

# Analysis of Factors Influencing the Utilization and Future Intentions of Professional Postpartum Exercise Rehabilitation Services: A Cross-Sectional Study Using Hierarchical Analysis and Firth Logistic Regression

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## Research Article

**Keywords:** Postpartum rehabilitation, Service utilization, Determinants, Stratified analysis, Firth logistic regression, Ordered logistic regression

**Posted Date:** July 9th, 2026

**DOI:** <https://doi.org/10.21203/rs.3.rs-9994331/v1>

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**Additional Declarations:** No competing interests reported.

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# Abstract

## Background

Utilization of postpartum exercise rehabilitation services is low with significant socioeconomic disparities, but the underlying mechanisms remain unclear.

## Objective

To investigate factors influencing postpartum women's utilization of professional exercise rehabilitation services and their future intentions, and to examine differences across population subgroups.

## Methods

A multicenter cross-sectional study was conducted from June 2025 to January 2026 using convenience sampling, enrolling 1,059 pregnant or postpartum women. We used Firth penalized likelihood logistic regression for service utilization, ordered logistic regression for future intentions, and stratified analyses by education, income, and residential area.

## Results

Postpartum stage was the primary factor for service utilization (postpartum  $\leq 12$  months: OR = 12.34, 95%CI:5.58–29.13;  $>12$  months: OR = 58.05, 95%CI:19.00–206.98; both  $P < 0.001$ ). Barrier scores were negatively associated with utilization (OR = 0.0004, 95%CI:0.000003–0.003,  $P < 0.001$ ). Living alone as a couple was also negative (OR = 0.34, 95%CI:0.15–0.72,  $P = 0.005$ ). Sensitivity analysis (excluding barriers) showed positive associations for cognitive scores (OR = 1.19,  $P < 0.001$ ) and educational level (OR = 1.45,  $P = 0.032$ ). Future intentions were positively associated with cognitive scores (OR = 1.19,  $P < 0.001$ ) and educational level (OR = 1.55,  $P = 0.001$ ), and negatively with barrier scores (OR = 0.77,  $P < 0.001$ ) and living in suburban/remote areas (OR = 0.56–0.46, both  $P < 0.001$ ). Stratified analyses confirmed consistent negative barrier effects and positive postpartum stage effects across all subgroups (all  $P < 0.001$ ).

## Conclusion

Postpartum stage and structural barriers are key predictors of service utilization, whereas cognitive and educational levels predict future intentions. The intention–behavior gap suggests interventions should prioritize reducing structural barriers rather than relying solely on health education.

## 1 Introduction

Postpartum health issues pose a significant challenge in global public health. A study published by the World Health Organization in *The Lancet Global Health* indicates that approximately 140 million women give birth

worldwide each year, and nearly 30% of them experience ongoing health problems after childbirth [1]. Clinical guidelines from multiple professional organizations have recommended that postpartum women gradually resume regular physical activity [2, 3]. Exercise interventions have been proven to be an effective means of postpartum rehabilitation and are cost-effective [4]. However, despite these guidelines and evidence, the proportion of postpartum women actively utilizing professional exercise rehabilitation services remains low, and significant socioeconomic disparities exist. More notably, there is currently a systemic gap in postpartum exercise rehabilitation services, with the conflict between traditional “confinement” customs and modern rehabilitation concepts being particularly pronounced [5]. This gap in the translation from “effective interventions” to “effective services” constitutes the core research question of this study.

The Andersen Model of Health Care Utilization serves as a key theoretical framework for explaining health care utilization. This model posits that an individual’s utilization behavior is primarily influenced by the combined effects of predisposing factors (e.g., education, health beliefs), enabling factors (e.g., income, accessibility), and need factors [6]. Previous studies have widely adopted this model, confirming that educational level, economic status, health literacy, and service accessibility are all closely associated with service utilization [7]. Furthermore, sociodemographic factors are closely linked to maternal and child health service utilization: women with lower educational levels tend to have lower utilization rates even when objective barriers to access are minimal [8]; transportation, financial burden, and uneven distribution of healthcare resources also serve as significant barriers [9].

However, existing studies are mostly based on population-level analyses and lack systematic exploration of differences across socioeconomic groups, making it difficult to uncover underlying heterogeneity. Furthermore, although different factors may drive actual utilization behavior and future intention to use, few studies have examined them simultaneously. Therefore, based on nationwide multicenter cross-sectional data and using the Andersen model as a theoretical framework, this study focuses on the utilization behavior and future intention to use professional postpartum exercise rehabilitation services among women. It systematically analyzes the influencing factors and compares their effects across populations with varying educational, income, and residential levels. Through stratified analysis, the study aims to reveal the influence patterns of each factor across different populations, thereby providing a scientific basis for developing targeted intervention strategies tailored to specific groups.

## **2 Materials and Methods**

### **2.1 Study Design**

This study employed a cross-sectional survey design. Data collection took place from June 2025 to January 2026. A combination of online and offline methods was used to recruit pregnant or postpartum women who met the inclusion criteria as study participants. Participants were not limited to specific regions or institutions; recruitment was primarily conducted through maternal and child health hospitals, community hospitals, and online platforms such as WeChat. Convenience sampling was used for data collection, which may introduce selection bias. This study has been approved by the Ningxia University Technology Ethics Committee (Ethics Approval No.: 24BTY043).

## 2.2 Inclusion and Exclusion Criteria

### 2.2.1 Inclusion Criteria

1. Pregnant or postpartum women; 2. Aged 18–50 years; 3. Possess normal verbal communication and literacy skills; 4. voluntarily participate in this study and sign an informed consent form.

### 2.2.2 Exclusion Criteria

1. Individuals with intellectual disabilities who are unable to complete the assessment scales independently; 2. Individuals unable to correctly understand the questionnaire content or engage in effective communication; 3. Individuals with significant disabilities, severe physical illnesses, or severe pregnancy complications.

## 2.3 Sample Size Determination

The sample size for this study was determined based on the event number requirements for multivariate regression analysis. Following the principle that logistic regression requires at least 10 outcome events per independent variable ( $EPV \geq 10$ ), this study included 15 explanatory variables, resulting in a theoretical minimum sample size of 150 outcome events. The actual study included 1,059 valid cases: 557 exhibited service utilization behavior, and 502 did not. The number of outcome events was sufficient and significantly exceeded the minimum requirement. In the multivariate analysis, due to the occurrence of complete or quasi-complete separation in traditional logistic regression models, this study employed Firth penalized likelihood logistic regression for estimation. This method is relatively more robust with respect to sample size requirements and is suitable for small samples or situations involving separated data. All models were analyzed based on the complete sample, without any additional sample screening.

