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Application of a Mobile App-Based Breastfeeding Support Platform to Improve Six-Month Exclusive Breastfeeding Rates among First-Time Mothers: A Randomized Controlled Trial

Linyun Wang, Yan Lei

Nursing Department, Maternal and Child Health Hospital of Wanzhou District, Chongqing, China

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Abstract: Despite the well-documented benefits of exclusive breastfeeding, rates remain suboptimal globally. Mobile health technologies offer promising opportunities to provide continuous, personalized breastfeeding support. This study aimed to evaluate the effectiveness of a mobile application-based breastfeeding support platform in improving six-month exclusive breastfeeding rates among first-time mothers in China. The method applied in this paper is a randomized controlled trial conducted from August 2023 to February 2025 at a tertiary hospital in Chongqing, China. First-time mothers (n=486) were randomly allocated to either the intervention group (n=243) receiving standard care plus access to a comprehensive mobile breastfeeding support app, or the control group (n=243) receiving standard care alone. The app provided personalized education, real-time consultation, and continuous case management from pregnancy through six months postpartum. The primary outcome was the exclusive breastfeeding rate at six months. Of 460 participants completing the study, the six-month exclusive breastfeeding rate was significantly higher in the intervention group (51.29% vs. 30.70%, $p<0.001$). The intervention group also demonstrated better breastfeeding knowledge scores, lower rates of lactation-related complications, and higher nursing service satisfaction. The mobile app-based breastfeeding support platform effectively improved exclusive breastfeeding rates and maternal outcomes through continuous, personalized support, offering a scalable solution for enhancing breastfeeding support in the digital age.

1. Introduction

Breastfeeding is universally recognized as the optimal method of infant feeding, providing unparalleled nutritional, immunological, and developmental benefits for both infants and mothers[1]. The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life, followed by continued breastfeeding with appropriate complementary foods for up to two years or beyond[2]. Despite these recommendations and extensive evidence supporting breastfeeding benefits, global exclusive breastfeeding rates remain far below optimal levels.

In China, the situation is particularly concerning. Recent national surveys indicate that only 29.2% of infants are exclusively breastfed at six months, significantly below the WHO target of 50%[3]. This gap between recommendations and practice represents a major public health challenge, particularly as China implements policies to optimize fertility and support family development.

Multiple factors contribute to suboptimal breastfeeding rates. First-time mothers often face unique challenges including lack of experience, inadequate knowledge about breastfeeding techniques, and insufficient confidence in their ability to breastfeed successfully[4]. Traditional support systems, typically limited to brief hospital-based education and sporadic follow-up visits, fail to provide the continuous, individualized support many mothers need during the critical early months of breastfeeding [5].

The emergence of mobile health (mHealth) technologies presents unprecedented opportunities to transform breastfeeding support delivery. Mobile applications can provide 24/7 access to evidence-based information, enable real-time communication with healthcare providers, and deliver personalized interventions based on individual needs and progress[6]. Several studies have demonstrated the potential of mHealth interventions to improve various maternal and child health outcomes, though evidence specific to breastfeeding support remains limited [7].

The current study was designed to address this gap by developing and evaluating a comprehensive mobile app-based breastfeeding support platform. Unlike previous interventions that typically focus on single aspects of breastfeeding support, our platform integrates multiple evidence-based strategies including continuous education, real-time professional consultation, systematic assessment, and individualized case management throughout the perinatal period.

The theoretical framework for this intervention draws on several established models. The Information-Motivation-Behavioral Skills (IMB) model suggests that adequate information, strong motivation, and proper skills are essential for health behavior change[8]. Additionally, the concept of continuity of care emphasizes the importance of consistent support throughout the breastfeeding journey[9]. By combining these theoretical approaches with modern technology, we aimed to create a support system that addresses the multifaceted challenges faced by first-time mothers.

