https://doi.org/10.53964/jmnpr.2026008

https://www.innovationforever.com

Journal of
Modern Nursing Practice and Research

ISSN 2708-2202 (Online)

Open Access

Research Article

Roy Adaptation Model with Kangaroo Care for Post-cesarean Primiparas: Effects on Maternal Mental Health and Infant Neurodevelopment

Hong Zheng[1], Guofang Feng[1], Sichao Chen[1*]

[1]Department of Obstetrics, Hangzhou Maternal and Child Health Hospital (Hangzhou Obstetrics and Gynecology Hospital), Hangzhou, Zhejiang Province, China

[*]**Correspondence to: Sichao Chen**, Department of Obstetrics, Hangzhou Maternal and Child Health Hospital (Hangzhou Obstetrics and Gynecology Hospital), Hangzhou, 310008, Zhejiang Province, China; Email: shtvrqsb36268@163.com

Received: July 15, 2026 **Revised:** August 28, 2026 **Accepted:** September 24, 2026 **Published:** September 30, 2026

Abstract

Objective: Primiparous women undergoing cesarean section often experience psychological distress, role adaptation difficulties, and breastfeeding challenges, which may adversely affect both maternal and infant health. Integrating psychological support with physiological nurturing interventions may offer synergistic benefits, yet evidence for combined approaches remains limited.

Methods: This retrospectiveZ before-and-after controlled study included 108 primiparous women who underwent cesarean section between April 2023 and June 2025. The control group (n=54) received routine perinatal care, while the observation group (n=54) received a combined protocol integrating the Roy Adaptation Model with Kangaroo Care. Maternal outcomes included anxiety (SAS), depression (SDS), maternal role adaptation (MRAQ), and breastfeeding status (BAT score, first breastfeeding success rate, exclusive breastfeeding rate at discharge). Infant outcomes included physical development (length, weight, head circumference) and neurodevelopmental status (NBNA).

Results: The observation group demonstrated significantly greater reductions in SAS and SDS scores compared with the control group (both $P<0.001$). MRAQ scores across all dimensions—caregiving behavior, role identity, and mother-infant attachment—improved more substantially in the observation group (all $P<0.05$). Breastfeeding outcomes were superior in the observation group, with higher BAT scores ($P<0.001$), first breastfeeding success rate (90.74% vs. 70.37%, $P=0.007$), and exclusive breastfeeding rate at discharge (77.78% vs. 55.56%, $P=0.014$). Infant physical growth indicators and NBNA scores across all neurobehavioral dimensions also showed significantly greater improvements in the observation group (all $P<0.05$).

Conclusion: The integrated application of Roy Adaptation Model and Kangaroo Care effectively alleviates maternal negative emotions, facilitates maternal role transition, promotes breastfeeding, and supports early infant physical and neurobehavioral development among primiparous women after cesarean section. This psychophysiological nursing model offers a promising strategy for maternal-infant health promotion in clinical practice.

Keywords: cesarean section; primiparous women; Roy Adaptation Model; Kangaroo Care; psychological emotion; breastfeeding; infant development

https://doi.org/10.53964/jmnpr.2026008

Citation: Zheng H, Feng G, Chen S. Roy Adaptation Model with Kangaroo Care for Post-cesarean Primiparas: Effects on Maternal Mental Health and Infant Neurodevelopment. *J Mod Nurs Pract Res*, 2026; 6(3): 8. DOI: 10.53964/jmnpr.2026008.

1 INTRODUCTION

Cesarean section is one of the most common delivery methods in modern obstetrics. With the increasing number of older mothers and advancements in obstetric technology, its clinical application rate continues to rise[1]. Statistics indicate that the cesarean section rate in some regions of China has exceeded 40%, with a higher proportion among primiparous women[2]. Although cesarean section plays an important role in reducing delivery risks and ensuring maternal and infant safety, postoperative women often experience pain, slow physical recovery, and psychological problems such as anxiety and depression. Primiparous women, in particular, due to the lack of childbirth and parenting experience, are more prone to adaptive disorders in psychological, emotional, and role identity aspects[3,4]. Without effective nursing interventions, these women may develop insufficient mother-infant attachment, breastfeeding difficulties, or postpartum depression, which negatively affect maternal and infant health[5,6]. Therefore, exploring scientific nursing models that promote both physical and psychological recovery and positive mother-infant interaction among primiparous women after cesarean section has become a key issue in clinical nursing research.

The Roy Adaptation Model, proposed by American nursing theorist Callista Roy, is a systematic nursing theory emphasizing that individuals respond to physiological, psychological, and social stimuli through adaptive mechanisms to achieve balance in physiological and psychological states[7,8]. In obstetric nursing, this model advocates comprehensive assessment and guidance for postpartum women to help them recognize role transitions, enhance self-efficacy, and establish positive psychological regulation mechanisms, thereby improving emotional well-being and facilitating role adaptation[9]. Kangaroo Care is also a helpful tool in the transition to motherhood, as it allows primiparous women to participate directly in infant care, experience early skin-to-skin contact, and develop confidence and emotional connection with their newborns. As a care approach centered on early skin-to-skin contact between mother and infant, Kangaroo Care was initially designed to promote thermoregulation and growth in preterm infants but has recently been extended to full-term infants and cesarean section care[10]. Studies[11,12] have demonstrated that Kangaroo Care promotes oxytocin secretion through skin contact, stabilizes infant body temperature and heart rate, alleviates maternal anxiety, and facilitates both milk secretion and mother-infant bonding. It is characterized by simplicity, safety, and intimacy, enhancing emotional communication and improving infant physical and neurological development, thereby supporting early growth and adaptation.

The Roy Adaptation Model and Kangaroo Care complement each other in both theory and practice. The former focuses on psychological and social adaptation, while the latter emphasizes physiological and emotional interaction. Their integration may yield synergistic effects by combining cognitive regulation with emotional bonding—helping mothers adjust psychologically, relieve anxiety and depression, and strengthen attachment and breastfeeding success through intimate contact. Hence, constructing a comprehensive nursing program that integrates the Roy Adaptation Model with Kangaroo Care can provide holistic support for primiparous women undergoing cesarean section and promote maternal-infant well-being. Currently, most studies focus on the individual application of either the Roy Adaptation Model or Kangaroo Care, with limited research on their combined use for this population.

Therefore, this study investigated 108 primiparous women undergoing cesarean section to explore the effects of integrating the Roy Adaptation Model with Kangaroo Care on maternal emotional state, role adaptation, breastfeeding, and infant development, aiming to provide a scientific nursing basis and valuable reference for innovation and promotion of obstetric nursing models.

