Research Square

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Factors Associated with the Utilization and Future Intention to Use Professional Postpartum Exercise Rehabilitation Services Among Postpartum Women: A Cross-Sectional Study Using Firth Logistic Regression and Stratified Analyses

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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 associated with postpartum women's utilization of professional exercise rehabilitation services and their future intentions, and to examine differences across population subgroups.

Methods

A cross-sectional survey was conducted from June 2025 to January 2026 using convenience sampling. Of 1076 records, 915 postpartum women were included in the final analysis. Firth penalized logistic regression was used to examine factors associated with professional postpartum exercise rehabilitation service utilization. Conventional logistic regression was conducted as a sensitivity analysis. Ordered logistic regression was used to examine future intention to use services, with previous service use included as an explanatory variable. Stratified Firth analyses were conducted by education, income, and residential area.

Results

In the Firth logistic model, higher cognitive scores (OR = 1.23, 95% CI: 1.11–1.36), older age (OR = 1.05, 95% CI: 1.01–1.08), Postpartum duration > 12 months versus ≤ 12 months (OR = 2.48, 95% CI 1.73–3.57), and being non-breastfeeding/weaned versus mixed feeding (OR = 2.68, 95% CI 1.74–4.14) were positively associated with service utilization. Living as a couple without older family members (OR = 0.39, 95% CI 0.28–0.55), other living arrangements (OR = 0.49, 95% CI 0.27–0.89), and residence in remote suburban/township/other areas (OR = 0.56, 95% CI 0.37–0.83) were negatively associated with utilization. In the ordered logistic model, previous service use was strongly associated with more positive future intention (OR = 3.15, 95% CI 2.31–4.31). Cognitive score (OR = 1.16, 95% CI 1.06–1.26) and the linear education contrast (OR = 1.71, 95% CI 1.28–2.29) were also positively associated with future intention, whereas suburban/general urban residence (OR = 0.61, 95% CI 0.43–0.86) and remote suburban/township/other residence (OR = 0.44, 95% CI 0.32–0.61) were negatively associated. The omnibus Brant test did not reject the proportional odds assumption (χ^2=24.11, df = 18, P = 0.15).

Conclusion

Service utilization and future intention among postpartum women were related but showed partially distinct associated factors. Previous service use showed a strong positive association with future intention, while cognitive awareness and residential context were relevant to both utilization-related and intention-related patterns. These findings support improving continuity of postpartum rehabilitation services, health information, and service accessibility. Because of the cross-sectional design, the findings should be interpreted as associations rather than causal effects.

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., age education, parity), enabling factors (e.g., income, residential), and need factors (e.g. demand score, postpartum stage) [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 a cross-sectional survey conducted across multiple cities and surrounding areas in China 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 examines factors associated with utilization and intention and compares these associations across populations

with varying educational, income, and residential levels. Through stratified analysis, the study aims to compare association patterns of each factor across population subgroups, 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 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.: NXU-2025-0221).

2.2 Inclusion and Exclusion Criteria

2.2.1 Inclusion Criteria

1. 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 estimated parameter (EPV ≥ 10), the models included up to 18 explanatory parameters, corresponding to a theoretical minimum of 180 outcome events. The actual study included 915 valid cases: 536 exhibited service utilization behavior, and 379 did not; in the ordered intention model, the smallest outcome category included 247 women. The number of outcome events was sufficient and significantly exceeded the minimum requirement. In the multivariate analysis, Firth penalized likelihood logistic regression was selected as the primary estimation approach to reduce potential small-sample and sparse-data bias and to maintain a consistent estimation framework across the overall and stratified analyses. Conventional logistic regression using the same covariates was additionally performed as a sensitivity analysis.

2.4 Data Collection

Data collection in this study was conducted using a structured questionnaire designed by the research team(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. In the final analytic sample, the internal consistency of the questionnaire-derived cognitive and demand dimensions was assessed using Cronbach's α. The coefficients were 0.709 and 0.767, respectively, indicating acceptable internal consistency. 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, 915 valid questionnaires were included in the analysis.