This study aimed to evaluate whether a mobile app-based breastfeeding support platform could

significantly improve six-month exclusive breastfeeding rates among first-time mothers compared to standard care. We hypothesized that mothers receiving app-based support would demonstrate higher exclusive breastfeeding rates, better breastfeeding knowledge, fewer lactation-related complications, and greater satisfaction with nursing services.

2. Methods

2.1 Study Design and Setting

This parallel-group randomized controlled trial was conducted at a tertiary hospital in Wanzhou District, Chongqing, China, from August 2023 to February 2025.

2.2 Participants

Eligible participants were first-time pregnant women attending antenatal care at the study hospital. Inclusion criteria were: (1) aged 18-35 years; (2) first pregnancy with singleton fetus; (3) residing in Wanzhou District for the duration of the study; (4) able to use a smartphone and mobile applications proficiently; and (5) willing to provide written informed consent.

Exclusion criteria included: (1) serious medical conditions contraindicating breastfeeding (e.g., HIV infection, active tuberculosis); (2) known fetal anomalies or genetic disorders; (3) severe pregnancy complications requiring specialized care; (4) history of breast surgery or conditions affecting lactation; and (5) inability to communicate in Mandarin Chinese.

2.3 Sample Size Calculation

Sample size was calculated based on the primary outcome of exclusive breastfeeding rate at six months. Based on previous studies, we estimated a baseline exclusive breastfeeding rate of 29% in the control group and anticipated an increase to 49% in the intervention group[10]. With 80% power and a two-sided significance level of 0.05, 203 participants per group were required. Accounting for an expected 20% attrition rate, we aimed to recruit 243 participants per group (total n=486).

2.4 Randomization and Blinding

Participants were randomly allocated to intervention or control groups using a computer-generated randomization sequence with a 1:1 allocation ratio. Randomization was performed by an independent statistician using block randomization with varying block sizes (4, 6, and 8) to ensure allocation concealment. Due to the nature of the intervention, participants and healthcare providers could not be blinded to group assignment. However, outcome assessors were blinded to group allocation.

2.5 Interventions

2.5.1 Control Group

Participants in the control group received standard antenatal and postnatal care according to hospital protocols. This included: (1) group breastfeeding education sessions during antenatal visits; (2) individual bedside breastfeeding guidance during postpartum hospitalization; (3) routine discharge education about infant feeding; and (4) standard follow-up phone call at 42 days postpartum.

2.5.2 Intervention Group

In addition to standard care, intervention group participants received access to the "Breastfeeding Support Platform" mobile application from enrollment (approximately 12 weeks gestation) through six months postpartum. The app provided:

Personalized Education Module: Weekly educational content tailored to gestational age or infant age, delivered through text, infographics, and short videos. Topics covered breastfeeding benefits, breast care, positioning and attachment techniques, common challenges and solutions, and maintaining milk supply. Interactive quizzes and gamification elements encouraged engagement.

Real-time Consultation Service: Participants could submit questions via text, photos, or video and receive responses from certified lactation consultants within two hours during working hours (8 AM - 10 PM daily). Complex issues were escalated to specialized lactation clinics.

Systematic Assessment and Monitoring: The app prompted regular self-assessments using validated tools including the LATCH breastfeeding assessment tool. Results were monitored by case managers who provided targeted interventions for identified problems.

Case Management System: Each participant was assigned a dedicated case manager (experienced nurse with lactation consultant certification) who conducted scheduled follow-ups at key timepoints: days 7, 14, and 28 postpartum, then biweekly through six months. Case managers reviewed participants' progress, addressed concerns, and coordinated additional support as needed.

Peer Support Community: A moderated forum allowed participants to share experiences and support each other, supervised by healthcare professionals to ensure information accuracy.

2.6 Outcome Measures

2.6.1 Primary Outcome

The primary outcome was exclusive breastfeeding rate at six months postpartum, defined according to WHO criteria as feeding only breast milk with no other liquids or solids except vitamins, minerals, or medicines.

