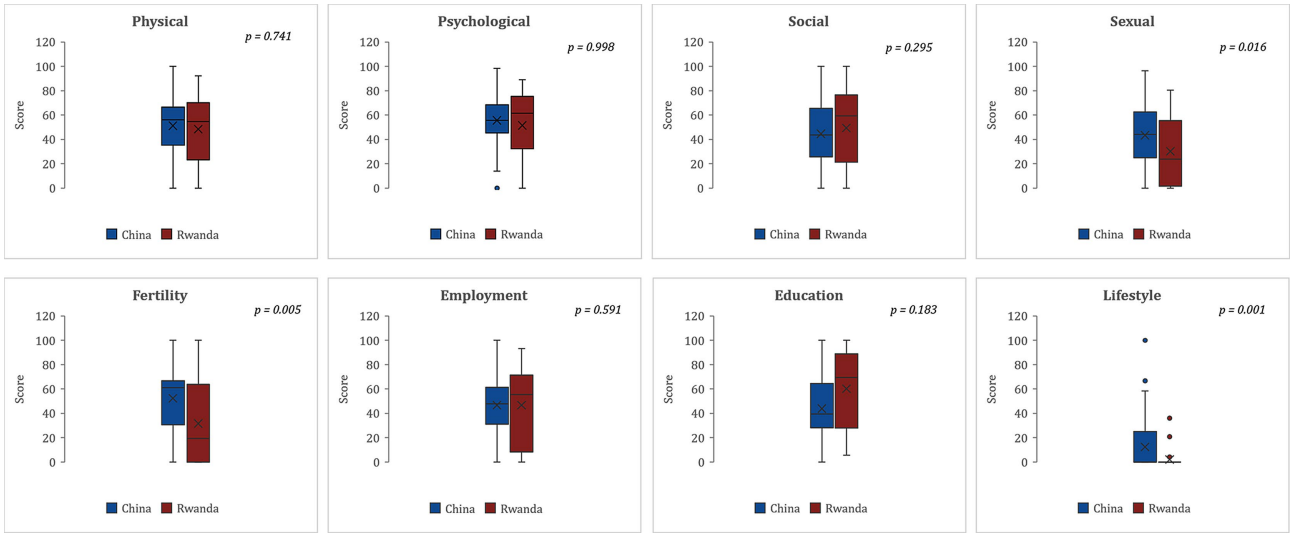


**Figure 2.** Median scores by participants in the different domains assessed. p-values indicate between-country differences.

**Table 3.** Multiple linear regression model of the predictors of the overall endometriosis impact scores among participants.

| Variable | Coefficient ($\beta$) | Robust SE | 95% CI | Adjusted p-value |
|---|---|---|---|---|
| **Country of residence** | | | | |
| Rwanda | Reference | | | |
| China | 4.5 | 6.4 | −8.2, 17.1 | 0.484 |
| **Age in years** | 0.2 | 0.4 | −0.5, 0.9 | 0.581 |
| **Marital status** | | | | |
| Single | Reference | | | |
| Married | −10.0 | 7.6 | −25.0, 5.0 | 0.19 |
| Divorced | 6.7 | 8.3 | −9.9, 23.2 | 0.427 |
| Widowed | −3.9 | 9.4 | −22.5, 14.8 | 0.679 |
| **Level of education** | | | | |
| Primary | Reference | | | |
| Secondary | −13.6 | 6.8 | −27.1, −0.1 | 0.049 |
| Tertiary | −17.0 | 7.3 | −31.5, −2.5 | 0.022 |
| **Employment status** | | | | |
| Not employed | Reference | | | |
| Employed | −1.1 | 6.1 | −13.2, 11.1 | 0.863 |

Continued

| | | | | |
|---|---|---|---|---|
| **Income in USD** | 0.0 | 0.0 | | 0.979 |
| **Has insurance coverage** | | | | |
| No | Reference | | | |
| Yes | −4.7 | 4.9 | −14.4, 5.1 | 0.344 |
| **Reported history of infertility** | | | | |
| No | Reference | | | |
| Yes | 2.9 | 5.1 | −7.2, 13.0 | 0.567 |

SE = Standard error.

### 3.3. Impact of Endometriosis on Fertility among Participants

Out of the 113 sexually active women, 71 (62.8%) reported history of infertility. In the unadjusted analysis, country of residence and income were significantly associated with infertility. Chinese participants had over fourfold higher odds of reporting infertility compared with Rwandan women (cOR = 4.16; 95% CI 1.83 - 9.49; p = 0.001).

However, after adjusting for age, marital status, income, and insurance status, the association with country was attenuated and no longer significant (aOR = 0.83; 95% CI 0.20 - 3.51; p = 0.797).