## 2.4 Data Collection

Data collection in this study was conducted using a structured questionnaire designed by the research team (See Attachment 1). The questionnaire content was developed based on relevant domestic and international literature and the study objectives, covering multiple dimensions, including demographic characteristics, fertility-related information, and cognitive, demands, and barriers related to postpartum recovery. The questionnaire design was tailored to the characteristics of the domestic study population, thereby enhancing comprehensibility and applicability. Prior to the formal survey, a pilot test was conducted with a sample representing approximately 5% of the total population. Based on the feedback received, necessary revisions were made to the wording and structure of the questionnaire items. During the pilot testing phase, Cronbach's  $\alpha$  was used to assess the internal consistency of each questionnaire dimension; results indicated good reliability for all dimensions ( $\alpha > 0.7$ ). The questionnaire content was reviewed by experts in maternal and child health or reproductive health to ensure content validity. Data collection was conducted through a combination of online and offline methods, with participants voluntarily completing and submitting the questionnaire anonymously. Mandatory items were included to minimize missing data. After data collection was completed, the research team performed unified data cleaning and quality control, including checks for logical consistency and outlier screening. Ultimately, 1,059 valid questionnaires were included in the analysis.

## 2.5 Operational Definitions of Core Variables

Used Chat GPT to generate code and resolve issues arising during the data processing. Employed Chat GPT to refine language expression and improve logical coherence during article writing. Finally, used Grammarly to correct grammar. This section provides specific details regarding the operational definitions of the variables (i.e., which questionnaire items correspond to each factor, how they are scored, and the meaning of the scores).

Based on the Andersen Model of Health Service Utilization, this study defines the independent variables as predisposing factors (cognitive scores), enabling factors (barrier scores), and demand factors (demand scores). All variables were measured using a self-developed questionnaire, as detailed below.

(1) Cognitive Score: Measured using two multiple-choice questions. The first question asks, "Which of the following methods do you believe are helpful for postpartum recovery?" Options include scientific exercise, dietary adjustments, physical therapy, and traditional Chinese medicine. The second question asks, "Which of the following postpartum issues do you believe exercise can improve?" Options include weight restoration, pelvic floor muscle function, diastasis recti, lower back/pelvic pain, and mental state. One point was awarded for each reported option. The total score was calculated by combining the scores from both questions, with a range of 0–9 points. A higher score indicates greater awareness of postpartum exercise rehabilitation.

(2) Barrier Score: Measured using two multiple-choice questions. The first question asked about the main reasons for not engaging in postpartum exercise rehabilitation (for non-users), and the second question asked about the main reasons for not exercising (for those who did not exercise). There are 10 barrier options in total, including: excessive cost, concerns about effectiveness, distance, lack of childcare, lack of awareness, belief that daily rest is sufficient, concerns about affecting breastfeeding, lack of family support, privacy concerns, and preference for traditional Chinese medicine. Each reported barrier is scored as 1 point; the total score is calculated by combining the scores from both questions, with a range of 0–10 points. A higher score indicates greater perceived structural barriers.

(3) Demand Score: Measured using a multiple-choice question and an ordinal question. The multiple-choice question asks, "What issues do you most hope to address through postpartum exercise rehabilitation?" Each selected need is scored 1 point. The ordinal question asks, "How likely are you to try professional postpartum exercise rehabilitation guidance in the future?" Responses are rated on a 5-point scale (1 = not at all likely, 2 = unlikely, 3 = uncertain, 4 = somewhat likely, 5 = very likely). This variable is treated as a continuous variable in regression analysis, with higher scores indicating stronger demand. In the main analysis, the ordinal question serves as the core indicator of demand score.

(4) Service Utilization Behavior: The dependent variable is the question "Have you already purchased or experienced specialized postpartum exercise rehabilitation?" A response of "Yes" is coded as 1, and "No" as 0.

(5) Future Intention to Use: The original question is "In the future, how likely are you to try professional postpartum exercise rehabilitation guidance?" with a 5-point scale: Very likely, Some what likely, Unsure, Not

very likely, and Not at all likely. Since the sample distribution was skewed (with low proportions in the “Unsure,” “Unlikely,” and “Not at all likely” groups), the last three options were merged into “Not positive.” “Very likely” was retained as “Very positive” and “Somewhat likely” as “Somewhat positive,” ultimately forming a three-category ordinal variable (1 = Very positive, 2 = Somewhat positive, 3 = Not positive). In Table 1, “future willingness” is ranked from low to high, whereas in the regression analysis, a smaller value indicates higher willingness; the interpretation of the OR values is consistent with this.

## 2.6 Data Processing and Analysis

This study used RStudio software for statistical analysis. The variable codes are as follows: (1) Educational level: 1 = low education (junior high school or below), 2 = intermediate education (high school/vocational school), 3 = high education (bachelor’s degree or above); (2) Income level (higher values indicate higher income): 1 = low income (< 5,000 RMB/month), 2 = middle income (5,000–10,000 RMB/month), 3 = higher income (> 10,000 RMB/month); (3) Residential area: 1 = core urban areas, 2 = suburban/general urban areas, 3 = remote suburban/township/other; (4) Parity: 1 = unipara, 2 = multipara. Cognitive, barrier, and demand scores were included in the model as continuous variables, with higher scores indicating higher levels.

In descriptive statistics, continuous variables are reported as mean  $\pm$  standard deviation, and categorical variables are reported as frequencies and proportions. In univariate analysis, the Kruskal–Wallis test was used for multi-group comparisons of continuous variables with non-normal distributions; the Wilcoxon signed-rank test was used for comparisons between the two groups regarding parity; and the Pearson  $\chi^2$  test was used for comparisons between categorical variables.