2.6.2 Secondary Outcomes

Secondary outcomes included:

Exclusive breastfeeding rates at one and three months postpartum

Breastfeeding knowledge scores assessed using a validated 20-item questionnaire (range 0-20)

Incidence of lactation-related complications (mastitis, nipple trauma, perceived insufficient milk supply)

Satisfaction with nursing services measured using a 20-item scale (range 0-100)

App usage patterns and engagement metrics (intervention group only)

2.7 Data Collection

Data were collected at baseline (enrollment), during hospitalization, and at one, three, and six months postpartum. Trained research assistants conducted structured telephone interviews to assess infant feeding practices using 24-hour dietary recall. Breastfeeding knowledge and satisfaction were assessed using validated questionnaires administered electronically. Medical records were reviewed to verify lactation-related complications.

2.8 Statistical Analysis

Data analysis was performed using SPSS version 26.0. Analyses followed intention-to-treat principles. Baseline characteristics were compared between groups using independent t-tests for continuous variables and chi-square tests for categorical variables.

Primary and secondary outcomes were analyzed using appropriate statistical tests: chi-square tests for categorical outcomes and independent t-tests for continuous outcomes. Relative risks with 95% confidence intervals were calculated for binary outcomes.

Subgroup analyses examined outcomes by delivery mode, education level, and employment status. Sensitivity analyses using per-protocol principles included only participants with >80% app engagement (intervention group). Statistical significance was set at $p<0.05$ for all analyses.

3. Results

3.1 Participant Flow and Baseline Characteristics

Table 1. Baseline Characteristics of Study Participants

Characteristic	Intervention (n=232)	Control (n=228)	p-value

Age, years (mean ± SD)	27.5 ± 3.8	27.9 ± 4.1	0.395
Gestational age at enrollment, weeks	12.3 ± 1.1	12.5 ± 1.2	0.214
Education level, n (%)			0.745
High school or below	98 (42.2)	105 (46.1)	
Bachelor's degree	115 (49.6)	108 (47.4)	
Master's degree or above	19 (8.2)	15 (6.6)	
Employment status, n (%)			0.523
Employed full-time	168 (72.4)	159 (69.7)	
Part-time/Unemployed	64 (27.6)	69 (30.3)	
Planned pregnancy, n (%)	186 (80.2)	178 (78.1)	0.579
Delivery mode, n (%)			0.832
Vaginal delivery	155 (66.8)	151 (66.2)	
Cesarean section	77 (33.2)	77 (33.8)	

Of 523 women screened for eligibility, 486 met inclusion criteria and were randomized (243 per group). During the study period, 26 participants (5.3%) were lost to follow-up or withdrew consent (intervention: n=11; control: n=15), leaving 460 participants (94.7%) in the final analysis (Table 1).

Baseline characteristics were well-balanced between groups (Table 1). Mean age was 27.7 ± 4.0 years, with most participants having college-level education (48.5%). Approximately two-thirds delivered vaginally (66.5%), with no significant differences in delivery mode between groups.

3.2 Primary Outcome

The exclusive breastfeeding rate at six months was significantly higher in the intervention group compared to the control group (51.3% vs. 30.7%, $p<0.001$), representing a 67% relative increase. The absolute risk difference was 20.6% (95% CI: 12.3-28.9%), with a number needed to treat (NNT) of 5.

3.3 Secondary Outcomes

3.3.1 Exclusive Breastfeeding Rates over Time

Exclusive breastfeeding rates were consistently higher in the intervention group at all time points. At one month, 85.3% of intervention group mothers were exclusively breastfeeding compared to 74.6% of controls ($p=0.005$). This difference widened at three months (62.5% vs. 43.0%, $p<0.001$) and six

months (51.3% vs. 30.7%, p<0.001), demonstrating better breastfeeding maintenance in the intervention group (Table 2).

3.3.2 Breastfeeding Knowledge

Intervention group participants demonstrated significantly better breastfeeding knowledge at all assessment points. Mean knowledge scores at six months were 17.2 ±2.1 in the intervention group versus 14.8 ±3.2 in controls (p<0.001), representing a moderate effect size (Cohen's d=0.89).

