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Expert Evaluation and Guidance for a Home-Based Rehabilitation System in Postpartum Low Back Pain

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ABSTRACT

Postpartum low back pain (LBP) is a prevalent health issue. Most patients with postpartum LBP recover within three months after delivery. However, a considerable number of women (50-80%) still report developing LBP after this, and some cases may progress to chronic back pain, lasting for months or even years. Postpartum LBP arises from multiple risk factors spanning physiological, psychological, and social aspects. Traditional rehabilitation protocols often provide generalized guidance, failing to address the individual needs of postpartum women, which vary depending on their physical condition, lifestyle, and recovery trajectory. Therefore, it is necessary to develop more convenient and personalized treatment services for patients. This study aims to obtain professional guidance on developing a personalized home-based rehabilitation service system for postpartum LBP. This study conducted semi-structured interviews with six multidisciplinary experts, including one kinesiology specialist, one rehabilitation physician, two physiotherapists, and two obstetricians. The interviews explored the experts' views on the feasibility, potential benefits, and risks of home-based exercise rehabilitation for patients with postpartum LBP. Analysis of the interview records revealed consensus among the experts on the value of personalized home-based interventions for the treatment of postpartum LBP.

Keywords: Postpartum low back pain, Home-based rehabilitation, Smart medical care

INTRODUCTION

Low back pain (LBP) is one of the most common health issues among women in the postpartum period. Research indicates that approximately 50-80% of women report experiencing LBP during pregnancy (Abenhaim et al., 2007). While some patients with postpartum LBP recover within three months after delivery (Gutke et al., 2018), many continue to experience pain that lasts for months or even years (Nilsson-Wikmar et al., 2003). Postpartum LBP not only restricts physical functions but is also significantly associated with postpartum depression (PPD), sleep disorders, and a decline in quality of life (Gutke et al., 2018), imposing a considerable physical and mental burden on postpartum women.

Treatment for postpartum LBP mainly includes cognitive behavioral therapy, which can be particularly effective for patients whose pain has psychosocial contributing factors (Noren et al., 2018), non-pharmacological approaches such as exercise therapy and physical agent modalities, as well

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as pharmacological interventions like acetaminophen and non-steroidal anti-inflammatory drugs (NSAIDs). In clinical practice, pharmacological interventions are severely restricted due to maternal breastfeeding requirements. Physical agent modalities, such as transcutaneous electrical nerve stimulation (TENS) and acupuncture, involve fewer contraindications; however, their therapeutic efficacy remains a matter of debate. For example, in a 2021 study, the experimental results indicated that interventions such as massage, acupuncture, hot/cold compress, and electrical nerve stimulation may have limited efficacy (Knezevic et al., 2021).

At present, a large number of studies have proved that exercise therapy is an effective measure to intervene in postpartum LBP. The intervention forms include core stability training (Saleh et al., 2019), Pilates (Manca et al., 2024), and general rehabilitation exercise (Knezevic et al., 2021; Nilsson-Wikmar et al., 2005).

Despite the demonstrated efficacy of exercise therapy in managing postpartum LBP, postpartum women face significant barriers when accessing conventional healthcare services. Research indicates that time constraints and childcare responsibilities are the primary factors hindering their participation in rehabilitation programs (Evenson et al., 2009). Additionally, tiredness, sleep loss, lack of support, irregular daily routines, and breastfeeding demands collectively make it challenging for new mothers to adhere to traditional exercise-based regimens (Evenson et al., 2009).

In recent years, with the advancement of mobile health technologies, digital home-based rehabilitation (DHBR) has emerged as a promising, more flexible, and convenient intervention. Existing evidence indicates that app-based or remotely guided interventions hold promise for pain relief and mental health improvement (Chen et al., 2024; Emam et al., 2023). However, the widespread clinical adoption of such approaches remains debated. The absence of real-time professional supervision during independent home-based training may lead to an incorrect execution of exercises (Tim & Mazur-Bialy, 2024), introducing potential risks such as movement compensation and injury.