2.5 Operational Definitions of Core Variables

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), 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) Barriers among non-users: Reasons for not purchasing or experiencing professional postpartum exercise rehabilitation services were assessed only among respondents who reported no previous service use. Because these items were subject to questionnaire skip logic and were not observed for

service users, they were analyzed descriptively among non-users and were not included as predictors in the regression models.

(3) Demand Score: Measured using a multiple-choice question: “Which issues would you most like to address through postpartum exercise rehabilitation?” There are 8 options in total; 1 point is awarded for each selected option, for a total score of 0 to 8. A higher score indicates a broader range of postpartum rehabilitation needs. This variable is included in the model as a continuous measure; higher scores indicate a stronger need.

(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. This variable reflects self-reported previous service utilization up to the time of survey completion rather than utilization within a fixed postpartum observation period.

(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, Somewhat likely, Unsure, Not very likely, and Not at all likely. Because the two least positive options were rarely selected (6.2% and 1.6%), 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 = Not positive, 2 = Somewhat positive, 3 = Very positive). For regression analysis, the three categories were ordered from low to high intention as: Not positive, Somewhat positive, and Very positive. Accordingly, an OR greater than 1 indicates higher odds of belonging to a more positive intention category.

(6) Previous service use: Previous purchase or experience of professional postpartum exercise rehabilitation services was coded as 1 for “Yes” and 0 for “No.” This variable represented the behavioral history of service utilization and was included as an explanatory variable only in the ordered logistic regression model for future intention.

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 and demand scores were included in the regression models as continuous variables. Barrier items were analyzed descriptively among non-users only.

In descriptive statistics, continuous variables are reported as mean ± 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 rank-sum test was used for two groups comparisons; and the Pearson χ^2 test was used for comparisons

between categorical variables. Education and income were treated as ordered factors using orthogonal polynomial contrasts, generating linear (.L) and quadratic (.Q) components.

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); A P value > 0.05 for the omnibus Brant test was interpreted as insufficient evidence to reject the proportional odds assumption.

To compare associations across population 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 the associations of the variables across subgroups. As a sensitivity analysis, the primary service-utilization model was refitted using conventional maximum-likelihood logistic regression with the identical analytic sample and covariates. The consistency of ORs, confidence intervals, and statistical inferences between conventional logistic regression and Firth logistic regression was evaluated. To assess whether these associations differed across strata, exploratory interaction tests were performed between the five key exposures (postpartum stage, cognition score, demand score, age, and parity) and the stratification variables using Firth logistic regression with nested penalized likelihood-ratio tests. Fifteen interaction tests were conducted in total; P values were adjusted using the Benjamini–Hochberg false discovery rate (FDR), and the results were interpreted as exploratory and used to supplement, rather than replace, the stratified estimates.

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 915 postpartum women were included in the analysis. In accordance with the study objectives, the sample was grouped and described according to variables such as postpartum stage, 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

Variables	Category	n	Constituent ratio(%)
Postpartum stage	≤ 12 months	429	46.9
	> 12 months	486	53.1
Occupation	Stay-at-home mother	393	43.0
	Stable occupation	239	26.1
	Unstable occupation	283	30.9
Feeding patterns	Mixed feeding	232	25.4
	Exclusive breastfeeding	279	30.5
	Non-breastfed/ Weaned	404	44.2
Living pattern	Living with the elderly	478	52.2
	Couples living alone	356	38.9
	Other	81	8.9
Education level	Low education level	333	36.4
	Secondary education	261	28.5
	High education level	321	35.1
Income level	Low income	366	40.0
	Middle income	397	43.4
	Higher income	152	16.6
Residential area	Core urban area	335	36.6
	Suburban/ General urban area	214	23.4
	Remote suburbs/ Townships/ Other	366	40.0
Parity	Primipara	350	38.3
	Multipara	565	61.7
Services use	Yes	536	58.6
	No	379	41.4
Future intentions	Not active	338	36.9
	Relatively positive	247	27.0

