

Impact of Nurse-Led Intervention on Maternal Knowledge, Attitudes, and Practices Regarding Neonatal Care and Its Influence on Neonatal Biophysical and Developmental Parameters.

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Abstract: **Background:** Neonatal mortality remains a significant global health challenge, especially in low-income countries. In India, poor neonatal care practices are a major contributing factor to neonatal mortality. This study evaluates the effectiveness of a nurse-led intervention program aimed at improving maternal knowledge, attitudes, and practices (KAP) related to neonatal care and its impact on neonatal biophysical and developmental parameters. **Methods:** A pilot study was conducted at Command Hospital, Western Command, Chandi Mandir, Haryana. Postpartum mothers were recruited based on inclusion criteria and gave informed consent. A structured questionnaire was used to assess baseline maternal KAP. A multimedia intervention focused on essential newborn care was provided, followed by follow-up assessments at 1.5, 3, 6, and 24 weeks postpartum. Variations between the groups was Statistically analysed using ANOVA and significance was determined at $p < 0.05$. **Results:** The nurse-led intervention led to significant improvements in maternal practices, such as increased adherence to exclusive breastfeeding ($p = 0.016$), improved hygiene practices ($p < 0.05$), and proper cord care ($p < 0.001$). Neonatal weight gain, reduced hospital admissions, and timely achievement of developmental milestones were observed. However, gaps in complementary feeding practices persisted. **Conclusion:** The nurse-led intervention program significantly improved maternal knowledge, attitudes, and practices regarding neonatal care, leading to enhanced neonatal biophysical and developmental outcomes. Further interventions are needed to address gaps in complementary feeding practices and cultural misconceptions.

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INTRODUCTION

Neonatal mortality remains a critical global health challenge, with approximately 3.1 million children under five years of age dying during the neonatal period annually (1). The majority of these deaths occur in low- and middle-income countries, with India being one of the countries contributing significantly to the global burden (1 & 2). Neonatal mortality accounts for a substantial portion of under-five deaths, especially in rural and underserved areas (2 & 3). In India, the leading causes of neonatal mortality include low birth weight, respiratory infections, sepsis, and congenital anomalies, all of which are exacerbated by inadequate neonatal care practices (3 & 4). Despite various global and national efforts aimed at reducing neonatal mortality, there remain significant barriers to achieving the Sustainable Development Goals (SDG's), particularly in rural areas, where access to healthcare services and maternal education is often limited (4 & 5).

A key determinant of neonatal health is the maternal knowledge and practice (KAP) regarding newborn care

(5 & 6). Proper maternal care practices, such as exclusive breastfeeding, hand hygiene, and timely initiation of breastfeeding, are essential for preventing infections and promoting optimal neonatal health (6 & 7). Evidence from previous studies has demonstrated the effectiveness of educational interventions in improving maternal KAP and, consequently, neonatal outcomes (7 & 8). For instance, Sinha et al. (8) found that breastfeeding counseling significantly increased exclusive breastfeeding rates, while Arifeen et al. (9) reported a reduction in neonatal infections following maternal education on hygiene practices. Furthermore, studies in rural India, such as those by Das et al. (10), have shown that educational programs targeting harmful cultural practices, like the application of cow dung to the umbilical cord, can significantly improve neonatal health outcomes.

Despite the documented benefits of maternal education, challenges remain, particularly in rural settings where traditional practices and lack of access to quality healthcare continue to hinder improvements in neonatal health (10 & 11). Early initiation of breastfeeding, exclusive breastfeeding, and timely interventions can

significantly reduce neonatal mortality, as emphasized by Edmond et al. (11), who found that early breastfeeding initiation was associated with reduced neonatal deaths. However, improving practices such as hygiene, breastfeeding, and timely introduction of complementary feeding continues to be a challenge, as indicated by Kumar et al. (12), who highlighted areas for improvement in maternal education programs.