This study synthesizes multidisciplinary expert insights to establish the safety and design requirements for home-based postpartum LBP rehabilitation. As foundational, provider-oriented research, it provides the conceptual framework for future digital interventions rather than clinical testing. Specifically, this work articulates the conflict between maternal duties and recovery needs, defines rigorous safety boundaries, and outlines the essential logic for a personalized, adaptive intervention system. These findings offer the necessary medical consensus and theoretical grounding to inform the development of future digital health services.

METHOD

This study employs a qualitative research design to explore in depth the perspectives and experiences of experts regarding home-based rehabilitation for postpartum LBP.

Recruitment and Participants

Utilizing a purposive sampling strategy, this study recruited six multidisciplinary experts through professional academic and medical networks. The panel comprised two obstetricians, two physical therapists, one rehabilitation physician, and one kinesiologist. To ensure the reliability of the insights, inclusion criteria required each expert to possess over three years of direct clinical or research experience in postpartum rehabilitation, LBP management, or exercise physiology. The experts' information is shown in Table 1.

Table 1: The experts' information.

Number	Domain	Years of Service	Highest Degree Earned
1	Obstetricians	7	Doctor
2	Obstetricians	11	Bachelor
3	Physical therapists	3	Bachelor
4	Physical therapists	6	Bachelor
5	Rehabilitation physician	4	Master
6	Kinesiologist	3	Master

Data Collection

Data collection was conducted using semi-structured individual interviews. This approach balances structure and flexibility. It ensures that core topics are consistently covered across all interviewees while allowing the researcher to conduct impromptu probing based on participant responses to collect open-ended data (De Jonckheere & Vaughn, 2019). Based on the existing literature and research objectives, this study developed an interview guide containing open-ended questions, following the framework proposed by Kallio et al. (2016). The interview guide specifically focused on three core domains: the primary barriers to traditional postpartum rehabilitation, the identification of safety boundaries and contraindicated movements for unsupervised exercise, and the essential functional requirements for a digital home-based intervention system.

Data Analysis

Data were analyzed using Reflexive Thematic Analysis (RTA) (Braun & Clarke, 2019). Rather than treating themes as pre-existing entities, this approach acknowledges the researcher's active role in interpreting the data. All interviews were transcribed verbatim and checked for accuracy (Morse & Field, 2013).

The analysis followed the six phases outlined by Braun and Clarke: familiarization with the data through repeated reading and reflexive memo-writing (Guba & Lincoln, 1994); generation of initial codes using NVivo (v.20); development of preliminary themes by grouping related codes; iterative review and refinement of themes in relation to the dataset; and final definition and naming of three themes, leading to the production of the analytical narrative.

RESULTS

This study employed RTA to conduct an in-depth examination of interview data from six experts in the fields of obstetrics, rehabilitation medicine, physical therapy, and kinesiology. The analysis ultimately identified three overarching themes that encompass both the recognition of problems and pathways toward their resolution. These themes are: (1) The conflict between rehabilitation needs and parenting demands, (2) Establishing boundaries of safety, and (3) Designing dynamically adaptive personalized rehabilitation services.

Theme 1: The Conflict Between Rehabilitation Needs and Parenting Demand

In the traditional rehabilitation model, it is often assumed that patients can develop a structured rehabilitation plan at fixed locations (such as hospitals or rehabilitation facilities) and carry out rehabilitation exercises under the supervision of physicians or therapists. However, the interviews revealed a profound mismatch between these idealized rehabilitation patterns and the fragmented, high-stress postpartum lives of patients. This mismatch stems not merely from superficial issues such as "lack of time" but from the inherent conflict between the woman's identity as a mother and her identity as a patient.

The Time and Space Consumed By "Motherhood"

All interviewed experts agreed that lifestyle changes represent the primary barrier to postpartum rehabilitation, rather than the complexity of the condition itself. For example, one obstetrician emphasized that, postpartum, a woman's body no longer belongs solely to her but is constantly appropriated for breastfeeding and childcare. "The biggest barrier is the mothers' time. Breastfeeding is the greatest restriction on their ability to engage in exercise-based rehabilitation. They need to feed the baby at regular intervals or provide mixed feeding to ensure adequate nutrition. If they want to exercise, they first need time for themselves."