Note: "Not positive" combines the original responses 'Unsure', 'Not very likely', and 'Not at all likely'

Variables	Category	n	Constituent ratio(%)
	Very positive	330	36.1
Note: "Not positive" combines the original responses 'Unsure', 'Not very likely', and 'Not at all likely'			

3.2 Univariate Analysis

The results of the univariate analysis showed cognitive score, demand score, service utilization, and future intention differed significantly across education, income, and residential-area groups. For parity, cognitive scores (W = 107582, P = 0.023) and future-intention distributions (χ^2=9.06,

P = 0.011) differed between primiparous and multiparous women, whereas demand scores (P = 0.424) and service utilization (P = 0.113) did not. See Table 2 for specific details.

Table 2
Univariate analysis of cognition, demand, service utilization and future intention across stratification variables

Stratification	Outcome	Statistic	P-value
Education (Low n = 333; Intermediate n = 261; High n = 321)	Cognition	χ^2=76.53	< 0.001
	Demand	χ^2=13.28	0.001
	Service use	χ^2=58.82	< 0.001
	Future intention	χ^2=94.31	< 0.001
Income (Low n = 366; Middle n = 397; Higher n = 152)	Cognition	χ^2=61.50	< 0.001
	Demand	χ^2=17.72	< 0.001
	Service use	χ^2=29.50	< 0.001
	Future intention	χ^2=30.91	< 0.001
Residence area (Core urban n = 335; Suburban/general urban n = 214; Remote/township/other n = 366)	Cognition	χ^2=39.83	< 0.001
	Demand	χ^2=16.45	< 0.001
	Service use	χ^2=53.77	< 0.001
	Future intention	χ^2=87.31	< 0.001
Parity (Primipara n = 350; Multipara n = 565)	Cognition	W = 107582	0.023
	Demand	W = 101948	0.424
	Service use	χ^2=2.51	0.113
	Future intention	χ^2=9.06	0.011

3.3 Multivariate Regression Analysis

3.3.1 Analysis of Factors Associated with Service Utilization Using Firth Logistic Regression

A multivariable Firth logistic regression model was fitted with previous professional postpartum exercise rehabilitation service utilization as the binary dependent variable. All 915 postpartum women were included. The model simultaneously adjusted for cognitive score, demand score, age, postpartum stage, occupation, feeding pattern, living arrangement, education, income, residential area, and parity (Table 3).

Higher cognitive score was associated with greater odds of previous service utilization (OR = 1.23, 95% CI 1.11–1.36, P < 0.001). Older age was also positively associated with utilization (OR = 1.05 per year, 95% CI 1.01–1.08, P = 0.011). Women surveyed more than 12 months postpartum had higher odds of reporting previous service utilization than those surveyed within 12 months postpartum (OR = 2.48, 95% CI 1.73–3.57, P < 0.001). Compared with mixed feeding, non-breastfeeding/weaned status was positively associated with utilization (OR = 2.68, 95% CI 1.74–4.14, P < 0.001).

Living arrangement and residential area were also associated with utilization. Compared with living with older family members, Couples living alone was associated with lower odds of previous service use (OR = 0.39, 95% CI 0.28–0.55, P < 0.001), as was another living arrangement (OR = 0.49, 95% CI 0.27–0.89, P = 0.020). Compared with core urban residence, living in a remote suburban/township/other area was associated with lower utilization (OR = 0.56, 95% CI 0.37–0.83, P = 0.004), whereas suburban/general urban residence was not (P = 0.930). Demand score, occupation, exclusive breastfeeding, education contrasts, income contrasts, and parity were not independently associated with previous service utilization at P < 0.05.