In multivariate analysis, “use of professional sports rehabilitation services” was used as the dependent variable (binary), and parameter estimates were obtained using Firth-penalized likelihood logistic regression, expressed as odds ratios (OR) and 95% confidence intervals (95% CI). An ordered logistic regression model was constructed with “intention to use in the future” (a 3-level ordered variable) as the dependent variable. Prior to analysis, the Brant test was used to verify the parallel lines hypothesis (proportional odds hypothesis); if  $P > 0.05$ , the hypothesis was accepted.

To investigate heterogeneity across subgroups, stratified analyses were conducted by educational level, income level, and residential area. In each subgroup, a Firth logistic regression model was constructed with “service utilization” as the dependent variable to compare differences in the effects of the variables across subgroups. A sensitivity analysis was performed: the Firth logistic regression model was refitted after excluding the disability score variable to assess the robustness of the model results.

All statistical tests were two-sided, and P-values < 0.05 were considered statistically significant.

## 3 Results

### 3.1 General Characteristics of the Study Participants

A total of 1,059 pregnant or postpartum women were included in the analysis. The mean age of the participants was 30.3 years ( $\pm 4.1$ ). In accordance with the study objectives, the sample was grouped and

described according to variables such as current generation, occupation, and feeding patterns. The specific distribution of each variable is shown in Table 1.

Table 1  
General demographic characteristics and social stratification distribution of the study participants(n = 1059)

| Variables                                                                                                           | Classification                   | n   | Constituent ratio(%) |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------|-----|----------------------|
| Current generation                                                                                                  | Pregnancy                        | 144 | 13.6                 |
|                                                                                                                     | Postpartum ≤ 12 months           | 429 | 40.5                 |
|                                                                                                                     | Postpartum > 12 months           | 486 | 45.9                 |
| Occupation                                                                                                          | Stay-at-home mom                 | 431 | 40.7                 |
|                                                                                                                     | Stable career                    | 287 | 27.1                 |
|                                                                                                                     | Unstable occupation              | 341 | 32.2                 |
| Feeding patterns                                                                                                    | Mixed feeding                    | 313 | 29.6                 |
|                                                                                                                     | Exclusive breastfeeding          | 334 | 31.5                 |
|                                                                                                                     | Non-breastfed/ Weaned            | 412 | 38.9                 |
| Living pattern                                                                                                      | Living with the elderly          | 532 | 50.2                 |
|                                                                                                                     | Couples living alone             | 438 | 41.4                 |
|                                                                                                                     | Rests                            | 89  | 8.4                  |
| Education level                                                                                                     | Low academic qualification       | 375 | 35.4                 |
|                                                                                                                     | Secondary education              | 308 | 29.1                 |
|                                                                                                                     | High academic qualifications     | 376 | 35.5                 |
| Income level                                                                                                        | Low income                       | 430 | 40.6                 |
|                                                                                                                     | Middle income                    | 463 | 43.7                 |
|                                                                                                                     | Higher income                    | 166 | 15.7                 |
| Residential area                                                                                                    | Core urban area                  | 415 | 39.2                 |
|                                                                                                                     | Suburban/ General urban area     | 245 | 23.1                 |
|                                                                                                                     | Remote suburbs/ Townships/ Other | 399 | 37.7                 |
| Parity                                                                                                              | Unipara                          | 443 | 41.8                 |
|                                                                                                                     | Multipara                        | 616 | 58.2                 |
| Whether to use sports rehabilitation services                                                                       | No                               | 502 | 47.4                 |
|                                                                                                                     | Yes                              | 557 | 52.6                 |
| Note: In future intentions, "not positive" includes the original options "uncertain," "unlikely," and "impossible." |                                  |     |                      |

| Variables                                                                                                           | Classification      | n   | Constituent ratio(%) |
|---------------------------------------------------------------------------------------------------------------------|---------------------|-----|----------------------|
| Future intentions                                                                                                   | Not active          | 397 | 37.5                 |
|                                                                                                                     | Relatively positive | 289 | 27.3                 |
|                                                                                                                     | Very positive       | 373 | 35.2                 |
| Note: In future intentions, "not positive" includes the original options "uncertain," "unlikely," and "impossible." |                     |     |                      |

## 3.2 Univariate Analysis

The results of the univariate analysis showed significant differences in service utilization and related indicators across different socioeconomic variables. Specifically, across educational, income, and residential area strata, statistically significant differences were observed in cognitive, barrier, and demand scores among different educational levels, income groups, and regions (all  $P < 0.001$ ). Similarly, significant differences were found in service utilization and future usage intentions (all  $P < 0.001$ ). In contrast, parity had no significant effect on scores for cognitive, barriers, or demand (all  $P > 0.05$ ). Regarding service utilization, parity did not significantly affect service utilization ( $P = 0.662$ ), but there was a statistically significant difference in the distribution of future usage intentions ( $P = 0.001$ ). See Table 2 for specific details.

Table 2  
Univariate analysis of cognition, disability, needs, and service utilization across different stratification variables(n = 1059)

| Stratified variable                | Target              | Statistical approach   | statistical magnitude | P-value |
|------------------------------------|---------------------|------------------------|-----------------------|---------|
| Education level                    | Cognitive score     | Kruskal–Wallis test    | $\chi^2=76.56$        | < 0.001 |
| Low academic qualification(375)    | Barrier score       | Kruskal–Wallis test    | $\chi^2=54.05$        | < 0.001 |
| Secondary education(308)           | Demand score        | Kruskal–Wallis test    | $\chi^2=15.06$        | < 0.001 |
| High academic qualifications(376)  | Service utilization | $\chi^2$ test          | $\chi^2=48.70$        | < 0.001 |
|                                    | Future intentions   | $\chi^2$ test          | $\chi^2=99.91$        | < 0.001 |
| Income level                       | Cognitive score     | Kruskal–Wallis test    | $\chi^2=65.52$        | < 0.001 |
| Low income(430)                    | Barrier score       | Kruskal–Wallis test    | $\chi^2=27.10$        | < 0.001 |
| Middle income(463)                 | Demand score        | Kruskal–Wallis test    | $\chi^2=21.07$        | < 0.001 |
| Higher income(166)☐                | Service utilization | $\chi^2$ test          | $\chi^2=31.79$        | < 0.001 |
|                                    | Future intentions   | $\chi^2$ test          | $\chi^2=35.21$        | < 0.001 |
| Residential area                   | Cognitive score     | Kruskal–Wallis test    | $\chi^2=30.11$        | < 0.001 |
| Core urban area(415)               | Barrier score       | Kruskal–Wallis test    | $\chi^2=39.38$        | < 0.001 |
| Suburban / General urban area(245) | Demand score        | Kruskal–Wallis test    | $\chi^2=12.46$        | 0.002   |
| Suburbs/ Townships/ Other(399)☐    | Service utilization | $\chi^2$ test          | $\chi^2=29.77$        | < 0.001 |
|                                    | Future intentions   | $\chi^2$ Test          | $\chi^2=78.19$        | < 0.001 |
| Parity                             | Cognitive score     | Wilcoxon rank-sum test | W = 142203            | 0.235   |
| Unipara(443)                       | Barrier score       | Wilcoxon rank-sum test | W = 128804            | 0.080   |
| Multipara(616)                     | Demand score        | Wilcoxon rank-sum test | W = 138234            | 0.713   |