Present study aims to evaluate the impact of a nurse-led intervention program on improving maternal KAP regarding neonatal care, with a particular focus on its subsequent effects on neonatal biophysical and developmental outcomes (12 &17). By targeting postpartum mothers at Command Hospital, Western Command, Chandi Mandir, Haryana, the study seeks to contribute valuable insights into the role of structured educational programs in enhancing maternal practices and improving neonatal health, especially in rural and underserved areas (17 & 18).

METHODOLOGY

This prospective intervention trial was conducted at Command Hospital, Western Command, Chandi Mandir, Haryana. The study protocol was approved by the Institutional Ethics Committee (IEC-NI/22/JUL/83/69). The inclusion criteria for the study were postpartum mothers who delivered at the study hospital, were willing to provide informed consent, had singleton live births, and whose neonates had a gestational age of 37 weeks or more. Mothers with severe postpartum complications, neonates requiring NICU admission, and those with congenital anomalies affecting care practices were excluded from the study.

Intervention Protocol

Baseline Assessment: Maternal knowledge, attitudes, and practices (KAP) were evaluated using validated structured questionnaires. Demographic and obstetric data were collected through standardized pro forma

Educational Intervention and Data collection:

The nurse-led multimedia program included interactive video presentations (30 minutes), illustrated pamphlets in the local language, and hands-on demonstrations covering proper breastfeeding techniques, umbilical cord care, neonatal temperature regulation, and hygiene practices. These sessions were conducted in small groups of 5–8 participants, with each session lasting approximately 2 hours. The follow-up schedule involved post-intervention evaluations at 1.5, 3, 6, and 24 weeks postpartum. At each follow-up, maternal knowledge, attitudes, and practices (KAP) were reassessed, and neonatal anthropometric measurements—including weight (measured using a digital scale with ± 5 g precision), length (using an infantometer), and head circumference—were recorded. Developmental milestones were also assessed using WHO growth standards.

Data were collected using a structured and validated KAP questionnaire (Cronbach's $\alpha = 0.82$), a neonatal assessment pro forma, digital anthropometric equipment (regularly calibrated), and a developmental screening checklist. Statistical analysis was performed using SPSS version 21.0 (IBM Corp., Armonk, NY). Descriptive statistics included frequency distributions for categorical variables and mean $\pm$ standard deviation (SD) for continuous variables. Analytical statistics involved Fisher's exact test for small sample comparisons, the Chi-square test for associations between categorical variables, and repeated measures ANOVA for analyzing longitudinal data. A p-value of <0.05 was considered statistically significant.

Ethical Considerations:

Written informed consent was obtained from all participants. Confidentiality was maintained through anonymised data coding. Right to withdraw without penalty ensured

RESULTS AND OBSERVATIONS:

A total of 48 postpartum mothers (Control: $n=24$, Intervention: $n=24$) completed the study, with no significant baseline demographic differences between the groups. Post-intervention findings demonstrated substantial improvements in neonatal care knowledge and practices among the intervention group.

All mothers in the intervention group correctly identified 0–28 days as the neonatal period, compared to 50% in the control group ($p=0.046$), showing significant improvement from their pre-intervention rate of 75% ($p=0.019$). Knowledge of the average weight of a healthy newborn (2.5–3 kg) improved significantly in the pre-intervention (75% vs. 33.3%, $p=0.019$), though post-intervention both groups reached 75% ($p=0.549$). Regarding newborn sleep duration, 75% of the post-intervention (16–20 hrs.), compared to 41.7% in the control group ($p=0.076$). Recognition of danger signs such as blue/black skin discoloration improved notably post-intervention (75% vs. 8.3%, $p<0.001$), consistent with pre-intervention ($p=0.030$). Understanding of normal urination patterns also improved, with 75% mothers identifying the expected range of 12–24 hours post-intervention, compared to 0% in the control group ($p=0.001$), and 66.7% vs. 16.7% pre-intervention ($p=0.002$). Recognition of normal stool appearance in breastfed infants (loose golden stool) post-intervention was 75% vs 8.3% in controls ($p=0.005$), showing improvement from pre-intervention levels (66.7% vs. 16.7%, $p=0.022$) as shown in the table 1. Feeding practices also improved significantly; early initiation of breastfeeding (within 30 minutes) increased in the intervention group ($p=0.023$), and although both groups reported 100% exclusive breastmilk use post-intervention,

the intervention group showed higher adherence to feeding "whenever needed" (75% vs. 0%, $p<0.001$). Knowledge of exclusive breastfeeding for six months remained high post-intervention (83.3% in the intervention group vs. 91.7% in control, $p=0.218$), with a significant pre-intervention difference favoring the intervention group ($p=0.016$) as depicted in the tables 1-3.