This physiological constraint directly translates into spatial limitations. Mothers find it challenging to leave their infants for extended periods, which makes frequent hospital visits for standardized low back pain interventions challenging. Beyond time constraints, the obstetrician also highlighted spatial restrictions—for instance, the home environment often lacks sufficient space to accommodate equipment such as a yoga mat.

Poor Patient Adherence: The difficulty in implementing the Traditional Outpatient Model

The aforementioned practical dilemmas directly decrease the efficacy of traditional outpatient rehabilitation models. Clinical observations by rehabilitation physicians reveal that, despite scientific recommendations for follow-up visits (e.g., twice weekly), actual patient adherence is often

suboptimal. As one physician noted, patients "might come only once a week, or even once every two or three weeks."

This poor adherence stems not from patient indolence, but from the high costs of rehabilitation. Physical therapists attribute this to the limited energy reserves of postpartum mothers, noting that "caring for an infant is already exhausting." Consequently, the requirement for frequent hospital visits places a substantial physical burden on patients. Furthermore, the lack of continuous supervision following the initial clinical consultation often results in high attrition rates. This view is supported by obstetricians, who highlight that the primary advantage of home-based intervention lies in eliminating the "time and energy costs associated with hospital visits."

Furthermore, postpartum LBP is rarely simply a physiological issue but is instead a complex syndrome intertwined with psychosocial factors. In the interviews, experts identified numerous stressors, including "insufficient external support," "poor sleep quality," and "postpartum mood disorders." Given this state of physical and mental exhaustion, it is indeed challenging to incorporate traditional hospital-based rehabilitation into the reality of postpartum life.

Home-Based Intervention as an Embedded Daily Mechanism

Addressing the complexities of the postpartum period, experts argue that home-based interventions for low back pain demonstrate high reliability and feasibility, serving as more than merely a marginal supplement to facility-based rehabilitation. Instead, it should be viewed as an intervention system capable of being embedded into the fragmented and demanding daily routines of postpartum women.

Physical therapists emphasized the flexibility of this model, noting that "home-based intervention allows rehabilitation to be integrated into daily life... utilizing fragmented time, such as when the baby is asleep, for exercise." Furthermore, kinesiology experts indicated that most women are willing to attempt home-based exercise provided that complex equipment is not required (e.g., relying on yoga mats and bodyweight training).

Theme 2: Establishing the Boundaries of Safety

While experts unanimously agree on the convenience of home-based intervention, their discourse shifts towards caution and vigilance when it comes to "safety". In the absence of professional supervision, incorrect exercise execution within the home environment poses a risk of exacerbating postpartum low back pain. Consequently, the establishment of a rigorous risk control system emerged as the second critical theme of this study.

Hidden Risks: Compensatory Patterns

The primary hazard of home-based rehabilitation lies in improper movement execution. Multiple experts noted that postpartum women commonly exhibit core muscle weakness, especially rectus abdominis diastasis and pelvic floor laxity, which predisposes them to compensatory patterns during exercise.

A rehabilitation physician provided a representative technical analysis of this mechanism:

"Because patients often lack core strength… they subconsciously rotate their pelvis when performing the 'Bird-Dog' exercise. If pelvic or spinal rotation occurs, it can cause anterior spinal tilting, which ultimately exacerbates the patient's LBP."

Physical therapists expressed similar concerns. One therapist highlighted that if a patient lacks adequate understanding of a movement and engages the wrong muscles, the exercise is not only ineffective but may also worsen low back pain. Furthermore, for patients lacking basic rehabilitation knowledge, relying solely on devices or instructional videos without prior professional assessment is considered inadvisable. Another physical therapist emphasized the necessity of pre-intervention assessment:

"In my clinical practice, understanding the patient's status primarily involves assessing their musculoskeletal condition. Respiratory patterns also require one-on-one assessment to be fully understood."

Contraindicated Movements and Safe Movements

To mitigate the aforementioned risks, the experts proposed a set of contraindicated movements and safe exercises. When patients perform self-directed exercise at home, the rehabilitation service system should recommend safe and effective movements and provide safety education, including explanations of the rationale behind the movements.

Contraindicated movements. The experts issued clear warnings regarding supine exercises. One physical therapist stated explicitly: "Except for alternating toe taps in supine position, we generally avoid supine exercises altogether, because they tend to exacerbate diastasis recti."