2 MATERIALS AND METHODS

2.1 Study Design and Participants

The study was conducted in the Department of Obstetrics of Hangzhou Maternal and Child Health Hospital , and cases were collected from April 2023 to June 2025. This was a retrospective before-and-after controlled study based on a temporal change in routine departmental nursing practice. From April 2023 to March 2024, before the combined nursing protocol was formally introduced, primiparous women undergoing cesarean section received routine perinatal nursing care, and eligible patients during this period were retrospectively classified into the control group. From April to June 2024, the department conducted unified training, protocol refinement, and documentation standardization for the Roy Adaptation Model combined with Kangaroo Care; cases from this transition period were excluded from the final analysis to avoid exposure misclassification due to inconsistent implementation. From July 2024 to June 2025, after the combined protocol had been formally adopted as a standardized departmental nursing practice, it was applied to all eligible primiparous women undergoing cesarean section who met the predefined clinical safety conditions for routine mother-infant contact. Eligible patients during this period were retrospectively classified into the observation group if their electronic medical records and nursing records documented routine care plus the Roy Adaptation Model combined with Kangaroo Care.

Group classification was based on two predefined criteria:

the calendar period of admission and the nursing care model documented in the original medical and nursing records. It was not determined by random assignment, concurrent allocation, patient preference, individual nurse discretion, clinical severity, prognosis, emotional status, breastfeeding performance, neonatal condition, or investigator selection. Consecutive primiparous women who underwent cesarean section during each predefined period were screened using the same inclusion and exclusion criteria. Patients who did not meet the safety requirements for mother-infant contact, such as neonates requiring NICU admission or mothers with severe postoperative complications, were excluded according to the predefined exclusion criteria. Group classification was performed during retrospective data extraction and was not influenced by maternal or neonatal outcomes. To reduce selection bias and confounding, cases with missing key maternal or neonatal outcome data were excluded, baseline characteristics were compared between groups, and group classification and data extraction were checked by two independent researchers using the original medical and nursing records.

Because this was a retrospective observational study, no intervention was prospectively assigned, initiated, or monitored by the research team for study purposes. Intervention exposure was identified after ethics approval by reviewing existing electronic medical records, nursing documentation, Kangaroo Care records, breastfeeding guidance records, and follow-up forms. Patients were classified as having received the combined intervention only when the source records documented routine care plus Roy Adaptation Model-based assessment or counseling and Kangaroo Care-related nursing activities, including the timing, frequency, or duration of skin-to-skin contact when available. Patients were classified as having received routine care when records from the routine-care period documented standard perinatal nursing care without the combined protocol.

Outcome data were also retrospectively extracted from existing routine clinical records. The Pre-intervention and Post-intervention assessment points described in this study refer to standardized assessment time points documented during routine inpatient care, rather than assessment visits arranged prospectively for this research. Maternal scale scores, breastfeeding outcomes, infant physical development indicators, and Neonatal Behavioral Neurological Assessment (NBNA) scores were extracted from electronic medical records, original nursing records, and follow-up forms. Two independent researchers extracted intervention exposure and outcome data using a predefined data extraction form. Any discrepancies were resolved by reviewing the source documents, and unclear records were discussed with pediatric or maternal–infant care experts when necessary.

The sample size was estimated based on previous literature and hospital data, using the difference in Self-rating Anxiety Scale (SAS) scores at discharge as the target variable. Assuming an expected effect size of $d \approx 0.6$, a two-tailed significance level of $\alpha=0.05$, and a statistical power of approximately 0.80, at least 45 cases per group were required. Therefore, 54 cases per group were included in this study, providing sufficient statistical power. The study protocol was reviewed and approved by the hospital's Ethics Committee (Approval No.FCKLC25-HL07). As this was a retrospective study based entirely on existing clinical data, the Ethics Committee approved a waiver of written informed consent. The study adhered to the Declaration of Helsinki and relevant ethical principles, and all patient-identifying information was anonymized during data processing and analysis to ensure confidentiality.

2.2 Inclusion and Exclusion Criteria

Inclusion criteria: (1) Age between 18 and 45 years; first pregnancy and cesarean section delivery (meeting surgical indications); (2) Singleton, full-term delivery (gestational age ≥37 weeks and <42 weeks); (3) Confirmed as healthy by prenatal examination, with no severe pregnancy complications; (4) Complete data on postpartum maternal and neonatal outcomes, nursing records, and follow-up information; and (5) No history of severe psychiatric illness, clear consciousness before surgery, and ability to cooperate with questionnaire evaluation.

Exclusion criteria: (1) Neonates requiring NICU admission, precluding routine mother-infant skin contact; (2) Mothers with severe organ dysfunction (heart, liver, kidney), requiring ICU monitoring or developing severe postoperative infection; (3) History of long-term use of psychotropic or cognition-impairing medications; (4) Severe intraoperative complications requiring reoperation or prolonged hospitalization that prevented adherence to the intervention; (5) Maternal breast skin damage, incomplete mammary glands, or neonates diagnosed with galactosemia; and (6) Missing data or failed follow-up.

2.3 Nursing Care Procedures and Retrospective Exposure Definition

Clinical Care Timeline and Recorded Assessment Points: The following section summarizes the routine nursing care procedures documented in the original clinical records during the control and observation periods. These procedures were not prospectively assigned by the research team. For the present retrospective analysis, the recorded care activities and assessment results were organized according to the main clinical time points from admission before cesarean section to maternal discharge. First, after admission and before the main nursing intervention, maternal Pre-intervention assessments were completed using SAS, Self-rating Depression Scale (SDS) and Medication Risk Assessment Questionnaire (MRAQ). Second, after delivery and initial maternal-neonatal stabilization, neonatal Pre-intervention assessments,

including length, weight, head circumference, and NBNA, were recorded. Third, routine care or the combined intervention was implemented from the postoperative period until discharge. In the observation group, Kangaroo Care was initiated only after maternal and neonatal vital signs were stable and was conducted twice daily for 60 minutes per session until discharge. Fourth, Post-intervention assessments were completed on the day of discharge. SAS, SDS, MRAQ, infant physical development indicators, and NBNA were assessed again, while Breastfeeding Assessment Tool (BAT) score and exclusive breastfeeding status were recorded at discharge. The first breastfeeding success rate was recorded during hospitalization when effective latching and sucking were first achieved.

2.4 Control Group

The control group received routine perinatal care, focusing on ensuring postoperative physiological safety and basic recovery. The specific interventions were as follows: (1) Preoperative health education: Nurses provided detailed explanations of the cesarean procedure, preoperative preparation, intraoperative precautions, and postoperative recovery requirements, including pain management, activity guidelines, dietary care, and wound management, to reduce anxiety and enhance psychological preparedness.

(2) Postoperative physiological monitoring and care: Nurses regularly monitored vital signs (blood pressure, pulse, respiration, temperature, and oxygen saturation), observed wound healing, and checked for exudation, redness, or signs of infection.

Wounds were disinfected and dressings changed as needed. Patients were guided to engage in moderate physical activity (turning over, sitting up, walking lightly) to prevent thrombosis and constipation.

(3) Pain management: Analgesics were administered as prescribed, supplemented by non-pharmacological pain relief measures such as posture adjustment, deep breathing, and gentle massage.

(4) Breastfeeding guidance: Nurses demonstrated correct breastfeeding positions and latching techniques, observed infant sucking behavior, answered maternal questions, encouraged early breastfeeding initiation, and helped mothers build breastfeeding confidence.