| Stratified variable | Target              | Statistical approach | statistical magnitude | P-value |
|---------------------|---------------------|----------------------|-----------------------|---------|
|                     | Service utilization | $\chi^2$ test        | $\chi^2=0.19$         | 0.662   |
|                     | Future intentions   | $\chi^2$ test        | $\chi^2=13.14$        | 0.001   |

### 3.3 Multivariate Regression Analysis

#### 3.3.1 Analysis of Factors Influencing Service Utilization Using Firth Logistic Regression

In the multivariate analysis, a regression model was constructed with “service utilization” as the dependent variable. Due to the occurrence of complete or quasi-complete separation during the fitting process in traditional logistic regression models, this study employed Firth penalized likelihood logistic regression for estimation; the results are shown in Table 3.

The results indicate that the postpartum stage is the primary factor influencing service utilization. Compared with the prenatal period, women in the postpartum period  $\leq 12$  months (OR = 12.34, 95% CI: 5.58–29.13,  $P < 0.001$ ) and those in the postpartum period  $> 12$  months (OR = 58.05, 95% CI: 19.00–206.98,  $P < 0.001$ ) were more likely to utilize services. The barrier score (OR = 0.0004, 95% CI: 0.000003–0.003,  $P < 0.001$ ) was significantly negatively correlated with service utilization. It should be noted that the barrier score ranges from 0 to 10 points, with each additional point representing the reporting of one more barrier type. Therefore, this OR value reflects the inhibitory effect on service utilization associated with each additional barrier type; a smaller value indicates a stronger negative effect. Cognitive and need scores did not show significant independent associations in the multivariate model (both  $P > 0.05$ ).

Among demographic variables, service utilization was lower among couples living alone (OR = 0.34, 95% CI: 0.15–0.72,  $P = 0.005$ ). After adjusting for other variables, no significant independent associations were observed for age, educational level, income level, residential area, parity, occupation, or feeding pattern (all  $P > 0.05$ ).

Table 3  
Multivariate Firth Logistic Regression Analysis of Factors Associated with the  
Purchase of Professional Sports Rehabilitation Services (n = 1059)

| Variables                    | OR     | 95%CI            | P-value |
|------------------------------|--------|------------------|---------|
| Cognitive score              | 1.08   | 0.89–1.32        | 0.410   |
| Barrier score                | 0.0004 | 0.000003–0.00310 | < 0.001 |
| Demand score                 | 1.06   | 0.87–1.28        | 0.572   |
| Age                          | 1.04   | 0.96–1.14        | 0.339   |
| Postpartum ≤ 12 months       | 12.34  | 5.58–29.13       | < 0.001 |
| Postpartum>12months          | 58.05  | 19.00–206.98     | < 0.001 |
| Stable career                | 2.42   | 0.88–6.99        | 0.089   |
| Unstable occupation          | 1.41   | 0.59–3.46        | 0.444   |
| Exclusive breastfeeding      | 0.86   | 0.40–1.86        | 0.700   |
| Non-breastfed / Weaned       | 1.62   | 0.62–4.32        | 0.328   |
| Couples living alone         | 0.34   | 0.15–0.72        | 0.005   |
| Other ways of living         | 0.48   | 0.11–2.72        | 0.375   |
| Educational level            | 1.18   | 0.54–2.63        | 0.676   |
| Income level                 | 1.33   | 0.64–2.90        | 0.449   |
| Suburban/ General urban area | 1.00   | 0.41–2.49        | 0.994   |
| Suburbs/ Townships/ Other    | 1.17   | 0.48–2.89        | 0.736   |
| Multipara                    | 1.02   | 0.46–2.25        | 0.963   |

### 3.3.2 First Logistic Regression Model Excluding Barriers

To assess the robustness of the model results, a sensitivity analysis was conducted by rebuilding the Firth Logistic regression model after excluding the barrier score variable from the multivariate model. The specific results are shown in Table 4. The results indicate that, after excluding the barrier score, the effects of some variables changed significantly. Cognitive scores shifted from a non-significant association in the original model to a significant positive association (OR = 1.19, 95% CI: 1.09–1.31,  $P < 0.001$ ). Educational level also had a positive effect (OR = 1.45, 95% CI: 1.03–2.03,  $P = 0.032$ ). The postpartum period was also a significant factor; compared with the prenatal period, women in the postpartum period ≤ 12 months (OR = 3.50, 95% CI: 2.07–6.14,  $P < 0.001$ ) and those in the postpartum period > 12 months (OR = 8.84, 95% CI: 5.01–16.11,  $P < 0.001$ ) were more likely to use the services, though the effect size was weaker than in the main model. The feeding patterns showed a significant effect in the sensitivity analysis, with non-breastfeeding or weaned women being more likely to use the services (OR = 2.66, 95% CI: 1.77–4.02,  $P < 0.001$ ). Women living alone with their spouse were less likely to use the service (OR = 0.39, 95% CI: 0.28–0.54,  $P < 0.001$ ), while those in

remote suburbs/ townships/ other areas were less likely to use the service compared to those in the central urban area (OR = 0.58, 95% CI: 0.39–0.85, P = 0.005).