Table 3
Multivariate Firth Logistic Regression Analysis of Factors Associated with the Purchase of Professional Sports Rehabilitation Services

Variables	OR	95% CI	P-value
Cognitive score	1.227	1.109–1.360	< 0.001
Demand score	1.053	0.962–1.152	0.258
Age	1.046	1.010–1.084	0.011
> 12 months vs ≤ 12 months	2.485	1.734–3.568	< 0.001
Stable occupation	1.503	0.911–2.486	0.110
Unstable occupation	0.893	0.599–1.328	0.578
Exclusive breastfeeding	0.787	0.523–1.183	0.249
Non-breastfed / Weaned	2.680	1.743–4.136	< 0.001
Couples living alone	0.392	0.277–0.551	< 0.001
Other living arrangement	0.489	0.270–0.894	0.020
Educational .L	1.380	0.966–1.972	0.077
Educational .Q	1.017	0.761–1.359	0.907
Income .L	1.163	0.808–1.684	0.419
Income .Q	1.199	0.908–1.588	0.202
Suburban/ General urban	1.020	0.660–1.580	0.930
Remote/township/other	0.558	0.373–0.832	0.004
Multipara	0.911	0.632–1.311	0.617

3.3.2 Sensitivity Analysis Using Conventional Logistic Regression

The same covariates and the same analytic sample were refitted using conventional maximum-likelihood logistic regression (Table 4). No fitting warnings were generated. The direction and magnitude of the principal estimates were highly consistent with the Firth model: cognitive score (OR = 1.23, 95% CI 1.11–1.37, P < 0.001), age (OR = 1.05, 95% CI 1.01–1.09, P = 0.011), postpartum > 12 months (OR = 2.54, 95% CI 1.76–3.66, P < 0.001), non-breastfeeding/weaned status (OR = 2.74, 95% CI 1.77–4.24, P < 0.001), Couples living alone (OR = 0.38, 95% CI 0.27–0.54, P < 0.001), other living arrangement (OR = 0.48, 95% CI 0.26–0.89, P = 0.019), and remote suburban/township/other residence (OR = 0.55, 95% CI 0.37–0.83, P = 0.004) remained statistically significant. This consistency supports the robustness of the primary Firth estimates.

Table 4
Sensitivity Analysis Using Conventional Logistic Regression for Service Utilization

Variables	OR	95% CI	P-value
Cognitive score	1.23	1.11–1.37	< 0.001
Demand score	1.05	0.96–1.15	0.256
Age	1.05	1.01–1.09	0.011
> 12 months vs ≤ 12 months	2.54	1.76–3.66	< 0.001
Stable occupation	1.52	0.91–2.52	0.107
Unstable occupation	0.89	0.60–1.33	0.570
Exclusive breastfeeding	0.78	0.52–1.18	0.245
Non-breastfed / Weaned	2.74	1.77–4.24	< 0.001
Couples living alone	0.38	0.27–0.54	< 0.001
Other ways of living	0.48	0.26–0.89	0.019
Educational .L	1.39	0.97–1.99	0.074
Educational .Q	1.02	0.76–1.36	0.907
Income .L	1.17	0.81–1.70	0.409
Income .Q	1.21	0.91–1.60	0.193
Suburban/general urban area	1.02	0.66–1.59	0.922
Remote suburban/township/other	0.55	0.37–0.83	0.004
Multipara	0.91	0.63–1.31	0.610

3.3.3 Ordinal Logistic Regression for Future Usage Intentions

In the ordered logistic regression model (Table 5), previous service use showed the strongest positive association with future intention: women who had previously used or purchased professional postpartum exercise rehabilitation services had higher odds of being in a more positive future-intention category (OR = 3.15, 95% CI 2.31–4.31, P < 0.001). Higher cognitive score was also positively associated with future intention (OR = 1.16, 95% CI 1.06–1.26, P < 0.001). The linear education contrast was positive (OR = 1.71, 95% CI 1.28–2.29, P < 0.001), whereas the quadratic education contrast was not significant. Compared with core urban residence, suburban/general urban residence (OR = 0.61, 95% CI 0.43–0.86, P = 0.005) and remote suburban/township/other residence (OR = 0.44, 95% CI 0.32–0.61, P < 0.001) were associated with lower odds of a more positive future intention. Demand score, age, postpartum stage, occupation, feeding pattern, living arrangement, income contrasts, and parity were not significant at P <

0.05. The omnibus Brant test did not reject the proportional odds assumption (χ^2=24.11, df = 18, P = 0.15). However, the covariate-specific test for the linear education contrast was significant (P = 0.02), so education-related estimates should be interpreted with some caution.