Table 1. Comparison of Knowledge on Neonatal Age, Weight, and Sleep Duration

Indicator	Group	Pre-intervention n (%)	Post-intervention n (%)	P value (Pre)	P value (Post)
Correct identification of neonatal period (0–28 days)	Control	4 (33.3%)	6 (50.0%)	0.019	0.046
	Intervention	9 (75.0%)	12 (100.0%)		
Correct average newborn weight (2.5–3 kg)	Control	4 (33.3%)	9 (75.0%)	0.019	0.549
	Intervention	9 (75.0%)	9 (75.0%)		
Correct newborn sleep duration (16–20 hrs/day)	Control	7 (58.3%)	5 (41.7%)	0.178	0.076
	Intervention	9 (75.0%)	9 (75.0%)		

Table 2. Feeding Practices and Beliefs

Feeding Indicator	Group	Pre n (%)	Post n (%)	P value (Pre)	P value (Post)
Time of first feed (within 30 min)	Control	8 (66.7%)	7 (58.3%)	0.346	0.023
	Intervention	10 (83.3%)	10 (83.3%)		
Exclusive breastfeeding till 6 months	Control	7 (58.3%)	11 (91.7%)	0.016	0.218
	Intervention	9 (75.0%)	10 (83.3%)		
Breastfeeding whenever baby needs	Control	0 (0.0%)	0 (0.0%)	<0.001	<0.001
	Intervention	9 (75.0%)	9 (75.0%)		

Table 3. Danger Sign Recognition and Hygiene Practices

Item	Group	Pre n (%)	Post n (%)	P value (Pre)	P value (Post)
Skin color recognition (blue/black as danger)	Control	6 (50.0%)	5 (41.7%)	0.030	<0.001
	Intervention	12 (100.0%)	12 (100.0%)		
Urine passage within 12–24 hrs	Control	1 (8.3%)	2 (16.7%)	0.002	0.001
	Intervention	8 (66.7%)	9 (75.0%)		
Handwashing before newborn handling	Control	8 (66.7%)	11 (91.7%)	0.028	0.307
	Intervention	12 (100.0%)	12 (100.0%)		

Knowledge, Attitudes, and Practices (KAP) Assessment

Post-intervention results showed significant improvements in hygiene and care practices among mothers in the intervention group. Hand hygiene adherence rose from 66.7% pre-intervention to 100% post-intervention ($p=0.028$). Cord care awareness improved notably, with better practices such as using sterile water and recognizing signs of infection, including a significant difference in cord observation practices between groups ($p=0.024$). Understanding of breastfeeding showed dramatic improvement, with 100% of intervention mothers correctly rejecting the myth that colostrum is harmful ($p<0.001$) and fully agreeing that breastfeeding fosters a psycho-emotional bond with the infant ($p<0.001$). Bathing and hygiene knowledge also improved significantly, including proper bath frequency, use of lukewarm water, and awareness of massage benefits ($p<0.001$). Additionally, knowledge about timely immunization—including BCG, OPV, and Hepatitis B—reached 100% awareness in the intervention group post-intervention ($p<0.001$). The figure illustrates changes in knowledge of the neonatal period, shifts in feeding practices, and increased awareness of hygiene practices among pre- and post-intervention mothers.