Table 4  
Firth Logistic Regression Adjusted for Confounding Factors

| Variables                        | OR   | 95% CI     | P-value |
|----------------------------------|------|------------|---------|
| Cognitive score                  | 1.19 | 1.09–1.31  | < 0.001 |
| Demand score                     | 1.06 | 0.97–1.15  | 0.172   |
| Age                              | 1.04 | 1.00–1.07  | 0.035   |
| Postpartum ≤ 12 months           | 3.50 | 2.07–6.14  | < 0.001 |
| Postpartum > 12 months           | 8.84 | 5.01–16.11 | < 0.001 |
| Stable career                    | 1.46 | 0.92–2.35  | 0.112   |
| Unstable occupation              | 0.88 | 0.60–1.28  | 0.511   |
| Exclusive breastfeeding          | 0.75 | 0.51–1.09  | 0.126   |
| Non-breastfed / Weaned           | 2.66 | 1.77–4.02  | < 0.001 |
| Couples living alone             | 0.39 | 0.28–0.54  | < 0.001 |
| Other ways of living             | 0.51 | 0.29–0.91  | 0.022   |
| Educational level                | 1.45 | 1.03–2.03  | 0.032   |
| Income level                     | 1.13 | 0.81–1.60  | 0.472   |
| Remote suburbs/ Townships/ Other | 0.58 | 0.39–0.85  | 0.005   |

### 3.3.3 Ordinal Logistic Regression for Future Usage Intentions

An ordinal logistic regression model was established with “future usage intentions” as the ordinal dependent variable. The results (see Table 5) showed that cognitive scores (OR = 1.19, 95% CI: 1.10–1.28, P < 0.001) and demand scores (OR = 1.07, 95% CI: 1.00–1.15, P = 0.045) were significantly associated with future usage intention. Higher barrier scores (OR = 0.77, 95% CI: 0.70–0.84, P < 0.001) were associated with lower future usage intention. Among demographic factors, educational level (OR = 1.55, 95% CI: 1.19–2.02, P = 0.001) was positively associated with future intention. Differences were also observed by residential area: compared with the central urban area, residents in the suburbs/general urban areas (OR = 0.56, 95% CI: 0.41–0.77, P < 0.001) and the remote suburbs/ townships/ other areas (OR = 0.46, 95% CI: 0.34–0.62, P < 0.001) exhibited lower future usage intentions. In the multivariate model, no significant independent associations were observed for income level, parity, age, current stage, occupation, feeding patterns, or living pattern (all P > 0.05). The Brant test results indicated that the parallel lines hypothesis was met ( $\chi^2 = 24.54$ , d f = 19, P = 0.176), supporting the use of an ordered logistic regression model.

Table 5  
Ordered Logistic Regression Analysis of Future Usage Intentions(n = 1059)

| Variables                        | OR   | 95% CI    | P-value |
|----------------------------------|------|-----------|---------|
| Cognitive score                  | 1.19 | 1.10–1.28 | < 0.001 |
| Barrier score                    | 0.77 | 0.70–0.84 | < 0.001 |
| Demand score                     | 1.07 | 1.00–1.15 | 0.045   |
| Age                              | 1.00 | 0.97–1.02 | 0.692   |
| Postpartum ≤ 12 months           | 1.18 | 0.78–1.79 | 0.438   |
| Postpartum>12months              | 1.30 | 0.81–2.09 | 0.280   |
| Income level                     | 1.12 | 0.86–1.31 | 0.40    |
| Couples living alone             | 0.76 | 0.57–1.01 | 0.056   |
| Educational level                | 1.55 | 1.19–2.02 | 0.001   |
| Suburban/ General urban area     | 0.56 | 0.41–0.77 | < 0.001 |
| Remote suburbs/ Townships/ Other | 0.46 | 0.34–0.62 | < 0.001 |

## 3.4 Stratified Analysis Using Firth Logistic Regression

To explore heterogeneity in influencing factors across subgroups, this study conducted stratified analyses using a Firth penalized likelihood logistic regression model, stratified by educational level, income level, and residential area. All models included cognitive, barrier, and demand scores, as well as relevant covariates. Overall, barrier scores were significantly negatively correlated across all stratified groups (all  $P < 0.001$ ). Compared with pregnant women, the likelihood of service utilization was significantly higher among women within 12 months postpartum and those more than 12 months postpartum (both  $P < 0.001$ ). In the remote suburban/ rural subgroup, cognitive scores were significantly positively correlated with service utilization.

### 3.4.1 Stratification by Educational Attainment

In the stratification by educational level, the results show that barrier scores hurt service utilization across different educational levels: low educational attainment (OR = 0.001, 95% CI: 0.000–0.010,  $P < 0.001$ ), intermediate educational attainment (OR = 0.002, 95% CI: 0.000–0.013,  $P < 0.001$ ), high educational attainment (OR = 0.000, 95% CI: 0.000–0.004,  $P < 0.001$ ). The likelihood of service utilization within 12 months postpartum was higher across different educational levels: low educational attainment (OR = 7.05, 95% CI: 1.64–36.61,  $P = 0.008$ ), intermediate educational attainment (OR = 81.34, 95% CI: 16.31–633.71,  $P < 0.001$ ), and high education (OR = 13.80, 95% CI: 4.47–48.43,  $P < 0.001$ ). Among different educational levels, the likelihood of service utilization more than 12 months postpartum was significantly higher than that of pregnant women: low education (OR = 51.93, 95% CI: 9.18–390.91,  $P < 0.001$ ), intermediate education (OR = 182.74, 95% CI: 36.69–1430.29,  $P < 0.001$ ), and high education (OR = 106.83, 95% CI: 19.84–1140.82,  $P <$

0.001). No statistical significance was observed for the remaining variables across any educational subgroups (all  $P > 0.05$ ). See Table 6 for specific results.