Monthly income remained a significant independent predictor (aOR = 1.002; 95% CI: 1.000, 1.003; p = 0.034), suggesting that women with higher income levels were more likely to report infertility. Health insurance showed a borderline protective association (aOR = 0.35; 95% CI 0.12 - 1.03; p = 0.056), whereas age and marital status were not significantly related to infertility (Table 4).

Table 4. Factors associated with a history of infertility among participants.

| Variable | cOR (95% CI) | p-value | aOR (95% CI) | p-value |
|---|---|---|---|---|
| **Age in years** | 0.98 (0.930, 1.033) | 0.455 | 0.97 (0.907, 1.037) | 0.37 |
| **Marital status** | | | | |
| Single | Reference | | | |
| Married | 0.461 (0.132, 1.607) | 0.224 | 0.429 (0.095, 1.938) | 0.271 |
| Divorced | 1.2 (0.237, 6.065) | 0.825 | 0.778 (0.116, 5.216) | 0.796 |
| Widowed | 4.4 (0.418, 46.261) | 0.217 | 2.922 (0.225, 37.987) | 0.413 |
| **Monthly income in USD** | 1.002 (1.001, 1.003) | 0.001 | 1.002 (1.000, 1.003) | 0.034 |
| **Country of residence** | | | | |
| Rwanda | Reference | | | |
| China | 4.161 (1.825, 9.487) | 0.001 | 0.827 (0.195, 3.506) | 0.797 |
| **Has insurance coverage** | | | | |
| No | Reference | | | |
| Yes | 0.417 (0.161, 1.081) | 0.072 | 0.348 (0.118, 1.029) | 0.056 |

USD = United States Dollar; cOR = Crude Odds Ratio; aOR = Adjusted Odds Ratio.

### 3.4. Fertility Treatment Modalities and Satisfaction

Among participants who experienced infertility (n = 71), 43 (60.5%) reported having received at least one fertility treatment modality, 33 (76.7%) of whom were in China. The most commonly reported modality across both countries was surgical interventions reported by 12/33 women in China and 8/10 women in Rwanda (Figure 3). This was followed by In vitro fertilization (IVF) which was reported exclusively by Chinese women (11/33 reported having used it) and medical therapy (e.g., clomiphene) reported by 9/33 Chinese and 2/10 Rwandan women and lastly intrauterine insemination (IUI) reported by 3/33 Chinese women.

The median satisfaction ratings across treatment modalities were 4 (IQR: 2 - 5) among Chinese women and 2 (IQR: 0 - 3) among Rwandan women.

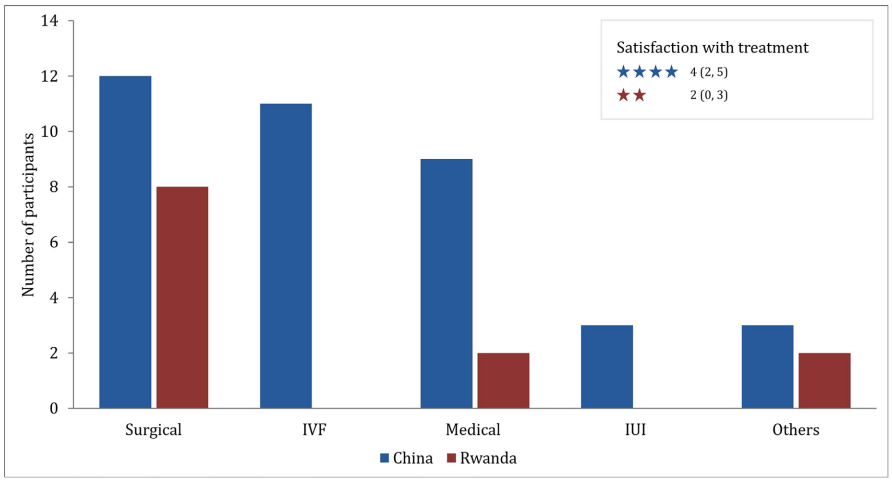


Figure 3. Treatment modalities received by participants for fertility. Participants also rated the treatment received on a scale of 0 - 5. Provided are medians with interquartile ranges in parentheses. IVF = In Vitro Fertilization, IUI = Intrauterine Insemination.