Table 5
Ordered Logistic Regression Analysis of Future Usage Intentions

Variables	OR	95% CI	P-value
Previous use	3.152	2.306–4.310	< 0.001
Cognitive score	1.156	1.062–1.258	< 0.001
Demand score	1.067	0.991–1.149	0.085
Age	0.995	0.966–1.024	0.730
> 12 months vs ≤ 12 months	0.912	0.665–1.253	0.571
Stable occupation	0.98	0.66–1.45	0.914
Unstable occupation	1.09	0.79–1.50	0.617
Exclusive breastfeeding	0.77	0.54–1.10	0.150
Non-breastfeeding/weaned	0.79	0.55–1.13	0.195
Couple living alone	0.95	0.71–1.26	0.724
Other living arrangement	1.24	0.77–1.99	0.378
Education .L	1.715	1.284–2.290	< 0.001
Education .Q	1.078	0.854–1.361	0.528
Income .L	1.019	0.767–1.354	0.898
Income .Q	1.157	0.927–1.443	0.197
Suburban/general urban	0.611	0.432–0.864	0.005
Remote/township/other	0.439	0.316–0.610	< 0.001
Multipara	1.080	0.805–1.448	0.607

3.4 Stratified Analysis Using Firth Logistic Regression

Stratified Firth logistic regression analyses were conducted by education, income, and residential area. Each stratum-specific model adjusted for cognitive score, demand score, age, parity, and postpartum stage. Across every education, income, and residential stratum, women more than 12 months postpartum had higher odds of previous service utilization than women within 12 months postpartum. Other associations varied descriptively across strata.

3.4.1 Stratification by Educational Attainment

Among women with low education (n = 333), cognitive score was positively associated with utilization (OR = 1.26, 95% CI 1.07–1.50, P = 0.007), and postpartum duration > 12 months was strongly associated with higher utilization (OR = 8.17, 95% CI 4.87–14.02, P < 0.001). Among women with intermediate education (n = 261), age was positively associated with utilization (OR = 1.11, 95% CI 1.05–1.19, P < 0.001), multiparity was negatively associated (OR = 0.50, 95% CI 0.27–0.91, P = 0.023), and postpartum duration > 12 months remained positively associated (OR = 3.07, 95% CI 1.76–5.42, P < 0.001). Among women with high education (n = 321), cognitive score (OR = 1.29, 95% CI 1.10–1.51, P = 0.002) and postpartum duration > 12 months (OR = 2.51, 95% CI 1.45–4.41, P < 0.001) were positively associated with utilization. Detailed estimates are shown in Table 6.

Table 6
Stratified Firth logistic regression by educational level

Variable	Low education (n = 333) OR (95% CI)	P value	Intermediate education (n = 261) OR (95% CI)	P value	High education (n = 321) OR (95% CI)	P value
Cognitive score	1.261 (1.066–1.499)	0.007	1.174 (0.981–1.410)	0.080	1.286 (1.100–1.510)	0.002
Demand score	1.054 (0.908–1.220)	0.483	1.060 (0.891–1.258)	0.510	1.087 (0.945–1.249)	0.243
Age (per year; centered)	1.008 (0.957–1.063)	0.760	1.115 (1.052–1.187)	< 0.001	1.044 (0.973–1.122)	0.229
Multipara	0.722 (0.365–1.416)	0.344	0.505 (0.273–0.910)	0.023	1.788 (0.998–3.246)	0.051
Postpartum > 12 months	8.174 (4.868–14.023)	< 0.001	3.071 (1.755–5.422)	< 0.001	2.512 (1.451–4.411)	< 0.001