Table 6  
Stratified by Educational Level(n = 1059)

| Variables              | Low academic qualification<br>(n = 375)<br>OR 95%CI | P-value | Secondary education (n = 308)<br>OR 95%CI | P-value | High academic qualifications<br>(n = 376)<br>OR 95%CI | P-value |
|------------------------|-----------------------------------------------------|---------|-------------------------------------------|---------|-------------------------------------------------------|---------|
| Cognitive score        | 1.10 (0.80–1.54)                                    | 0.574   | 1.35 (0.91–2.029)                         | 0.132   | 0.85 (0.59–1.16)                                      | 0.307   |
| Barrier score          | 0.001(0.000–0.010)                                  | < 0.001 | 0.002(0.000–0.013)                        | < 0.001 | 0.000(0.000–0.004)                                    | < 0.001 |
| Demand score           | 1.29 (0.92–1.85)                                    | 0.135   | 1.02 (0.66–1.54)                          | 0.934   | 0.87 (0.65–1.13)                                      | 0.291   |
| Age                    | 1.07(0.93–1.25)                                     | 0.357   | 1.04(0.89–1.22)                           | 0.629   | 0.997(0.85–1.18)                                      | 0.971   |
| Parity                 | 0.65(0.24–1.71)                                     | 0.377   | 0.65(0.18–2.05)                           | 0.464   | 2.93(0.97–11.29)                                      | 0.057   |
| Postpartum ≤ 12 months | 7.054(1.644–36.609)                                 | 0.008   | 81.34(16.31–633.71)                       | < 0.001 | 13.80(4.47–48.43)                                     | < 0.001 |
| Postpartum>12months    | 51.93(9.84–390.91)                                  | < 0.001 | 182.74(36.69–1430.29)                     | < 0.001 | 106.83(19.84–1140.82)                                 | < 0.001 |

### 3.4.2 Stratification by Income Level

In the stratified analysis by income level, barrier scores hurt service utilization across all income groups: low income (OR = 0.001, 95% CI: 0.00–0.01,  $P < 0.001$ ), middle income (OR = 0.00, 95% CI: 0.00–0.005,  $P < 0.001$ ), and higher income groups (OR = 0.001, 95% CI: 0.00–0.002,  $P < 0.001$ ). Service utilization within 12 months postpartum was higher than during pregnancy across all income groups: low income (OR = 25.89, 95% CI: 6.79–117.48,  $P < 0.001$ ), middle income (OR = 10.77, 95% CI: 4.08–31.28,  $P < 0.001$ ), and higher income (OR = 332.41, 95% CI: 13.31–1,400,167.09,  $P = 0.001$ ). Service utilization among women more than 12 months postpartum was higher than among pregnant women across all income groups: low income (OR = 83.30, 95% CI: 19.22–466.74,  $P < 0.001$ ), middle income (OR = 119.95, 95% CI: 25.84–1,180.17,  $P < 0.001$ ), and higher income (OR = 1,300.46, 95% CI: 45.29–8,175,695.28,  $P < 0.001$ ). The remaining variables did not demonstrate consistent statistical significance across the income subgroups (all  $P > 0.05$ ). See Table 7 for specific results.

Table 7  
Stratified by Income Level (n = 1059)

| Variables              | Low income(n = 430)<br>OR 95%CI | P-value | Middle income<br>(n = 463)<br>OR 95%CI | P-value | Higher income(n = 166) OR 95%CI | P-value |
|------------------------|---------------------------------|---------|----------------------------------------|---------|---------------------------------|---------|
| Cognitive score        | 1.31(0.98–1.77)                 | 0.066   | 0.92(0.70–1.20)                        | 0.553   | 0.902(0.12–5.44)                | 0.861   |
| Barrier score          | 0.001(0.00–0.01)                | < 0.001 | 0.00(0.00–0.005)                       | < 0.001 | 0.001(0.00–0.02)                | < 0.001 |
| Demand score           | 1.15(0.86–1.54)                 | 0.352   | 1.003(0.80–1.26)                       | 0.979   | 1.19(0.20–4.26)                 | 0.719   |
| Age                    | 1.01(0.90–1.14)                 | 0.887   | 1.02(0.91–1.15)                        | 0.740   | 1.43(0.99–3.18)                 | 0.058   |
| Parity                 | 0.65(0.31–1.31)                 | 0.225   | 1.82(0.81–4.45)                        | 0.153   | 0.25(0.002–3.002)               | 0.258   |
| Postpartum ≤ 12 months | 25.89(6.79–117.48)              | < 0.001 | 10.77(4.08–31.28)                      | < 0.001 | 332.41(13.31–1400167.09)        | < 0.001 |
| Postpartum > 12 months | 83.30(19.22–466.74)             | < 0.001 | 119.95(25.84–1180.17)                  | < 0.001 | 1300.46(45.29–8175695.28)       | < 0.001 |

### 3.4.3 Stratification by Residential Area

In the stratified analysis by residential area, the cognitive score in the remote suburban/ township/ other areas (OR = 1.47, 95% CI: 1.01–2.24, P = 0.042) had a positive effect on service utilization, while the barrier score hurt service utilization in all areas: core urban areas (OR = 0.001, 95% CI: 0.00–0.008, P < 0.001), suburban/ general urban areas (OR = 0.004, 95% CI: 0.00–0.033, P < 0.001), and remote suburban/ townships/ other areas (OR = 0.001, 95% CI: 0.00–0.006, P < 0.001). In contrast, demand scores were significantly associated with purchasing behavior only among residents of suburban/ general urban areas (OR = 1.61, 95% CI: 1.13–2.38, P = 0.008). Across different regions, service utilization among women within 12 months postpartum was higher than among pregnant women: core urban areas (OR = 12.49, 95% CI: 4.82–35.20, P < 0.001), suburban/ general urban areas (OR = 33.37, 95% CI: 5.44–281.23, P < 0.001), and remote suburban/ townships/ other areas (OR = 17.43, 95% CI: 4.02–102.06, P < 0.001). Across different regions, service utilization more than 12 months postpartum was significantly higher than among pregnant women: core urban areas (OR = 83.4, 95% CI: 22.01–475.20, P < 0.001), suburban/ general urban areas (OR = 67.15, 95% CI: 10.05–701.34, P < 0.001), and remote suburban/ townships/ other areas (OR = 143.55, 95% CI: 22.23–1822.68, P < 0.001). The remaining variables did not demonstrate consistent statistical significance across regional subgroups (all P > 0.05). Specific results are shown in Table 8.