2.5 Observation Group

During the post-implementation period, eligible patients in the observation group had nursing records documenting routine care plus the standardized departmental protocol combining the Roy Adaptation Model and Kangaroo Care. This protocol was applied in routine clinical practice once maternal and neonatal vital signs were stable and no contraindication to mother-infant contact was present. The documented care activities included Roy model-based assessment, psychological support, breastfeeding guidance, family participation, and Kangaroo Care. For clarity and reproducibility, the care activities retrospectively identified from the nursing records are summarized below according to the standard departmental workflow.

Step 1: Assessment Phase: (1) First-level assessment: Upon admission, the nursing team conducted a comprehensive assessment based on the four adaptive modes. a. Physiological function: Postoperative pain level, sleep quality, wound healing, physical recovery, and nutritional status. b. Self-concept: Emotional state, anxiety and depression levels, perception and expectations regarding childbirth and motherhood. c. Role function: Maternal role cognition, mastery of infant care skills, willingness and confidence in mother-infant interaction. d. Interdependence: Quality of interaction and support between the mother and her spouse, family, and nursing staff, as well as available social support systems. (2) Second-level assessment: Issues identified in the first-level assessment were quantified and categorized to formulate individualized intervention plans. SAS and SDS were used to quantify anxiety and depression levels; BAT was used to evaluate breastfeeding skills; mother-infant intimacy and interaction quality were observed and recorded; NBNA was used to assess neonatal neurobehavioral performance.

Step 2: Individualized Intervention Phase: (1) Psychological intervention: Nurses provided approximately 30 minutes of emotional counseling and psychological support daily, using techniques such as active listening, cognitive-behavioral guidance, deep breathing, progressive muscle relaxation, and imagery training to alleviate anxiety and depression and enhance self-efficacy and maternal role identity. (2) Behavioral intervention: Nurses demonstrated and guided mothers in breastfeeding, holding, diaper changing, and soothing techniques. Practical training was conducted twice daily for 15 minutes per session. Nurses observed and corrected operational details to ensure skill mastery and improve breastfeeding success. (3) Interdependence intervention: Husbands and family members were encouraged to participate in daily care and Kangaroo Care-related operations. They were guided on safe handling and infant observation techniques to enhance maternal social support and psychological security. Family members participated at least once daily for over 30 minutes.

Step 3: Kangaroo Care Intervention: (1) Initiation conditions and procedure: Implemented after maternal and neonatal vital signs stabilized. The mother adopted a semi-recumbent or seated position, with the infant placed prone on her bare chest for direct skin-to-skin contact. The infant's head was turned to one side to maintain airway patency and was dressed only in a diaper and cap to prevent hypothermia. (2) Intervention frequency and duration: Conducted twice daily for 60 minutes each session (total ≥2 hours/day). During each session, nurses observed the infant's sucking response, body temperature, skin color, and activity level during breastfeeding. (3) Dynamic adjustment: The nursing team

documented the duration of each Kangaroo Care session, infant sucking performance, and maternal milk secretion. Any abnormal maternal or infant responses were promptly addressed by adjusting the intervention plan. For mothers with high anxiety levels, breastfeeding difficulties, or poor operational proficiency, additional psychological counseling and hands-on training sessions were provided.

Step 4: Recorded Discharge Assessment: On the day of discharge, routine Post-intervention assessment results were recorded according to the same standardized departmental assessment procedures and were retrospectively extracted for this study.

2.6 Observation Indicators and Testing Methods

All outcome assessments were completed as part of routine inpatient nursing assessment and were recorded contemporaneously in electronic medical records, nursing records, or follow-up forms. The research team did not prospectively administer the scales or re-assess patients for this study; rather, all outcome data were retrospectively extracted from existing clinical records after ethics approval. Maternal self-report scales, including SAS, SDS, and MRAQ, were administered by trained inpatient obstetric nurses according to unified nursing assessment procedures at Pre-intervention and Post-intervention. BAT score, first breastfeeding success, and exclusive breastfeeding status were assessed or recorded by trained obstetric nurses during routine breastfeeding guidance and discharge assessment. Infant physical development indicators and NBNA were assessed by uniformly trained pediatric nurses after neonatal stabilization before the main nursing intervention and again on the day of maternal discharge. The same department-level assessment procedures and the same trained obstetric and pediatric nursing teams were used for both groups, although the individual nurse performing an assessment could vary according to routine clinical shifts. During the present retrospective study, two independent researchers extracted the recorded assessment results from the original records, and discrepancies were resolved by checking the source documents.

(1) Negative Emotional Status[13]: At both the Pre-intervention and Post-intervention stages, the SAS (Cronbach's α=0.768, validity=0.743) was used to evaluate maternal anxiety levels. The total score of the scale is 100 points, with a cutoff value of 50; higher scores indicate greater anxiety. The SDS (Cronbach's α=0.785, validity=0.761) was used to assess maternal depression, with a total score of 100 points and a cutoff value of 53; higher scores represent higher levels of depressive symptoms.

(2) Role Transition Status: At both the Pre-intervention and Post-intervention stages, the MRAQ (Cronbach's α=0.836, validity=0.794)[14] was used to evaluate the maternal role transition. The questionnaire includes three dimensions—caring behavior, role identity, and mother-infant attachment—with eight items in each dimension. Each item is scored from 0 to 4, and higher scores indicate better maternal role adaptation.

(3) **Breastfeeding Status:** On the day of discharge, the BAT (Cronbach's α=0.743, validity=0.719)[15] was used to evaluate breastfeeding performance. The BAT includes four aspects: infant's latch and positioning, sucking behavior, timing of feeding, and infant's behavior when contacting the breast. Each item is scored from 0 to 3, with a total of 12 points. Higher scores indicate better breastfeeding performance. The first breastfeeding success rate (defined as the first time during hospitalization when the mother successfully completes latching and maintains effective sucking for ≥5 minutes with visible swallowing) and the exclusive breastfeeding rate at discharge were also recorded.

(4) Infant Physical Development: Infant physical development was assessed at the same two time points in both groups. The Pre-intervention measurement was performed within 24 hours after birth, after the newborn's condition had stabilized and before the main nursing intervention. The Post-intervention measurement was performed on the day of maternal discharge. At both time points, the same group of uniformly trained pediatric nurses evaluated infant physical development, including measurements of length, weight, and head circumference. All measurements were performed in the morning before feeding and after voiding, with the infant in a quiet state to minimize measurement error. Length was measured using a standard infant recumbent measuring bed: the infant was placed supine, the head positioned against the fixed end, and both legs naturally straight and aligned with the ruler, with readings accurate to 0.01cm. Weight was measured using a calibrated electronic infant scale placed on a stable, clean surface and zeroed before each use, with readings accurate to 0.01 g. Head circumference was measured using a soft tape measure placed around the head, passing over the supraorbital ridge and the most prominent part of the occiput, with readings accurate to 0.01cm. Each measurement was repeated three times, and the average was taken to ensure accuracy.

(5) Infant Neurodevelopment: At both the Pre-intervention and Post-intervention stages, the NBNA (Cronbach's α=0.825, validity=0.786)[16] was used to assess infant neurodevelopment. The NBNA includes five dimensions—general condition, behavioral ability, primitive reflexes, active muscle tone, and passive muscle tone—comprising 20 items in total. Each item is scored from 0 to 2, with a total score of 40. A score of <35 indicates possible neurological impairment, and higher scores reflect better neurodevelopmental outcomes.