Safe movements. In contrast, the experts identified and endorsed a series of high-tolerance, low-risk exercises.

(1) Cat-Cow Pose: The cat-cow pose was unanimously recognized by obstetricians, physical therapists, and exercise specialists as the best movement. It effectively relieves spinal pressure while carrying a very low risk of injury.
(2) Glute Bridge: The glute bridge was also frequently identified as one of the best exercises. It effectively activates the commonly weakened gluteal muscles in the postpartum period and enhances core stability.
(3) Breathing Training: All experts emphasized the fundamental importance of breathing exercises, with one obstetrician noting that breathing training constitutes the very first step in postpartum rehabilitation. However, opinions diverged regarding the specific type of breathing technique. While the majority of experts supported diaphragmatic (abdominal) breathing, one obstetrician argued: "The preferred breathing training is not the conventional abdominal breathing we used to teach, but rather diaphragmatic breathing." A physical therapist further cautioned against abdominal breathing, stating: "Abdominal breathing… can actually

create unstable intra-abdominal pressure and potentially worsen pelvic floor dysfunction."

(4) Relaxation-based Movements: Movements such as Child's Pose and Four-Point Kneeling were recommended as particularly suitable for mothers with low physical stamina or those experiencing emotional stress.

(5) Aerobic Exercise: For patients with higher BMI, physical therapists and kinesiology experts suggested incorporating low-impact aerobic activities such as brisk walking or uphill walking to facilitate weight reduction, thereby decreasing the overall risk of low back pain.

Assessment-Led Intervention Model

To ensure exercise safety and correctness, several experts advocated a "hybrid intervention" approach that includes pre-exercise assessment. One obstetrician emphasized that before implementing exercise training via digital tools, there must be a foundational data collection process. This should include screening for surgical history, and trauma history, and pain tolerance, which should be assessed using the Visual Analogue Scale (VAS) score.

A rehabilitation specialist noted that the optimal treatment model involves the rehabilitation therapist meeting with the patient before they commence home training using digital tools, and assisting the patient in adjusting their training plan several times.

Another physiotherapist expressed a similar view. He believes that a reassessment should be conducted after the patient has exercised for one or two weeks, before matching them with the most suitable training programme.

In practice, this hybrid model positions home-based rehabilitation as a natural extension of hospital management rather than a disconnected process. Through reliable medical assessment, high-risk factors (such as severe pain or absolute contraindications) can be identified and screened out, thereby avoiding inappropriate training regimens. Subsequently, online guidance can be used to support and monitor the training process.

Theme 3: Designing Dynamically Adaptive Personalized Rehabilitation Services

The third theme focuses on the implementation of home-based intervention. Experts strongly advocated for a personalized service system capable of dynamic adjustment based on the patient's immediate status and needs.

Basis for Personalized Diagnosis: Multidimensional Risk Factors

In the experts' view, "personalization" involves more than adjusting plans based on physiological factors such as BMI or the degree of diastasis recti; it also necessitates a holistic consideration of the mother's psychological and lifestyle status. In the interviews, experts repeatedly emphasized the impact of sleep quality, mood disorders/PPD, and external support on rehabilitation.

For patients with mood disorders or severe sleep deprivation, exercise regimens should prioritize relaxation over intensity. For instance, an

obstetrician noted that for postpartum women with mood disorders, exercises with moderate intensity, such as side planks or side leg lifts, can help alleviate emotional stress and improve sleep. She also recommended low-intensity movements like the Child's Pose: "Child's Pose is very good because the intensity is not that high, and lying prone like that is quite comfortable". This suggests that an ideal home exercise regimen should support dual interventions for both the body and the mind.

Basis for Determining Training Intensity: Patient Capability and Perception

To assist patients in judging appropriate training intensity in a home environment lacking external supervision, experts formulated two primary criteria: patient capability and subjective perception.

Rule 1: Movement quality defines intensity. A kinesiology expert proposed a core standard: "If you can perform every movement with proper form and technique, the intensity is optimal." Once form breakdown, tremors, or compensation occur, even if the target repetition count has not been met, it implies that the intensity has exceeded the patient's load capacity.