Table 8  
Stratified by Residential Area (n = 1059)

| Variables              | Core urban area (n = 415)<br>OR[95%CI] | P-value | Suburban / General urban area (n = 245)<br>OR[95%CI] | P-value | Remote Suburbs/ Townships/ Other (n = 339)<br>OR[95%CI] | P-value |
|------------------------|----------------------------------------|---------|------------------------------------------------------|---------|---------------------------------------------------------|---------|
| Cognitive score        | 1.10(0.84–1.45)                        | 0.49    | 0.97(0.73–1.49)                                      | 0.896   | 1.47(1.01–2.24)                                         | 0.042   |
| Barrier score          | 0.001(0.00–0.008)                      | < 0.001 | 0.004(0.000–0.033)                                   | < 0.001 | 0.001(0.000–0.006)                                      | < 0.001 |
| Demand score           | 0.88(0.68–1.12)                        | 0.294   | 1.61(1.13–2.38)                                      | 0.008   | 0.932(0.649–1.37)                                       | 0.717   |
| Age                    | 1.08(0.96–1.22)                        | 0.187   | 1.19(0.97–1.52)                                      | 0.098   | 0.96(0.805–1.13)                                        | 0.596   |
| Parity                 | 1.13(0.47–2.84)                        | 0.794   | 0.56(0.17–1.61)                                      | 0.291   | 0.96(0.37–2.67)                                         | 0.940   |
| Postpartum ≤ 12 months | 12.49(4.82–35.20)                      | < 0.001 | 33.37(5.44–281.23)                                   | < 0.001 | 17.43(4.02–102.06)                                      | < 0.001 |
| Postpartum > 12 months | 83.4(22.01–475.20)                     | < 0.001 | 67.15(10.05–701.34)                                  | < 0.001 | 143.55(22.23–1822.68)                                   | < 0.001 |

## 4 Discussion

Based on nationwide multicenter cross-sectional data, this study employed Firth penalized likelihood logistic regression and stratified analysis to systematically examine the determinants of service utilization among women during pregnancy or postpartum, as well as the heterogeneity of these factors across the population. The results indicate that structural barriers are consistently and significantly negatively associated with service utilization in both the overall model and all stratified subgroups, suggesting that they may impose significant constraints on service utilization. This finding is consistent with the conclusions of Yoseph A et al. [10]. Cognitive factors and demand showed negative effects only in two subgroups within the regional stratification, reflecting that structural barriers (distance, cost) exert a stronger influence on individuals than cognitive factors and need [11]. However, in sensitivity analyses, cognitive scores, the postpartum stage, and the non-breastfeeding/ weaned group were significantly positively correlated with service utilization ( $P < 0.001$ ). However, the mechanisms underlying actual service utilization and future intention to use may differ, primarily because behavior is more constrained by real-world conditions. In contrast, intention is more influenced by cognitive factors and social resources. This finding is consistent with the “intention-behavior” research results of Desta M et al. [12].

### 4.1 The Dominant Role of Barriers and Explanations of Their Mechanisms

The main finding of this study is that barrier scores were significantly negatively correlated with service utilization in all models, suggesting that higher barrier scores are associated with a lower likelihood of service utilization. This is consistent with previous research findings, indicating that economic burden, distance to services, and time costs may be important factors limiting the utilization of healthcare services [10, 11, 13]. The non-breastfeeding/ weaned subgroup showed a significant positive correlation with service utilization. This may be because, compared to breastfeeding infants, toddlers are less dependent on their mothers; under equal conditions regarding other factors, women in this subgroup have more time and may therefore be more willing to seek services. The Andersen model of health service utilization posits that healthcare utilization is influenced by the combined effects of predisposition, promotion, and need factors; however, it is important to note that structural barriers may play a significant constraining role in the actual behavioral process [6, 7]. Furthermore, the barrier dimensions in this study encompassed multiple aspects, including financial, time, and family-related factors, consistent with the concept of “multidimensional accessibility barriers” proposed by Abtew et al. [14] and Alkhamis et al. [15], further supporting the importance of structural factors in healthcare service utilization.

## **4.2 The Effect of Information Awareness Varies Across Subgroups**

The results show that, in the overall model, information awareness significantly promotes the intention to use services. However, a stratified analysis, further controlling for age, parity, and postpartum stage, revealed that the effect of information awareness is not consistent across all subgroups. While the association between information awareness and service utilization did not show an independent significant effect, it did show a significant positive effect among women in remote suburbs/ townships/ other subgroups (OR = 1.47, P = 0.042). Compared to other subgroups, this subgroup may be subject to regional resource constraints, making the impact of information awareness on the intention to use services more pronounced; other subgroups may have greater access to resources. The findings suggest that this effect may be “suppressed” by real-world barriers, consistent with the observations of Yoseph A et al. [10]. and Gabrysch S et al. [11]. In environments with high barriers, an individual’s cognitive advantages may struggle to translate into actual action. According to the Theory of Planned Behavior, an individual’s intention does not necessarily translate into behavior; both may be more heavily constrained by the external environment [16, 17]. In other words, even with high cognitive ability, when real-world resources are limited, cognitive advantages may fail to manifest fully. Consequently, in the presence of barrier scores, the independent effect of cognitive scores was suppressed and did not reach statistical significance.

## **4.3 Heterogeneity Analysis of Influencing Factors by Socioeconomic Stratification**

This study employed stratified analysis to explore differences in influencing factors and their mechanisms of action across different socioeconomic groups. Across populations with varying educational, income, and residential levels, barrier factors consistently exerted a stable negative effect. Structural barriers exert a fundamental constraining effect on healthcare utilization; that is, even when individuals possess certain cognitive awareness or needs, practical conditions may still constrain their behavior, consistent with previous findings [18–20]. Furthermore, this finding aligns with healthcare utilization theory, which posits

that in resource-constrained contexts, structural barriers often take precedence over individual characteristics in influencing behavior [6]. Given the characteristics of these barriers, service utilization exhibits significant social stratification, indicating systematic differences in service access and utilization across populations of varying socioeconomic status. This aligns with theories of health inequity, which suggest that socioeconomic status continuously influences individual health service utilization through pathways such as resource acquisition capacity, information accessibility, and service accessibility [12, 21].

## **4.4 The Postpartum Period Significantly Influences Service Utilization**

The results indicate that, in stratified analyses, the postpartum period ( $\leq 12$  months and  $> 12$  months) demonstrated a consistent positive effect across educational, income, and residential areas, significantly increasing the likelihood of service utilization among women. Hailemariam et al.[22] and Pradhan et al. [23]Also noted a significant increase in outpatient utilization of postpartum rehabilitation services. The findings of this study suggest that the impact on service utilization is consistent across different populations. Among these, the finding that different postpartum stages significantly influence service utilization holds strong practical validity. Postpartum exercise rehabilitation primarily addresses issues such as pelvic floor muscle dysfunction, rectus abdominis diastasis, and physical recovery resulting from childbirth. Women only develop a stronger need for these services after entering this stage. As the postpartum period progresses, physical injuries caused by childbirth may continue to affect women's health, and opportunities for individuals to access service information and actually receive services continue to increase. Consequently, the service-seeking behavior of postpartum women is significantly higher than that of pregnant women. However, it should be noted that, given the unique nature of the postpartum stage, this result likely reflects differences in service-exposure opportunities rather than a strict causal effect.