2.7 Data Quality Control and Compliance Monitoring

All nurses who performed routine maternal and neonatal

https://doi.org/10.53964/jmnpr.2026008

Table 1. Comparison of Baseline Characteristics between the Two Groups (mean±SD, n[%])

	Control (n=54)	Observation (n=54)	t/χ^2	*P*
Age (years)	28.75±3.43	29.14±3.56	0.579	0.563
Gestational weeks	39.12±1.18	38.86±1.07	1.199	0.233
Marital status	-	-	0.259	0.610
Married	51 (94.44%)	53 (98.15%)	-	-
Unmarried/divorced	3 (5.56%)	1 (1.85%)	-	-
Education level	-	-	0.613	0.433
High school or below	20 (37.04%)	24 (44.44%)	-	-
College or above	34 (62.96%)	30 (55.56%)	-	-

Table 2. Comparison of Negative Emotional Status Between the Two Groups (mean±SD, points)

	Control (n=54)	Observation (n=54)	*t*	*P*
SAS score	-	-	-	-
Pre-intervention	58.32±6.67	59.04±6.52	0.567	0.571
Post-intervention	48.26±6.05[@]	42.22±5.84[@]	5.278	<0.001
SDS score	-	-	-	-
Pre-intervention	56.43±6.83	57.15±6.37	0.566	0.572
Post-intervention	44.57±5.12[@]	38.38±5.37[@]	6.130	<0.001

Notes: Compared with the same group before intervention, [@]*P*<0.05.

assessments completed standardized training in the relevant nursing assessment procedures. During clinical practice, assessment results were documented in electronic medical records, nursing records, or follow-up forms according to departmental requirements. For the present retrospective analysis, the research team was responsible only for case screening, data extraction, and data verification, rather than direct prospective assessment of participants. Two independent researchers extracted group information and outcome data separately from the original records, and discrepancies were resolved by reviewing the source documents. Key variables, including first breastfeeding success, infant physical development indicators, and NBNA scores, were further checked against the original nursing records or reviewed by pediatric or maternal–infant care experts when necessary to improve data reliability.

2.8 Statistical Analysis

Data visualization was performed using GraphPad Prism 8, and statistical analyses were conducted using SPSS 25.0. Measurement data were tested for normality using the Shapiro–Wilk test. Normally distributed continuous variables were expressed as mean ± standard deviation (SD). Independent-samples *t*-tests were used for between-group comparisons, and paired *t*-tests were used for within-group comparisons between Pre-intervention and Post-intervention values. Categorical variables were expressed as numbers and percentages, and χ^2 tests or Fisher's exact tests were used as appropriate. To strengthen the interpretation of the results, effect estimates and 95% confidence intervals (95%CIs) were additionally calculated for the main outcomes. For continuous outcomes, the between-group difference at Post-intervention or discharge was expressed as mean difference (MD) with 95%CI and standardized mean difference (Cohen's d). For categorical outcomes, odds ratios (ORs) with 95%CIs were calculated. Considering the retrospective design, supplementary multivariable regression analysis was also performed to assess the robustness of the main findings after adjustment for potential confounding variables, including age, gestational weeks, marital status, and education level. Linear regression models were used for continuous outcomes, and binary logistic regression models were used for categorical breastfeeding outcomes. A $P<0.05$ was considered statistically significant.

3 RESULTS

3.1 Comparison of Baseline Characteristics between the Two Groups

There were no significant differences between the two groups in terms of age, gestational weeks, marital status, or education level ($P>0.05$), indicating comparability, as shown in Table 1.

3.2 Comparison of Negative Emotional Status between the Two Groups

After intervention, both SAS and SDS scores decreased significantly compared with the Pre-intervention values in both groups, with greater changes observed in the observation group ($P<0.05$), as shown in Table 2.

3.3 Comparison of Maternal Role Transition between the Two Groups

After intervention, the scores of caring behavior, role identity, and mother–infant attachment all increased

https://doi.org/10.53964/jmnpr.2026008

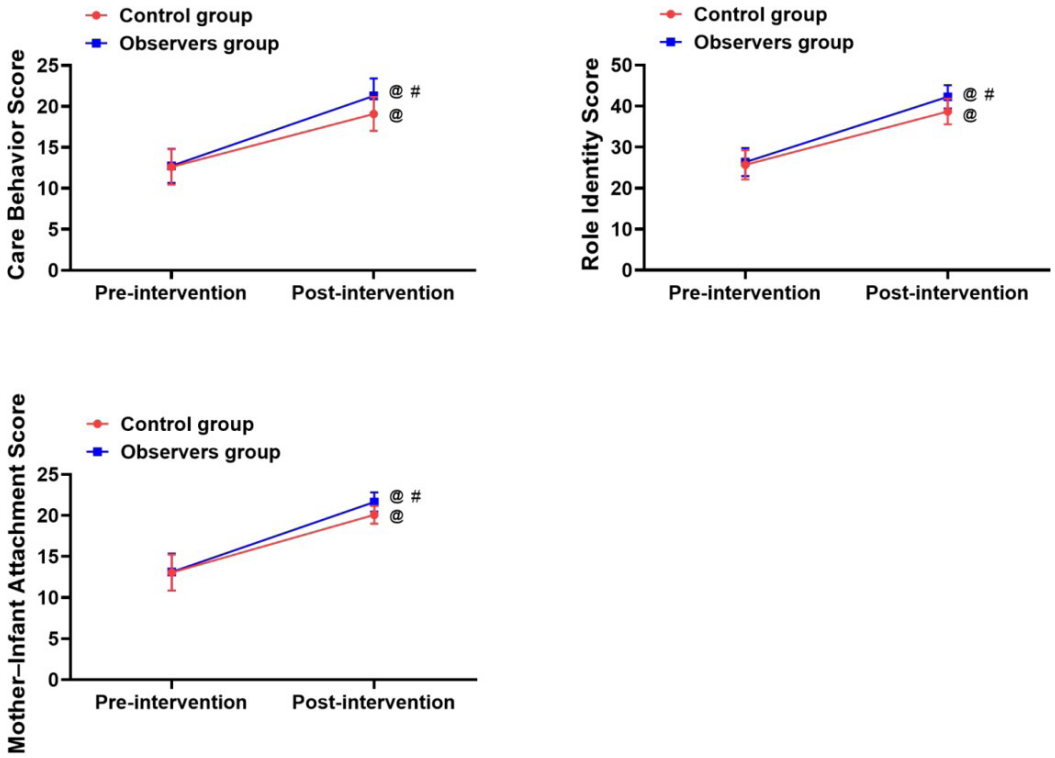


Figure 1. Comparison of Maternal Role Transition between the Two Groups (mean±SD, points). Notes: Compared with the same group before intervention, $^{@}P<0.05$; comparison between groups, $^{\#}P<0.05$.