## 4. Discussion

This study compared the impact of endometriosis on quality of life (QoL) and fertility among women of reproductive age in two resource-diverse settings: China and Rwanda. Despite substantial sociodemographic and economic differences, the overall EIQ scores were comparable, indicating that endometriosis imposes a significant burden irrespective of healthcare infrastructure or income level. This finding is not surprising, as previous studies have documented the substantial impact of endometriosis in both low-resource and high-income settings, although most were non-comparative in nature [21]. A similar comparative assessment by Nnoaham E.K. and colleagues across economically and ethnically diverse countries found consistently high disease burden, further exacerbated by prolonged diagnostic delays characteristic of state-funded health systems [22]. Such delays are common in low-resource settings, including Rwanda, where healthcare is predominantly state-funded. The lack of differences in QoL scores in our study may therefore be partly explained by Rwanda's community-based health insurance

programme, which enhances financial sustainability and reduces out-of-pocket expenditure, thereby improving access to care for affected women. However, it is important to note that insurance coverage does not necessarily eliminate indirect economic barriers, such as transportation costs, loss of income, and limited access to specialised services, which may differentially affect specific QoL domains. Nonetheless, these findings highlight the potential value of adopting similar insurance schemes in other low-resource countries to improve equitable access to essential health services.

Despite comparable overall EIQ scores, domain-specific differences emerged, with Rwandan women reporting lower impact in sexual, fertility, and lifestyle domains. These variations likely reflect contextual factors such as cultural perceptions of infertility, marital expectations, and limited access to specialised reproductive care. In addition, the marked income disparity between participants in China and Rwanda may have acted as an important confounding factor influencing these domains. Economic constraints can limit access to fertility investigations, assisted reproductive technologies, pain management options, and lifestyle-modifying interventions, thereby shaping women's experiences regardless of their cultural contexts [9]. Notably, the study found that higher education is a significant protective factor against the impact of endometriosis on QoL, a finding consistent with previous evidence [23]. Educated women may be better equipped to seek timely care, adopt effective coping strategies, and adhere to management plans, thereby reducing disease burden. In contrast, a similar study conducted in Poland reported an association between education and lower QoL, although in that study, the effect was limited to the treatment domain [24]. This is rather not unexpected, as educated women may have higher expectations regarding treatment standards and may be more easily frustrated by the limitations of current endometriosis care. The difference in findings is, therefore, likely due to the use of different measurement tools; the EIQ used in our study does not assess treatment-related perceptions as a QoL domain. Although there are studies which have explored the role of educational interventions in improving awareness, care-seeking, and QoL among women with endometriosis, with promising outcomes [25] [26], there is little evidence that such strategies have been widely implemented. Nonetheless, these studies show that integrating targeted educational programs could help reduce diagnostic delays, improve treatment outcomes, and enhance overall QoL for affected women. Future studies should examine the feasibility, acceptability, and cost-effectiveness of implementing such programs to inform policy and practice.

Overall, 62.8% of women in our study reported having experienced infertility, with significantly higher proportions among Chinese participants. This prevalence far exceeds global estimates, which suggest a pooled infertility prevalence of 12.8%, with slightly higher rates in Africa (16.3%) than in Asia (14.9%) [27]. However, the strong association between endometriosis and infertility is well documented, and likely explains the high infertility prevalence observed in this clinical

population [28]. Because this was a hospital-based study, the lower proportion of reported infertility among Rwandan women may reflect underdiagnosis or cultural reluctance to disclose infertility rather than a true epidemiological difference. Previous literature highlights how stigma and social pressure, particularly among women from low socioeconomic backgrounds, can lead to nondisclosure or denial of infertility [29]-[32]. These insights highlight the need for fertility counselling and screening programs that are both affordable and culturally sensitive. Clinicians should receive contextually relevant training to proactively screen women presenting with chronic pelvic pain or dysmenorrhea for infertility risk to support early diagnosis and disclosure. Moreover, the study also observed that women with higher income levels were more likely to report infertility. This is likely because higher-income women are more able to access diagnostic evaluations and fertility services [33]. Population-level studies consistently show that higher-income women tend to have lower infertility risk, due to better healthcare access, healthier lifestyles, improved nutrition, and greater engagement in physical activity, all factors associated with good reproductive health outcomes [34] [35]. However, it is worth noting that although higher income was statistically associated with reported infertility in this study, the magnitude of effect per unit increase was small and should be interpreted as indicative of access to diagnostic and fertility services rather than a clinically meaningful risk factor. Lastly, given these were self-reported cases, infertility may have been over-estimated, potentially explaining the unusually high prevalence (74.3%) observed in the Chinese cohort.