## **4.5 The Intention-Behavior Gap and Its Public Health Implications**

This study found significant differences in the factors influencing service utilization and future intention to use: service utilization is primarily influenced by structural barriers, whereas future intention to use is more closely related to individual cognitive levels and educational attainment. This suggests a clear disconnect between intention and behavior during service utilization. This aligns with the “intention-behavior gap” in health behavior theory, which posits that the process of translating intentions into actions is constrained by multiple factors, including resource availability, environmental limitations, and behavioral control [16, 17, 24]. In real life, even when individuals possess high health literacy and a strong intention to use services, they may still be unable to translate these into action due to financial constraints, time limitations, or insufficient service accessibility[25–27]. From a public health perspective, relying solely on health education to enhance health literacy may primarily influence the “intention level” but has a limited impact on actual behavioral change. Therefore, while improving health literacy, comprehensive interventions—such as reducing financial burdens, optimizing service provision, and enhancing service accessibility—should be implemented to facilitate the effective translation of intentions into actions [28].

## **5 Limitations and Future Prospects**

## 5.1 Limitations

This study has certain limitations, which should be carefully considered when interpreting the results. These limitations are specifically reflected in the following aspects: 1. The cross-sectional study design cannot establish the temporal sequence or causal relationships among variables; the statistical variables obtained may be influenced by unmeasured confounding factors or reverse causality mechanisms; 2. The sample size for some subgroups in the stratified analysis was limited, resulting in wide confidence intervals for some results; the stability of these findings requires further validation; 3. Measures such as service utilization, future intentions, and perceived barriers are based on self-reported data, which may be subject to social desirability bias or recall bias. 4. The study participants were drawn from different cities and surrounding areas; the applicability of the results across different regions and healthcare resource contexts requires further evaluation.

## 5.2 Future Prospects

This study found that postpartum women generally have a high potential demand for professional exercise rehabilitation; however, actual utilization is still significantly constrained by financial costs, time constraints, caregiving pressures, and service accessibility. This suggests that relying solely on health education is unlikely to increase effective service utilization. It is more important to optimize intervention pathways at the levels of service provision and primary care management. In future practice, efforts can be advanced in the following areas: 1. Integrate basic rehabilitation screening with routine postpartum follow-ups. It is recommended to incorporate standardized pelvic floor function assessments and health education into postpartum follow-up visits, community maternal and child health follow-ups, and child health care programs. This would improve women's ability to identify rehabilitation needs early and reduce the cost of additional medical visits. 2. Improve accessibility at the grassroots level. In the future, consideration should be given to establishing grassroots pelvic floor rehabilitation service points through community health service centers, maternal and child health hospitals, and county-level medical consortia to reduce the burden of cross-regional travel for medical care. 3. Optimize service hours and family support. Explore models such as flexible clinic hours, weekend clinics, online follow-ups, and home-based guidance to mitigate the impact of caregiving conflicts on rehabilitation adherence. 4. Moderately lower financial barriers. For certain basic rehabilitation programs, explore inclusion in postpartum health management packages, commercial insurance, supplementary coverage under universal health insurance, or local maternal and child public health initiatives, with a focus on resource-limited areas. 5. Strengthen digitalization and continuity of care. In the future, mobile healthcare platforms could be integrated to provide a full-service offering spanning screening, training, and follow-up. Through online reminders, home exercise guidance, and periodic feedback, adherence and service continuity can be improved. Future research could further adopt a longitudinal follow-up design to dynamically observe key influencing factors in the "awareness-willingness-behavior" transition process among postpartum women. By accounting for regional variations in healthcare resource allocation, the actual effectiveness of primary-level service delivery models in postpartum rehabilitation service utilization can be further evaluated.

## 6 Conclusions

Based on multicenter cross-sectional data, this study found that barriers are significant predictors of the utilization of professional exercise rehabilitation services, exhibiting a consistent negative association across populations with varying levels of education, income, and residential areas. Meanwhile, cognitive level, perceived need, and educational attainment were more closely associated with future intention to use these services, suggesting a potential “intention-to-action gap.” Stratified analysis revealed that the utilization of professional exercise rehabilitation services exhibits distinct patterns of social stratification. This suggests that future efforts should not only strengthen health education but also incorporate comprehensive measures, such as reducing financial burdens, improving service accessibility, and optimizing service delivery, to facilitate the transition from intention to action and thereby increase the utilization rate of postpartum exercise rehabilitation services.

## Declarations

### Ethics approval and consent to participate

This study was reviewed and approved by the Ningxia University Technology Ethics Committee (approval number: 24BTY043). All procedures involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Written informed consent was obtained from all individual participants included in the study. Participants were informed of the study purpose, voluntary nature of participation, right to withdraw at any time, and confidentiality of their data. No identifying information was collected, and all data were anonymized prior to analysis.

### Consent for publication

Not applicable.

### Availability of data and materials

The datasets used or analyzed during the current study are available from the corresponding author upon reasonable request. Due to privacy and ethical restrictions, the data are not publicly available.

### Competing interests

The authors declare that this study was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

### Funding

This work was supported by the National Social Science Fund of China (Grant No. 24BTY043).

### Author contributions

Ju Wen was responsible for designing and revising the questionnaire, while Ge Wen and Yiqing Xu were in charge of distributing and collecting it. Ge Wen handled data organization, analysis, and drafting the

manuscript. Ge Wen also translated the article and refined its grammar. Ju Wen and Haitao Liu were responsible for key revisions of the article.

## Acknowledgments

We sincerely thank the community hospitals and rehabilitation centers for their assistance in distributing the questionnaires. We also extend our heartfelt gratitude to all participants for their valuable time and active cooperation.

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## Supplementary Files

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- [Attachment1StudyontheMatchedDegreeofPostpartumExercise.pdf](#)