Table 3. Comparison of Breastfeeding Status between the Two Groups (mean±SD, n[%])

Control (n=54)	Observation (n=54)		t/χ^2	P
BAT score (points)	7.23±0.85	8.34±1.12	5.801	<0.001
First breastfeeding success rate	38 (70.37%)	49 (90.74%)	7.152	0.007
Exclusive breastfeeding rate at discharge	30 (55.56%)	42 (77.78%)	6.000	0.014

compared with the Pre-intervention stage in both groups, with greater improvements in the observation group ($P<0.05$), as shown in Figure 1.

3.4 Comparison of Breastfeeding Status between the Two Groups

The observation group showed significantly higher BAT scores, first breastfeeding success rate, and exclusive breastfeeding rate at discharge compared with the control group ($P<0.05$), as shown in Table 3.

3.5 Comparison of Infant Physical Development between the Two Groups

After intervention, infant length, weight, and head circumference all increased in both groups compared with Pre-intervention levels, with greater improvements in the observation group (P<0.05), as shown in Figure 2.

3.6 Comparison of Infant Neurodevelopment between the Two Groups

After intervention, the scores of general condition, behavioral ability, primitive reflexes, active muscle tone, and passive muscle tone all increased significantly in both groups compared with Pre-intervention, with the observation group showing greater improvements (P<0.05), as shown in Figure 3.

3.7 Effect Estimates and Supplementary Adjusted Analysis of Main Outcomes

To further evaluate the magnitude and precision of the intervention effect, effect estimates and 95%CIs were calculated for the main outcomes. As shown in Table 4, the observation group showed more favorable results than the control group across maternal emotional status, maternal role transition, breastfeeding outcomes, infant physical development, and NBNA dimension scores. Specifically, the observation group had lower Post-intervention SAS and SDS scores, higher maternal role adaptation scores, better breastfeeding outcomes, and greater improvements in infant growth and neurodevelopment-related indicators. In the supplementary multivariable analysis adjusting for age, gestational weeks, marital status, and education level, the direction of the associations remained consistent with the unadjusted results, suggesting that the observed findings were not fully explained by measured baseline characteristics.

4 DISCUSSION

The results of this study demonstrated that the

https://doi.org/10.53964/jmnpr.2026008

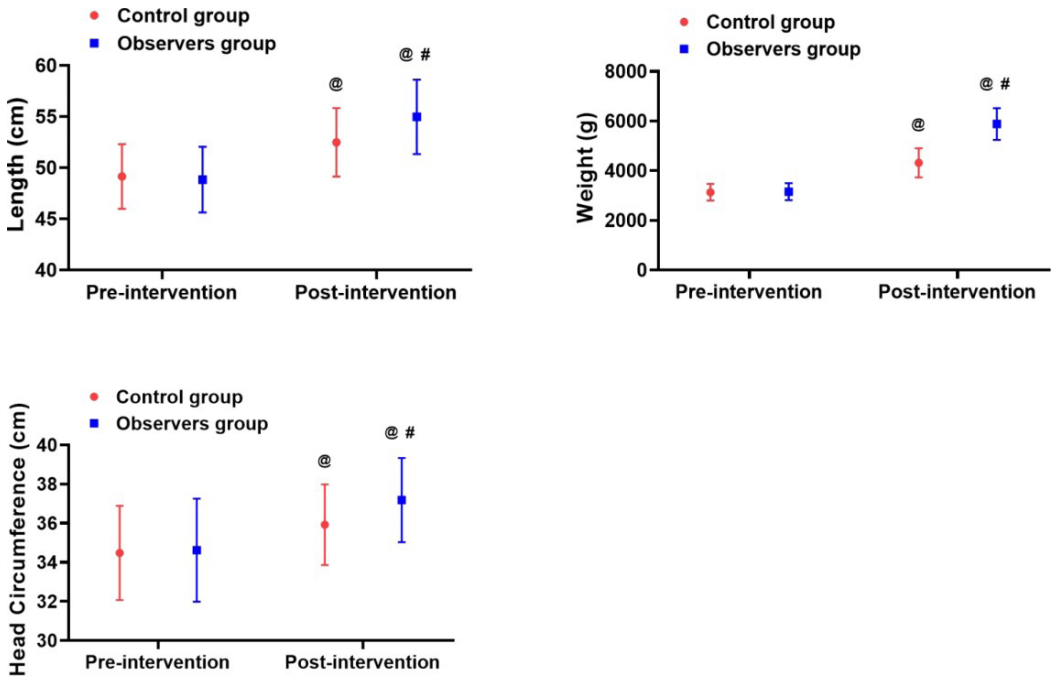


Figure 2. Comparison of Infant Physical Development between the Two Groups (mean±SD). Notes: Compared with the same group before intervention, $^{@}P<0.05$; comparison between groups, $^{\#}P<0.05$.