3.4.2 Stratification by Income Level

Among low-income women (n = 366), cognitive score (OR = 1.27, 95% CI 1.09–1.49, P = 0.003), demand score (OR = 1.18, 95% CI 1.02–1.37, P = 0.023), age (OR = 1.05, 95% CI 1.00–1.11, P = 0.041), and postpartum duration > 12 months (OR = 4.58, 95% CI 2.78–7.63, P < 0.001) were positively associated with utilization. Among middle-income women (n = 397), cognitive score (OR = 1.29, 95% CI 1.13–1.48, P < 0.001), age (OR = 1.05, 95% CI 1.00–1.10, P = 0.040), and postpartum duration > 12 months (OR = 3.36, 95% CI 2.18–5.25, P < 0.001) were positively associated. Among higher-income women (n = 152), age

(OR = 1.16, 95% CI 1.05–1.29, P = 0.004) and postpartum duration > 12 months (OR = 2.77, 95% CI 1.25–6.28, P = 0.012) were significant. See Table 7.

Table 7
Stratified Firth logistic regression by income level

Variables	Low income (n = 366) OR (95% CI)	P-value	Middle income (n = 397) OR (95% CI)	P-value	Higher income (n = 152) OR (95% CI)	P-value
Cognitive score	1.268 (1.086–1.487)	0.003	1.294 (1.134–1.483)	< 0.001	1.175 (0.893–1.550)	0.248
Demand score	1.183 (1.024–1.369)	0.023	0.976 (0.865–1.100)	0.696	0.982 (0.783–1.222)	0.872
Age (per year; centered)	1.054 (1.002–1.111)	0.041	1.049 (1.002–1.099)	0.040	1.157 (1.047–1.290)	0.004
Multipara	0.617 (0.353–1.065)	0.083	0.815 (0.515–1.284)	0.379	0.581 (0.236–1.361)	0.214
Postpartum > 12 months	4.582 (2.778–7.633)	< 0.001	3.362 (2.176–5.245)	< 0.001	2.767 (1.251–6.276)	0.012

3.4.3 Stratification by Residential Area

Among women living in core urban areas (n = 335), cognitive score (OR = 1.36, 95% CI 1.17–1.59, P < 0.001), age (OR = 1.06, 95% CI 1.01–1.12, P = 0.021), and postpartum duration > 12 months (OR = 3.03, 95% CI 1.84–5.06, P < 0.001) were positively associated with utilization. In suburban/general urban areas (n = 214), demand score (OR = 1.26, 95% CI 1.07–1.49, P = 0.005), age (OR = 1.08, 95% CI 1.00–1.17, P = 0.039), and postpartum duration > 12 months (OR = 2.13, 95% CI 1.13–4.04, P = 0.020) were significant. In remote suburban/township/other areas (n = 366), cognitive score (OR = 1.27, 95% CI 1.09–1.49, P = 0.002) and postpartum duration > 12 months (OR = 6.98, 95% CI 4.24–11.68, P < 0.001) were positively associated with utilization. See Table 8.

Table 8
Stratified Firth logistic regression by residential area

Variables	Core urban area (n = 335) OR (95% CI)	P-value	Suburban / General urban area (n = 214) OR (95% CI)	P-value	Remote Suburbs/ Townships/ Other (n = 366) OR (95% CI)	P-value
Cognitive score	1.358 (1.167–1.592)	< 0.001	1.194 (0.980–1.459)	0.078	1.274 (1.092–1.493)	0.002
Demand score	0.896 (0.777–1.030)	0.123	1.263 (1.073–1.493)	0.005	1.086 (0.938–1.256)	0.268
Age (per year; centered)	1.061 (1.009–1.117)	0.021	1.084 (1.004–1.175)	0.039	1.034 (0.979–1.093)	0.234
Multipara	0.912 (0.547–1.516)	0.722	0.881 (0.434–1.754)	0.721	0.571 (0.317–1.014)	0.056
Postpartum > 12 months	3.034 (1.842–5.063)	< 0.001	2.131 (1.128–4.039)	0.020	6.978 (4.244–11.677)	< 0.001