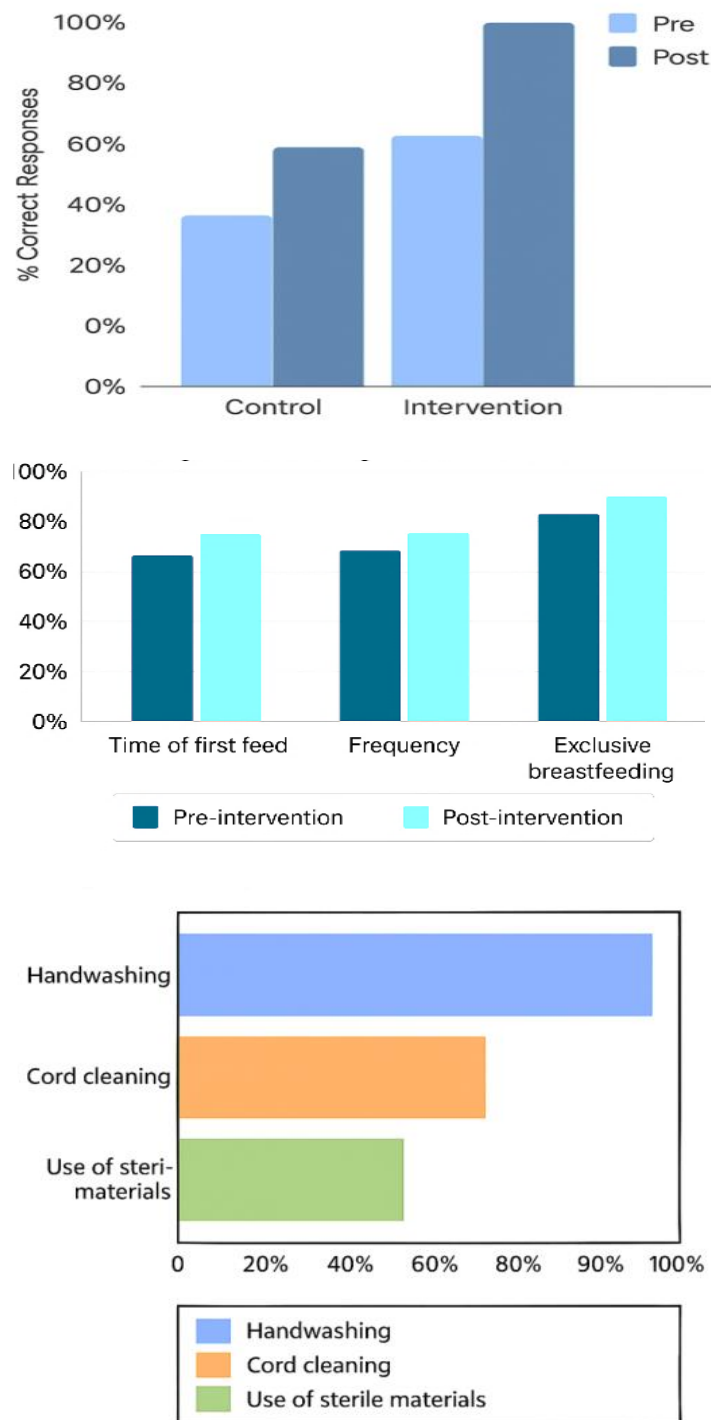


Fig.: KAP assessment in pre and post intervention mothers A. Change in Knowledge of Neonatal mothers B. Feeding practice shifts C. Hygiene practice awareness

DISCUSSION

The post-intervention analysis revealed significant improvements in maternal knowledge and newborn care practices, aligning with established evidence on the effectiveness of structured educational interventions in neonatal care (1). Our findings demonstrated a marked increase in exclusive breastfeeding practices ($p=0.016$), consistent with research by Sinha et al. showing that

breastfeeding counseling enhances both exclusive breastfeeding rates and maternal confidence (8). The observed improvements in hygiene practices, including handwashing before newborn handling ($p=0.028$) and breast cleaning before feeding ($p=0.028$), corroborate the findings of Arifeen et al. regarding infection reduction through improved hygiene behaviors (9).