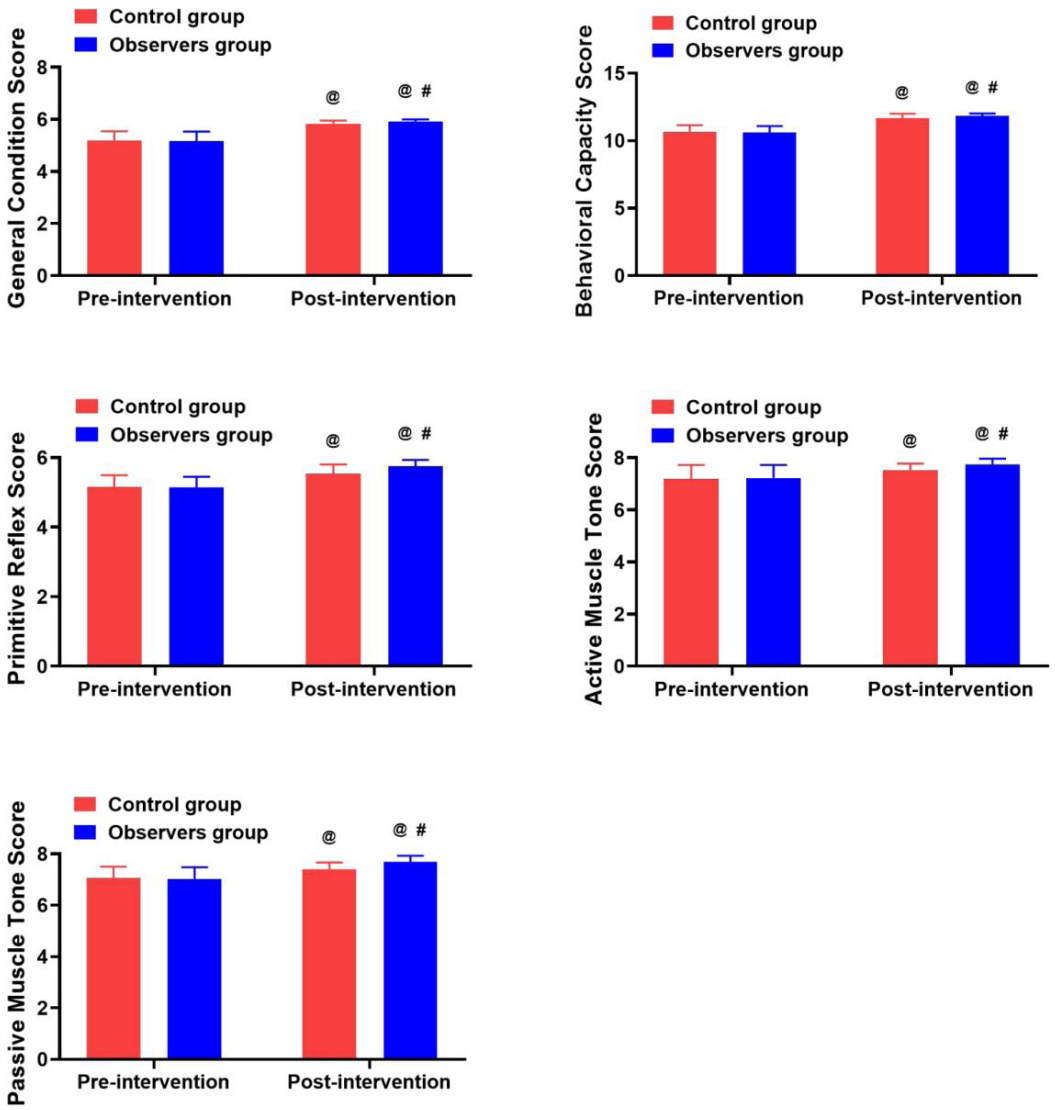


Figure 3. Comparison of Infant Neurodevelopment Between the two Groups (x±s, Points). Notes: Compared with the same group before intervention, $^{@}P<0.05$, comparison between groups, $^{\#}P<0.05$.

Table 4. Effect Estimates and 95% Confidence Intervals for Main Outcomes

Outcome	Effect Estimate	95%CI	Standardized Effect	*P*
Post-intervention SAS score	MD=−6.04	−8.31 to −3.77	Cohen's d=−1.02	<0.001
Post-intervention SDS score	MD=−6.19	−8.19 to −4.19	Cohen's d=−1.18	<0.001
Caring behavior score	MD=2.22	1.42 to 3.02	Cohen's d=1.06	<0.001
Role identity score	MD=3.58	2.44 to 4.72	Cohen's d=1.20	<0.001
Mother-infant attachment score	MD=1.57	1.14 to 2.00	Cohen's d=1.39	<0.001
BAT score at discharge	MD=1.11	0.73 to 1.49	Cohen's d=1.12	<0.001
First breastfeeding success rate	OR=4.13	1.39 to 12.27	—	0.007
Exclusive breastfeeding rate at discharge	OR=2.80	1.21 to 6.46	—	0.014
Body length	MD=2.50	1.17 to 3.83	Cohen's d=0.71	<0.001
Weight	MD=1563.29	1329.71 to 1796.87	Cohen's d=2.55	<0.001
Head circumference	MD=1.26	0.46 to 2.06	Cohen's d=0.60	0.002
General condition score	MD=0.09	0.05 to 0.13	Cohen's d=0.80	<0.001
Behavioral ability score	MD=0.18	0.08 to 0.28	Cohen's d=0.67	<0.001
Primitive reflex score	MD=0.22	0.13 to 0.31	Cohen's d=0.96	<0.001
Active muscle tone score	MD=0.23	0.14 to 0.32	Cohen's d=0.97	<0.001
Passive muscle tone score	MD=0.28	0.19 to 0.37	Cohen's d=1.14	<0.001

Notes: For continuous outcomes, MD represents the difference between the observation group and the control group at Post-intervention or discharge. For categorical outcomes, OR represents the odds ratio comparing the observation group with the control group. Cohen's d was calculated for continuous outcomes. Negative MD values indicate lower scores in the observation group, while positive MD values indicate higher scores in the observation group.

combination of the Roy Adaptation Model and Kangaroo Care in perinatal intervention for primiparous women undergoing cesarean section could significantly improve maternal and neonatal outcomes across multiple dimensions. These included alleviation of negative maternal emotions, facilitation of positive maternal role transition, enhancement of breastfeeding quality, and promotion of infant physical and neurodevelopment. This highlights the comprehensive nursing advantages of integrating both psychological and physiological regulation. From the perspective of emotional regulation, Post-intervention SAS and SDS scores in the observation group were significantly lower than those in the control group, indicating that the combined intervention effectively relieved maternal anxiety and depression. The Roy Adaptation Model achieves dynamic balance in four adaptive modes—physiological, self-concept, role function, and interdependence—by identifying individual stressors and providing targeted adjustments. Primiparous women after cesarean section are prone to emotional fluctuations due to postoperative pain and sudden role transition[17]. In this study, nurses applying the Roy model identified psychological stressors during the first-level assessment, analyzed stress responses in the second-level assessment, and provided psychological counseling and emotional support to help the mothers understand the surgical process and enhance self-efficacy, thereby reducing anxiety.

Similarly, Wang et al.[18] reported that the Roy model intervention significantly reduced the incidence of postpartum depression, consistent with the findings of this study. Meanwhile, Kangaroo Care alleviates stress responses from a neuroendocrine perspective by promoting oxytocin secretion and suppressing cortisol release through skin-to-skin contact, thermal transfer, and maternal-infant gaze[19]. Its psychological soothing effect complements the cognitive adjustment of the Roy model, jointly promoting emotional stability.

In terms of maternal role transition, the observation group achieved significantly higher scores in caregiving behavior, role identity, and mother-infant attachment compared with the control group. According to Roy's theory, individuals need to establish self-identity in new social roles, a process influenced by psychological readiness and social support[20]. Primiparous women after cesarean section often experience difficulties in role identity due to being first-time mothers and slower physical recovery[21]. In this study, interventions such as role education, caregiving demonstrations, and experiential reinforcement improved maternal cognition and confidence regarding the mother role. Kangaroo Care, through direct mother-infant contact, enhanced the sense of being needed and personal accomplishment, strengthening emotional bonding. Studies[22,23] have shown that continuous Kangaroo Care shortens the time required for maternal role establishment, consistent with our findings. These two models formed a positive feedback loop on cognitive, emotional, and behavioral levels, promoting maternal role adaptation. Regarding breastfeeding, the observation group demonstrated significantly higher BAT scores, initial breastfeeding success rates, and exclusive breastfeeding rates at discharge compared with the control group. Kangaroo Care facilitates oxytocin and prolactin secretion, stimulates milk ejection, and enhances mother-infant physiological synchrony[24]. The Roy model strengthens cognitive

education and emotional support during the intervention[25], using stepwise guidance to help mothers establish correct feeding concepts and confidence, thereby reducing feeding failure caused by anxiety or pain. A study[26] found that early skin-to-skin contact exceeding one hour significantly increases breastfeeding success, consistent with our results. Therefore, the cognitive support of the Roy model and the physiological stimulation of Kangaroo Care exert synergistic effects in promoting breastfeeding.

In terms of infant physical development, Post-intervention increases in length, weight, and head circumference were greater in the observation group than in the control group. Cesarean-born infants lack the physiological stress of vaginal delivery, resulting in relatively lower metabolic and immune regulation capabilities[27].