Exploratory interaction tests. Likelihood-ratio interaction tests between the five key exposures and the stratification variables showed no evidence of heterogeneity for cognitive score (all P > 0.62) or for demand score by educational level or income level (P = 0.68 and P = 0.33, respectively). The association of rehabilitation demand with service utilization differed by residential area (χ^2=13.04, df = 2, P = 0.001; FDR-adjusted P = 0.022): demand was positively associated with utilization among women in suburban/general urban areas (OR = 1.26, 95% CI 1.07–1.49; Table 8) but not among women in core urban or remote suburban/township areas. The association of postpartum stage with utilization did not differ significantly by income level (P = 0.94) or residential area (P = 0.07), although the association appeared strongest in the low-education stratum (interaction P = 0.012; FDR-adjusted P = 0.061; Table 6). A significant interaction was also observed between parity and educational level (χ^2=10.81, df = 2, P = 0.004; FDR-adjusted P = 0.034): stratified estimates suggested lower utilization among multiparous women in the intermediate-education stratum (OR = 0.50, 95% CI 0.27–0.91) and a reversed, non-significant direction in the high-education stratum (OR = 1.79, 95% CI 1.00–3.25; Table 6).

4 Discussion

This cross-sectional analysis of 915 postpartum women identified several factors associated with previous use of professional postpartum exercise rehabilitation services and future intention to use such services. In the overall Firth model, cognitive score, age, postpartum duration > 12 months, feeding status, living arrangement, and residential location were associated with previous utilization. Conventional logistic regression produced nearly identical conclusions. These findings are broadly

consistent with the service-access barriers and awareness gaps documented by Yoseph A et al. [10]. In the future-intention model, previous service use showed a strong positive association, while cognitive score, the linear education contrast, and residential area were also associated with intention, reflecting that structural barriers (distance, cost) exert a stronger influence on individuals than cognitive factors and need [11]. Stratified analyses showed that postpartum duration > 12 months was positively associated with utilization in every education, income, and residential stratum. In contrast, intention showed stronger associations with cognitive factors and social resources. This finding is consistent with the intention-behavior research reviewed by Sheeran P et al. [17].

4.1 Perceived Barriers Among Non-Users and Their Implications

Although barrier items were not included as predictors in the final multivariable regression models because they were collected only among women who had not previously used professional postpartum exercise rehabilitation services, the descriptive findings still indicate that practical accessibility constraints are important considerations among non-users. 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 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 Cognitive Awareness in Relation to Service Utilization and Future Intention

Cognitive score was positively associated with both previous service utilization and future intention. Because the score was derived from participants’ recognition of postpartum recovery methods and potential benefits of exercise rehabilitation, this finding suggests that broader rehabilitation-related awareness was associated with more positive service-related outcomes. Women in remote suburban/township/other areas had lower adjusted odds of previous utilization than those in core urban areas, and both suburban/general urban and remote areas were associated with less positive future intention. The findings suggest that this association may be offset 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.

4.3 Stratified Analysis of Factors Associated with Service Utilization by Socioeconomic Stratum

Socioeconomic factors and the use of postpartum rehabilitation services do not have a simple linear relationship: after controlling for other variables, education and income show limited independent associations with actual service utilization, and their effects may be indirectly reflected through more direct pathways such as cognition, living environment, and caregiving conditions. In contrast, place of residence simultaneously reflects individual characteristics and service-related environmental factors (such as institutional accessibility, transportation, and information availability), thus maintaining a consistent association with service utilization; that is, even when individuals possess certain cognitive awareness or needs, practical conditions may still constrain their behavior, consistent with previous findings [12, 18–20]. Furthermore, this finding aligns with healthcare utilization theory, in which service availability and accessibility are key enabling conditions for utilization [6]. Given the characteristics of these barriers, service utilization exhibits significant social stratification, suggesting potential 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 [21]. Exploratory interaction tests further indicated that the association between rehabilitation demand and service utilization differed by residential area (P = 0.001): demand was positively associated with utilization among women in suburban/general urban areas (OR = 1.26, 95% CI 1.07–1.49; Table 8) but not among those in core urban or remote/township areas, suggesting that structural accessibility constraints may dominate where services are either readily available or largely absent.