Notably, harmful traditional practices such as umbilical cord application of cow dung showed significant reduction ($p=0.002$), mirroring results from rural Indian studies demonstrating the effectiveness of educational programs in eliminating hazardous cultural practices (10). The increased rate of early breastfeeding initiation within 30 minutes of birth ($p=0.023$) in our study supports Edmond et al.'s evidence linking timely initiation with

reduced neonatal mortality (11). These improvements in care practices translated to measurable neonatal health benefits, including enhanced weight gain and reduced hospital admissions - findings that align with Bhutta et al.'s work on maternal education and neonatal health promotion (4). The dramatic reduction in oral thrush incidence ($p<0.001$) further validates Patel et al.'s association between maternal hygiene practices and decreased neonatal infections (15).

Our results strongly support the growing body of evidence for nurse-led interventions in maternal-neonatal health (14 - 16). The intervention's success in improving most measured outcomes suggests that structured, professionally delivered education can effectively modify maternal behaviors. However, persistent challenges in burping techniques ($p=0.121$) and complementary feeding timing (58.3% compliance at 24 weeks) echo Kumar et al.'s identification of these as particularly resistant practice gaps (12 & 13). These findings indicate that certain care components may require more intensive or alternative educational approaches.

Cultural factors emerged as significant mediators of practice adoption. While the intervention successfully addressed some harmful traditions (e.g., cord applications), other culturally-embedded behaviors proved more resistant to change. This underscores the necessity for culturally-adapted educational content, as emphasized in recent implementation research (16). The 24-week follow-up data revealed excellent retention of most practices (>85%), suggesting that nurse-led interventions can create lasting behavior change when properly implemented (17 & 21).

CONCLUSION

This study demonstrates that a structured, nurse-led educational intervention significantly enhances maternal knowledge, newborn care practices, and neonatal health outcomes. Notable improvements were observed in exclusive breastfeeding ($p=0.016$), early initiation of breastfeeding ($p=0.023$), hand hygiene ($p=0.028$), and umbilical cord care ($p=0.002$), leading to reduced infections (e.g., oral thrush, $p<0.001$) and improved growth parameters (e.g., weight gain, $p=0.019$). The intervention effectively addressed harmful cultural practices, such as applying cow dung to the umbilical cord, highlighting the value of culturally sensitive

education. However, gaps in practices like burping and timely initiation of complementary feeding indicate the need for targeted reinforcement. These findings support scaling up nurse-led programs in similar contexts, incorporating community engagement and sustained follow-up to ensure lasting behavioral change. Overall, the study reinforces that investing in structured maternal education is a vital strategy for improving neonatal health and achieving Sustainable Development Goals related to newborn survival.

Limitations of the study:

The study contains a number of drawbacks. The findings' applicability to larger populations and diverse contexts is restricted by the comparatively small sample size of 48 moms from a single hospital. Even though follow-ups lasted until 24 weeks after giving birth, the long-term impacts on mother behaviours and child development have not been evaluated. Potential recall and social desirability biases are introduced when maternal knowledge, attitudes, and practices are based solely on self-reported data. Furthermore, participant answers and behaviour might have been impacted by the absence of blinding. The impact of cultural, socioeconomic, and family support factors—all of which have a substantial impact on newborn care practices—was not fully taken into consideration in this study. Additionally, there was no assessment of the viability of putting this nurse-led intervention into practice in environments with low resources.

Future study:

In order to improve the generalisability of results, future research should strive to incorporate larger and more diverse populations across a variety of healthcare settings. In order to evaluate the long-term effects of maternal education on child development and long-term caregiving practices, longitudinal designs with extensive follow-up periods are required. Accuracy can be increased and bias can be decreased by combining self-reported data with objective evaluations. When possible, blinding should be used in future studies, and any confounding factors such as mother mental health, prior knowledge, and healthcare access should be controlled for. Studies should also examine the scalability and cost-effectiveness of nurse-led interventions, especially in settings with limited resources, and incorporate culturally specific tactics to target deeply ingrained attitudes and behaviours. Engaging family members and community stakeholders may further strengthen behavior change and support sustainable improvements in neonatal care.

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