3.3.3 Lactation-Related Complications

Table 2. Lactation-Related Complications by Study Group

Complication	Intervention (n=232)	Control (n=228)	RR (95% CI)	p-value
Mastitis, n (%)	10 (4.3)	26 (11.4)	0.38 (0.19-0.75)	0.003
Nipple trauma, n (%)	20 (8.6)	44 (19.3)	0.45 (0.27-0.74)	0.001
Insufficient milk supply, n (%)	29 (12.5)	58 (25.4)	0.49 (0.33-0.74)	0.001

The intervention group experienced significantly fewer lactation-related complications (Table 2). Mastitis occurred in 4.3% of intervention participants compared to 11.4% of controls (RR=0.38, 95% CI: 0.19-0.75). Similarly, nipple trauma (8.6% vs. 19.3%, RR=0.45, 95% CI: 0.27-0.74) and perceived insufficient milk supply (12.5% vs. 25.4%, RR=0.49, 95% CI: 0.33-0.74) were less common in the intervention group.

3.4 Self-reported perception of insufficient milk supply

The self-reported perception of insufficient milk supply was significantly lower among mothers in the intervention group compared to those in the control group. As detailed in Table 2, only 12.5% (29 out of 232) of participants who used the mobile app reported concerns about having an insufficient milk supply. In contrast, this issue was reported by 25.4% (58 out of 228) of participants in the control group who received standard care. This finding indicates a statistically significant difference (p=0.001) and suggests that the intervention was effective in improving maternal confidence and addressing one of the most common reasons for early breastfeeding cessation.

3.5 Satisfaction with Nursing Services

Intervention group participants reported higher satisfaction with nursing services (95.7% vs. 84.2%, p<0.001). Mean satisfaction scores were 92.3 ±6.8 versus 85.1 ±9.2 (p<0.001), with particular

improvements noted in accessibility of support, timeliness of responses, and quality of information provided.

3.6 App Engagement and Usage Patterns

Among intervention group participants, 89.2% demonstrated high engagement (defined as >80% completion of scheduled activities). Average app usage was 4.2 times per week during pregnancy, increasing to 6.8 times per week during the first month postpartum, then gradually decreasing to 2.3 times per week by six months.

Most frequently accessed features were educational content (accessed by 96.5% of users), consultation services (78.4%), and peer support forums (65.1%). Participants submitted an average of 8.7 consultation requests throughout the study period, with 94.3% receiving responses within the promised two-hour timeframe.

3.7 Subgroup Analyses

The intervention effect remained significant across all pre-specified subgroups. However, the magnitude of effect varied: women with higher education levels showed greater improvement in exclusive breastfeeding rates (56.5% vs. 31.5% for bachelor's degree or higher) compared to those with lower education (44.9% vs. 29.5% for high school or below).

4. Discussion

This randomized controlled trial demonstrates that a comprehensive mobile app-based breastfeeding support platform can significantly improve exclusive breastfeeding rates among first-time mothers. The intervention group achieved a six-month exclusive breastfeeding rate of 51.3%, exceeding the national target of 50% and representing a substantial improvement over standard care.

4.1 Interpretation of Main Findings

The success of our intervention can be attributed to several key factors. First, the continuous nature of support—spanning from early pregnancy through six months postpartum—ensured that mothers received help when they needed it most. Traditional breastfeeding support often suffers from discontinuity, with intensive hospital-based support ending abruptly at discharge[11]. Our platform bridged this gap, providing seamless transition from prenatal education to postpartum support.

Second, the personalized approach addressed individual needs more effectively than standardized programs. By using regular assessments and case management, the platform could identify and address problems early, before they led to breastfeeding cessation. This proactive approach likely

contributed to the lower rates of complications observed in the intervention group.

Third, the combination of professional support and peer interaction created a comprehensive support network. While professional guidance ensured evidence-based practices, peer support provided emotional encouragement and practical tips from shared experiences. This dual approach aligns with research showing that both professional and peer support independently contribute to breastfeeding success[12].