Regarding fertility treatment, marked differences were observed between the two countries. Chinese participants reported access to a wider range of interventions, including IVF, IUI, hormonal therapies, and surgery. In contrast, women in Rwanda primarily relied on medical or surgical management. This disparity may be partly explained by the substantial income difference between the groups, with Rwandan women earning a median of USD 103.5 per month compared to USD 674.8 in China, making advanced reproductive therapies financially inaccessible. Additionally, although Rwanda's community-based health insurance model improves access to general healthcare services, it does not cover ART services. Furthermore, ART services in Rwanda are limited to a few private-for-profit facilities where a single IVF cycle costs approximately USD 5000, far beyond the means of most women [36]. While surgery and hormonal therapy may offer symptomatic relief, they are associated with significant drawbacks. Surgical management carries risks such as infertility, chronic pain, and urological, intestinal, vascular, or neurological complications [11] [12]. Hormonal therapies, likewise, are linked to recurrence of symptoms and adverse effects, including mood changes, weight gain, breast tenderness, headaches, and nausea [10] [37] [38]. These limitations may explain the lower treatment satisfaction reported by Rwandan women compared with their Chinese counterparts. Although including ART within the community-based insurance package may be financially challenging, strengthen-

ing public-private partnerships could help expand access to fertility services in Rwanda and similar settings. Coupled with tailored reproductive health education programs, such strategies could promote timely care-seeking, reduce diagnostic delays, and ultimately improve treatment outcomes and overall well-being for women affected by endometriosis.

### Limitations of the Study

This study has some limitations that should be considered when interpreting the findings. First, because this was a hospital-based study, participants may have been more health-conscious than the general population, which may limit representativeness. Nevertheless, the hospital setting provided the most reliable means of identifying women with a confirmed diagnosis of endometriosis, ensuring that the questionnaire was administered to an appropriate target population. Second, the EIQ captures experiences across three recall periods extending up to more than five years, which may introduce recall bias. However, because recall-period-specific analyses yielded similar results, the impact of recall bias was likely minimal. Lastly, the target sample size was not fully achieved, particularly in Rwanda, where only 51 women participated, reducing statistical power and could have impacted the statistical reliability of the non-significant findings between countries.

## 5. Conclusion

This study demonstrates that women with endometriosis in China and Rwanda experience a substantial burden on their quality of life, although the overall impact does not differ significantly between the two settings. However, notable domain-specific variations were observed, with Rwandan women reporting lower impact in the sexual, fertility, and lifestyle domains, likely reflecting contextual differences in expectations, access to specialised care, and cultural perceptions. Education appears to play a protective role, with higher educational attainment associated with better QoL outcomes. Infertility remains a major concern in both countries, yet access to advanced fertility treatments was limited in Rwanda, where satisfaction with care was also markedly lower. These findings highlight the need to strengthen reproductive health education to improve timely care-seeking, and to promote public-private partnerships aimed at expanding access to assisted reproductive technologies in Rwanda and similar low-resource settings. Strengthening these areas may contribute to improved fertility outcomes and better quality of life for women affected by endometriosis.

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## Ethics Approval and Consent to Participate

This study was conducted according to ethical principles as stated in the Declaration of Helsinki (1996) and applicable guidelines on Good Clinical Practice. Approval was obtained from the Research and Ethics Committees of three hospitals involved in this study, with reference numbers: Jingzhou First People's Hospital (IRB-AF/16-1.0), CHUK (EC/CHUK/042/2025) and KFH (KFH/2025/296/IRD). In China, the approval from Jingzhou First People's Hospital was deemed sufficient by the Jingzhou Central Hospital, where only administrative clearance to access the clinic was sought.

Participants provided written informed consent to participate in the study and were informed of their right to withdraw at will without any repercussions. Participants' identifiers, such as names, registration numbers or initials, were not captured.

## Availability of Data and Materials

The datasets analysed in this study can be provided by the corresponding author upon reasonable request.

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## Authors' Contribution

FI conceived the study idea. FI and CY designed the methodology. FI, and SLD oversaw data collection activities. FI drafted the manuscript while SLD, HW, QSZ and CY critically reviewed it. All authors read and approved the final manuscript.

## Conflicts of Interest

The authors declare that they have no competing interests.

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## List of Abbreviations

| | |
|---|---|
| **ART:** | Assisted Reproductive Technologies |
| **CHUK:** | University Teaching Hospital of Kigali |
| **CNY:** | Chinese Yuan Renminbi |
| **EIQ:** | Endometriosis Impact Questionnaire |
| **FPHJ:** | First People's Hospital of Jingzhou |
| **IQR:** | Interquartile Range |
| **IRB:** | Institutional Review Board |
| **IUI:** | Intrauterine Insemination |
| **IVF:** | *In Vitro* Fertilisation |
| **JCH:** | Jingzhou Central Hospital |
| **KFHR:** | King Faisal Hospital, Rwanda |
| **MRI:** | Magnetic Resonance Imaging |
| **QoL:** | Quality of Life |
| **RWF:** | Rwandan Franc |
| **USD:** | United States Dollar |