4.4 Association of Postpartum Stage with Service Utilization

The results indicate that, in stratified analyses, the postpartum period (≤ 12 months and > 12 months) showed a positive association with service utilization in each stratum. Exploratory interaction tests suggested that this association did not differ significantly by income level (P = 0.94) or residential area (P = 0.07), while a stronger association among women with lower educational attainment was indicated (interaction P = 0.012; FDR-adjusted P = 0.061, interpreted as an exploratory signal; OR = 8.17, 95% CI 4.87–14.02 in the low-education stratum vs OR = 2.51, 95% CI 1.45–4.41 in the high-education stratum; Table 6); this pattern should be confirmed in larger, adequately powered studies. Hailemariam et al. [22] reported that postnatal care utilization remained low and varied with women's education and service accessibility, and Pradhan et al. [23] found that postpartum outpatient care utilization increased when insurance coverage expanded, suggesting that both women's circumstances and service accessibility shape postpartum service utilization. The association between postpartum stage and service utilization was consistent across income and residential strata and appeared strongest among women with lower educational attainment. Postpartum exercise rehabilitation primarily addresses issues such as pelvic

floor muscle dysfunction, rectus abdominis diastasis, and physical recovery resulting from childbirth. As the postpartum period progresses, women may have accumulated more opportunities to obtain service information and to access rehabilitation services.

4.5 The Intention-Behavior Gap and Its Public Health Implications

The final analysis indicates that there is a significant correlation between past behavior usage and future intentions, suggesting that behavior and intentions are not completely disconnected but rather show a certain degree of behavioral continuity. This correlation may stem from the fact that direct experience can reduce uncertainty and psychological barriers, or it may result from self-selection – that is, more positive-attitude women are more likely to simultaneously possess past behavior usage patterns and report future intentions. However, the theory of health behavior suggests that there is a gap between "intention and behavior", and this theory holds that the process of converting intentions into actions is constrained by various factors, including resource availability, environmental limitations, and behavioral control ability. This also indicates that intentions are susceptible to influence and thus reduce the likelihood of behavior occurrence [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

Among 915 postpartum women, previous use of professional postpartum exercise rehabilitation services was associated with cognitive awareness, age, postpartum stage, feeding status, living arrangement, and residential location. Future intention to use services was strongly associated with previous service use and was also associated with cognitive awareness, education-related linear trend, and residential location. Stratified analyses consistently showed higher previous utilization among women more than 12 months postpartum than among those within 12 months postpartum, and exploratory interaction tests suggested that this association may be stronger among women with lower educational attainment. Overall, previous utilization and future intention showed both overlapping and distinct correlates. These findings support efforts to improve rehabilitation information, continuity of service experience, and geographic and practical accessibility, while causal interpretations should be avoided because of the cross-sectional design.

Declarations

Ethics approval and consent to participate

This study was reviewed and approved by the Ningxia University Technology Ethics Committee (approval number: NXU-2025-0221). 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.

Clinical trial number

Not applicable.

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.

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Author contributions

Conceptualization, J.W. (Ju Wen) and G.W. (Ge Wen); methodology and questionnaire design, J.W. (Ju Wen); investigation and data collection, J.W. (Ju Wen), G.W. (Ge Wen) and Y.X. (Yiqing Xu); data curation, G.W. (Ge Wen) and J.W. (Ju Wen); formal analysis, G.W. (Ge Wen) and J.W. (Ju Wen); writing—original draft preparation, G.W. (Ge Wen); writing—review and editing, J.W. (Ju Wen) and H.L. (Haitao Liu); supervision, project administration and funding acquisition, J.W. (Ju Wen). All authors have read and agreed to the published version of the manuscript.

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