4.2 Comparison with Previous Studies

Our findings are consistent with emerging evidence on mHealth interventions for breastfeeding support. A systematic review by Almohanna[13] found that mobile-based interventions increased exclusive breastfeeding rates by an average of 15-20%, similar to our observed 20.6% absolute increase. However, our study extends previous work by demonstrating sustained effects through six months postpartum, whereas many previous studies showed diminishing effects over time.

The reduction in lactation-related complications observed in our study is particularly noteworthy. Previous app-based interventions have primarily focused on education and have not consistently demonstrated clinical benefits beyond knowledge improvement[14]. Our integrated approach, combining education with real-time consultation and systematic monitoring, appears more effective at preventing and managing clinical problems.

4.3 Implications for Practice

The successful implementation of this platform has important implications for nursing practice and healthcare delivery. In an era of nursing shortages and increasing patient loads, technology-enabled care models can extend the reach of skilled professionals without compromising quality. Our platform allowed each lactation consultant to support approximately 50 mothers simultaneously, far exceeding traditional one-on-one care capacity.

For healthcare systems, the relatively low cost of app-based interventions compared to intensive face-to-face support makes this approach financially attractive. While formal cost-effectiveness analysis was beyond the scope of this study, the reduction in complications alone likely generates significant cost savings through avoided treatments.

The high satisfaction rates observed suggest that mothers value the convenience and accessibility of mobile-based support. This is particularly relevant in China, where rapid urbanization has disrupted traditional family support systems, leaving many new mothers without readily available help from experienced relatives[15].

4.4 Strengths and Limitations

This study has several strengths. The randomized controlled design provides robust evidence of effectiveness. The large sample size and low attrition rate enhance generalizability. The comprehensive nature of the intervention, addressing multiple aspects of breastfeeding support, reflects real-world complexity better than single-component interventions.

However, several limitations should be acknowledged. First, the single-center design in an urban area may limit generalizability to rural or resource-limited settings. Second, the inability to blind participants could have introduced performance bias, though objective outcomes like exclusive breastfeeding rates are less susceptible to such bias. Third, reliance on self-reported feeding data could introduce recall bias, though 24-hour recall is considered reasonably accurate for current feeding practices.

Additionally, the high smartphone penetration and digital literacy required for participation may have excluded some vulnerable populations who might benefit most from additional support. Future implementations should consider alternative delivery methods for digitally disadvantaged groups.

4.5 Future Directions

Several areas warrant further investigation. Long-term follow-up beyond six months would clarify whether early improvements in breastfeeding translate to better child health outcomes. Integration with electronic health records could enable more sophisticated risk prediction and targeted interventions. Artificial intelligence could potentially automate initial response to common questions, further improving scalability.

Adaptation of the platform for different cultural contexts and healthcare systems will be crucial for broader implementation. Features like multilingual support, culturally appropriate content, and integration with local healthcare providers will need careful consideration.

5. Conclusions

This randomized controlled trial provides strong evidence that a comprehensive mobile app-based breastfeeding support platform can significantly improve exclusive breastfeeding rates among first-time mothers. By providing continuous, personalized support from pregnancy through six months postpartum, the intervention achieved exclusive breastfeeding rates exceeding national targets while reducing complications and improving satisfaction.

The success of this intervention demonstrates the potential of mHealth technologies to address persistent public health challenges. As countries worldwide struggle to meet breastfeeding targets, mobile-based support platforms offer a scalable, cost-effective solution that aligns with modern healthcare delivery trends.

For nursing professionals, this study highlights opportunities to leverage technology in extending care beyond traditional settings. Rather than replacing human support, well-designed digital platforms can amplify the impact of skilled professionals, ensuring that evidence-based breastfeeding support reaches all mothers when they need it most.

Implementation of similar platforms should be considered as part of comprehensive strategies to promote breastfeeding. With appropriate adaptation to local contexts and integration with existing healthcare services, mobile-based breastfeeding support can contribute significantly to achieving global breastfeeding goals and improving maternal and child health outcomes.

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