Kangaroo Care improves neonatal energy metabolism and gastrointestinal function through thermal stability, tactile stimulation, and breastfeeding, thereby accelerating growth[28]. Ornelas et al.[29] reported that Kangaroo Care was associated with improved breastfeeding and growth outcomes in preterm and/or low-birth-weight newborns, supporting the beneficial role of Kangaroo Care in early infant development. In this study, integrating the Roy model's mother-infant guidance further enhanced maternal sensitivity and consistency in feeding and soothing behaviors, optimizing nutritional absorption and developmental rhythms and achieving a bidirectional facilitation effect.

For hospital-assessed neonatal neurobehavioral performance, the observation group scored significantly higher across all NBNA dimensions than the control group at discharge. Kangaroo Care promotes the development of the brainstem and limbic system through continuous skin contact and auditory-emotional stimulation, improving neural responsiveness and behavioral integration[30]. The Roy model indirectly supports neural maturation by stabilizing maternal emotions and fostering a supportive emotional environment. Studies[31] have found a negative correlation between maternal anxiety or depression and infant neurobehavioral development. In this study, the emotional improvement in the observation group fostered positive mother-infant interactions, suggesting that emotional transmission may be a key pathway promoting neurobehavioral development.

Integrating existing research, the Roy Adaptation Model provides systematic nursing strategies for improving maternal psychology and role adaptation, while Kangaroo Care enhances neonatal physiological development and mother-infant bonding. The innovation of this study lies in the organic combination of these two approaches, providing a comprehensive intervention for the high-risk group of primiparous women after cesarean section. The results verified synergistic benefits across emotional, role, feeding, and developmental outcomes, expanding the conclusions of previous single-model studies. Unlike earlier studies focusing solely on short-term emotional or feeding outcomes, this research simultaneously examined multidimensional outcomes including maternal psychology, role transition, and infant physical and neural development, embodying the "mother-infant co-benefit" concept in nursing care.

From a clinical perspective, integrating Roy-based adaptive assessment processes with Kangaroo Care in cesarean section management shows strong feasibility and promotion potential. It is recommended to establish standardized operation and documentation systems, strengthen cross-training for nursing staff, conduct preoperative psychological education, and implement staged postoperative skill guidance. Family involvement should also be encouraged to enhance external support and emotional bonding. Implementation should proceed only after ensuring stable maternal and infant vital signs, with standardized recording of contact duration and responses. Prompt intervention or referral is necessary in cases of emotional or breastfeeding difficulties to ensure nursing safety and continuity.

However, this study has several limitations. First, this was a single-center retrospective before-and-after controlled study rather than a randomized controlled trial. Group classification was based on predefined calendar periods and the nursing care model documented in routine clinical records. Therefore, although the same inclusion and exclusion criteria were applied to both groups and baseline characteristics were compared, potential selection bias and unmeasured confounding could not be completely avoided. In addition, because the control and observation groups were derived from different calendar periods before and after implementation of the combined nursing protocol, temporal changes in clinical practice, staffing, or perioperative management may have introduced additional bias. Accordingly, the observed differences should be interpreted as associations between departmental implementation of the combined nursing protocol and clinical outcomes, rather than as definitive causal effects of a prospectively assigned intervention.

Second, the follow-up period was relatively short. Infant neurobehavioral outcomes were assessed only during hospitalization using NBNA, and no extended follow-up data were available to determine whether the observed short-term differences could translate into sustained long-term neurodevelopmental benefits. Third, outcome assessments were performed by trained clinical nurses as part of routine inpatient care rather than by independent blinded evaluators. Therefore, observer bias and documentation bias could not be excluded, although unified assessment procedures and retrospective data verification were used to reduce this risk. Moreover, because intervention exposure and outcome variables were identified from existing medical and nursing records, incomplete documentation or variation in routine

record quality may have led to exposure misclassification or information bias.

Fourth, the combined intervention was a multicomponent nursing program that included the Roy Adaptation Model, Kangaroo Care, psychological counseling, breastfeeding training, and family involvement. Therefore, the present study could evaluate only the overall effect of the integrated intervention and could not determine the independent contribution of each component. Future studies should adopt multicenter, prospective randomized controlled designs with larger sample sizes, longer follow-up periods, standardized long-term neurodevelopmental assessments, independent blinded outcome evaluation where feasible, and component-specific or factorial designs to further clarify the independent and combined effects of different intervention components.

5 CONCLUSION

The results of this study indicate that the combined application of the Roy Adaptation Model and Kangaroo Care in primiparous women undergoing cesarean section can achieve short-term improvements in maternal emotional status, maternal role adaptation, breastfeeding outcomes, infant physical growth, and NBNA-assessed neonatal neurobehavioral performance during hospitalization. This intervention model integrates a theoretical assessment framework with practical nursing measures, enhancing both the precision and effectiveness of mother-infant-centered care. However, because infant neurobehavioral outcomes were assessed only during hospitalization, these findings should not be interpreted as evidence of long-term neurodevelopmental benefit. Future high-quality studies with longer follow-up periods and standardized neurodevelopmental assessments are needed to verify the durability and broader applicability of these findings.

Acknowledgements

This study was supported by Zhejiang Province Medical and Health Science and Technology Plan 2024 (No. 2024KY1401).

Ethical Statement

This study was reviewed and approved by the Ethics Committee of Hangzhou Maternal and Child Health Hospital (Approval No. FCKLC25-HL07). As this was a retrospective study based entirely on existing clinical data, the Ethics Committee approved a waiver of written informed consent. The study adhered to the Declaration of Helsinki and relevant ethical principles, and all patient-identifying information was anonymized during data processing and analysis to ensure confidentiality.

Conflicts of Interest

The authors declared no conflict of interest.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Copyright Permissions

Copyright © 2026 The Author(s). Published by Innovation Forever Publishing Group Limited. This open-access article is licensed under a Creative Commons Attribution 4.0 International License (https://creativecommons.org/licenses/by/4.0), which permits unrestricted use, sharing, adaptation, distribution, and reproduction in any medium, provided the original work is properly cited.

Author Contribution

Zheng H and Feng G contributed to the study design, data collection, and data analysis. Chen S contributed to the study conception, supervision, and critical revision of the manuscript. All authors contributed to the manuscript and approved the final version.