Rule 2: Subjective tolerance and willingness. An obstetrician suggested adopting an "inquiry-feedback" mechanism within the system: after completing a set, the user must be asked, "Has pain increased? Has fatigue increased?" If the answer is affirmative, the session must cease. Another obstetrician went further to point out that intensity settings must respect "the postpartum mother's willingness"; if a patient feels unable to continue, forced training could lead to irreversible injury, for which the physician must be held responsible.

AI as an Auxiliary Tool

Finally, experts discussed the realization of this dynamic personalization. AI is viewed as a valuable supplement to medical decision-making tools. An obstetrician suggested that by integrating patient chief complaints, AI can provide an experience analogous to an offline consultation and automatically progress or regress the exercise regimen based on patient feedback. However, kinesiology experts also delineated clear boundaries for AI: "AI can provide reference, but it cannot serve as the basis". While AI is appropriate for initial screening, it cannot replace a definitive diagnosis when addressing complex clinical conditions.

DISCUSSION

This research investigates the parameters of feasibility and the necessary service architecture for home-based rehabilitation targeting postpartum LBP. Our findings suggest that multidisciplinary experts view digital home-based interventions as a potential solution to the disconnect currently existing between clinical protocols and the realities of postpartum daily life. However, the primary obstacle remains in ensuring intervention safety and adapting to

the complex physiological and psychological states of mothers in the absence of real-time supervision.

The demanding nature of childcare often leads to the marginalization of postpartum women's own physical rehabilitation needs. When the burden of parenting impedes autonomous recovery, mothers must rely on external support or education from external systems to enhance their self-care and rehabilitation abilities (Hartweg, 1991). In this study, experts agree that home-based interventions can serve as a support system integrated into the daily lives of postpartum women with LBP.

Therefore, in designing a rehabilitation system for postpartum LBP, it is essential to incorporate Just-in-Time Adaptive Interventions (JITAI) (Hardeman et al., 2019). The core of JITAI lies in dynamically adapting the timing and mode of intervention to the user's real-time context—for instance, guiding patients through equipment-free exercises during fragmented periods such as when the baby is asleep. Such a flexible rehabilitation approach can effectively reduce environmental and time-related costs for patients, thereby improving adherence.

However, convenience in rehabilitation plans must be predicated on safety. The interviewed experts highlighted the potential risks associated with compensatory patterns. Therefore, a risk screening mechanism must be integrated into the system to stratify patients by risk level.

Furthermore, the development of personalized intervention systems must incorporate not only physiological metrics but also psychological and social factors. Postpartum LBP is associated with sleep disorders, PPD, and a lack of external support. Consequently, adjustments to intervention plans should depend not only on movement quality but also on the patient's subjective tolerance and willingness. Moreover, research suggests that AI capable of expressing empathy can improve long-term adherence (Bickmore & Picard, 2005). As an auxiliary tool, AI should not only simulate clinical diagnostic logic but also provide emotional support to patients.

CONCLUSION

This study explored the feasibility, risk factors, and service design of home-based rehabilitation for postpartum LBP through interviews with experts in postpartum rehabilitation, obstetrics and gynecology, and physical therapy. The conclusions are as follows: First, home-based rehabilitation can effectively mitigate the conflict between rehabilitation needs and childcare activities for postpartum LBP patients by reducing time and environmental costs. Second, safety is a prerequisite for home-based interventions, necessitating the establishment of risk identification and triage mechanisms. Third, the system should be grounded in the "bio-psycho-social" model, comprehensively analysing patients' multidimensional data to customize personalized intervention plans.

LIMITATIONS AND FUTURE RESEARCH

Despite offering multidimensional expert perspectives, this study has limitations. It involved a small sample size (n = 6) and focused exclusively

on the viewpoints of professionals, as it did not include direct feedback from postpartum women.

Future research should focus on the following areas: first, collecting data from postpartum LBP patients to investigate barriers to home-based interventions, and second, conducting randomized controlled trials to validate the efficacy of the home-based intervention model. Additionally, further research should explore the application of AI algorithms to more precisely predict risk and enhance the personalization of home-based rehabilitation.

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