Abbreviation List

BAT, Breastfeeding Assessment Tool
MD, Mean difference
MRAQ, Medication Risk Assessment Questionnaire
NBNA, Neonatal Behavioral Neurological Assessment
OR, Odds ratio
SAS, Self-rating Anxiety Scale
SD, Standard deviation
SDS, Self-rating Depression Scale

References

[1] Yu Y, Zhang Y, Zhu X et al. Application of goal-oriented fluid replacement therapy in volume management of postpartum hemorrhage during cesarean section [In Chinese]. *Zhonghua Wei Zhong Bing Ji Jiu Yi Xue*, 2021; 33: 305-310.[DOI]

[2] Tian X, Wu J, Li B et al. Occurrence of cesarean section and related factors in 40 counties of China from 1978 to 2010 [In Chinese]. *Zhonghua Yu Fang Yi Xue Za Zhi*, 2014; 48: 391-395.[DOI]

[3] Giang HTN, Duy HTN, Hieu LTM et al. Factors associated with the very high caesarean section rate in urban areas of Vietnam. *PLoS One*, 2022; 17: e0273847.[DOI]

[4] Narayan R, Mohammadnezhad M, Kumar N et al. Characteristics and predictors of pain among women who underwent cesarean section in Fiji. *Pain Manag*, 2024; 14: 283-291.[DOI]

[5] Wilbourne M, Hand F, McAllister S et al. Reviewing past and present consent practices in unplanned obstetric interventions: an eye towards the future. *J Med Ethics*, 2025; 51: 5.[DOI]

[6] Ran M, Songwathana P, Damkliang J. Discharge readiness and its associated factors among first-time mothers undergoing cesarean section in China. *Belitung Nurs J*, 2022; 8: 497-504.[DOI]

[7] Tolasa AG, Akyol AD. Effectiveness of a theory-based foot care education program on self-efficacy and adaptation in patients with diabetes in Turkey: a randomized controlled trial. *Wound Manag Prev*, 2024; 70: 1.[DOI]

[8] Chen CY, Ding H, Wang SS. Effectiveness of Roy Adaptation Model-Based Cognitive Stimulation Therapy in Elderly Patients with Non-Small Cell Lung Cancer Undergoing Curative Resection. *Tohoku J Exp Med*, 2024; 263: 27-34.[DOI]

[9] Mecdi Kaydirak M, Aslan E. Efficacy of Nursing Support in the Pre- and Postmedical Termination of Pregnancy Phases: A Randomized Study. *Omega-J Death Dying*, 2021; 84: 51-68.[DOI]

[10] Habte A, Tamene A, Gizachew A. Compliance toward key elements of kangaroo mother care and its predictors among postnatal mothers with preterm and/or low birth weight newborns in southern Ethiopia, 2021: A count analysis. *Womens Health (Lond)*, 2023; 19: 17455057231175806.[DOI]

[11] Prakash S, Jindal A, Jain K et al. Effect of immediate kangaroo mother care (iKMC) on neonatal mortality and culture-positive sepsis in low-birth-weight neonates in district hospitals in Chhattisgarh, India (PRISM study): protocol for a stepped-wedge cluster randomized trial. *Trials*, 2025; 26: 397.[DOI]

[12] Dargahiyan Z, Ghasemi F, Karami K et al. A comparative study of the effects of Kangaroo care by mothers and maternal grandmothers on the vital signs of hospitalized preterm newborns: a randomized controlled clinical trial study. *Trials*, 2023; 24: 275.[DOI]

[13] He TT, Zhang XH, Kong XL et al. Effect of virtual reality video-based pre-discharge psychological intervention on the post-discharge emotions of patients with deep facial burns: a prospective randomized controlled study [In Chinese]. *Zhonghua Shao Shang Za Zhi*, 2021; 37: 70-75.[DOI]

[14] Sajadian SZ, Javadifar N, Aslani K et al. Effectiveness of mindfulness-based intervention in the improvement of maternal role adaptation among first time mothers: A randomized controlled trial. *Complement Ther Clin* 2022; 49: 101665.[DOI]

[15] Bellieni CV, Gioia LA, Calcagna I et al. Ankyloglossia in newborns: incidence and breastfeeding follow-up at 1 and 6 months. *Minerva Pediatr (Torino)*, 2024.[DOI]

[16] Wang R, Xi Y, Yang M et al. Application of apparent diffusion coefficient histogram in moderate to severe neonatal hypoxic-ischemic encephalopathy [In Chinese]. *Zhonghua Yi Xue Za Zhi*, 2021; 101: 624-629.[DOI]

[17] Chiu HY, Chen HH, Wang CW et al. The risks of emergency C-section, infant health conditions and postpartum complications in Taiwanese primiparous women with gestational diabetes mellitus: A propensity matched cohort study. *Taiwan J Obstet Gynecol*, 2024; 63: 880-886.[DOI]

[18] Wang E, Li L. The effect of community nursing based on the Roy adaptation model on postpartum depression and sleep quality of parturients. *Am J Transl Res*, 2021; 13: 8278-8285.

[19] Liu X, Chen XH, Li ZK et al. Implementation experience of a 12-month intervention to introduce intermittent kangaroo mother care to eight Chinese neonatal intensive care units. *World J Pediatr*, 2022; 18: 849-853.[DOI]

[20] Er Güneri S, Şen S. The adaptation states of women with urinary incontinence according to the Roy Adaptation Model: A qualitative study. *Neurourol Urodyn*, 2022; 41: 1423-1430.[DOI]

[21] Viirman F, Hesselman S, Wikström AK et al. Negative childbirth experience - what matters most? a register-based study of risk factors in three time periods during pregnancy. *Sex Reprod Healthc*, 2022; 34: 100779.[DOI]

[22] Brotherton H, Gai A, Tann CJ et al. Protocol for a randomised trial of early kangaroo mother care compared to standard care on survival of pre-stabilised preterm neonates in The Gambia (eKMC). *Trials*, 2020; 21: 247.[DOI]

[23] Souza-Vogler SR, Lima GMS. The effect of kangaroo care on modulate chronic stress response in preterm infants and mothers. *Stress*, 2021; 24: 742-752.[DOI]

[24] Cooijmans KHM, Beijers R, Brett BE et al. Daily mother-infant skin-to-skin contact and maternal mental health and postpartum healing: a randomized controlled trial. *Sci Rep*, 2022; 12: 10225.[DOI]

[25] Park M, Ahn S. An explanatory model of quality of life in high-risk pregnant women in Korea: a structural equation model. *Korean J Women Health Nurs*, 2023; 29: 302-316.[DOI]

[26] Brimdyr K, Mbalinda SN, Blair A et al. The impact of implementing and sustaining the international guidelines for skin-to-skin contact in the first hour after birth in Uganda. *Sci Rep*, 2024; 14: 32042.[DOI]

[27] Zhao YJ, Chen Q, Huang LS et al. Association between cesarean section and sensory integration dysfunction in preschool children: a prospective cohort study. *Zhongguo Dang Dai Er Ke Za Zhi*, 2021; 23: 773-778.[DOI]

[28] Kritzinger A, Van Rooyen E, Bergh AM. A swallowing and breastfeeding intervention programme for small and sick neonates embedded in kangaroo mother care. *S Afr J Commun Disord*, 2024; 71: e1-e7.[DOI]

[29] Ornelas SL, Guimarães RP, Silva LA et al. Third stage of the kangaroo method: exclusive breastfeeding and growth of preterm and/or low birth weight newborns. *Rev Paul Pediatr*, 2024; 42: e2023141.[DOI]

[30] Raiol M, Savelon SV, de Moraes M. Care with child development and André Bullinger's special look at prematurity. *Rev Paul Pediatr*, 2022; 40: e2020416.[DOI]

[31] Springer K, Eatman JA, Brennan PA et al. Maternal symptoms of depression and anxiety as modifiers of the relationship between prenatal phthalate exposure and infant neurodevelopment in the Atlanta African American maternal-child cohort. *Brain Behav Immun Health*, 2024; 40: 100846.[DOI]