RESEARCH PAPER

Effectiveness of Structured Teaching with Digital Media on Home-Based Newborn Care (HBNC) on Knowledge and Practice among Postnatal Mothers: A Quasi-Experimental Study from a Government Headquarters Hospital in Cuddalore, Tamil Nadu, India

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ABSTRACT

Background: The neonatal period accounts for the largest share of under-five mortality worldwide, and a substantial proportion of these deaths occur at home owing to delayed recognition of danger signs and suboptimal newborn-care practices. Empowering postnatal mothers through structured, technology-assisted health education is a promising strategy to strengthen Home-Based Newborn Care (HBNC).

Objectives: To assess the effectiveness of structured teaching delivered through digital media on the knowledge and practice of HBNC among primiparous postnatal mothers, to determine the association between baseline outcomes and selected socio-demographic variables, and to examine the correlation between knowledge and practice.

Methods: A quasi-experimental, single-group pre-test–post-test design was adopted at the Government Headquarters Hospital, Cuddalore, Tamil Nadu, India. Sixty-five primiparous postnatal mothers were recruited through non-probability convenience sampling. A validated three-part instrument captured socio-demographic data, a 30-item knowledge questionnaire, and a 10-item practice checklist (Cronbach's $\alpha = 0.792$ and 0.83, respectively). After the pre-test, a 30-minute video-based structured teaching programme covering thermoregulation, breastfeeding, eye care, cord care, immunization, and infection prevention was administered; the post-test followed on day seven. Data were analysed using descriptive statistics, paired t-test, Karl Pearson's correlation, and the chi-square test.

Results: Mean knowledge scores rose from 11.83 ± 3.65 to 28.58 ± 2.83 (mean difference 16.75; $t = 48.52$; $p < 0.001$), and mean practice scores rose from 3.21 ± 1.37 to 9.65 ± 0.79 (mean difference 6.43; $t = 33.87$; $p < 0.001$). Post-intervention, 87.69% of mothers attained adequate knowledge and 93.85% demonstrated good practice. A statistically significant positive correlation emerged between post-test knowledge and practice ($r = 0.522$; $p < 0.001$). No baseline outcome was significantly associated with any socio-demographic variable ($p > 0.05$).

Conclusion: Structured teaching delivered through digital media produced large, statistically significant gains in both knowledge and practice of HBNC. Integrating low-cost, scalable digital education into routine postnatal care can strengthen maternal competence and support neonatal survival, particularly in resource-constrained settings.

Keywords: Structured teaching; home-based newborn care; postnatal mothers; digital media; nursing intervention; neonatal mortality.

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1. INTRODUCTION

The neonatal period, the first 28 days of life, is the most susceptible time in the human life course. In this short period of time the newborn has to go through dramatic changes from intrauterine to extrauterine life and is the most vulnerable to death at any other time. The first month of life contributes to almost 50 per cent of all the under fives' deaths worldwide. In 2023, the World Health Organization (WHO) estimated 2.3 million children died in the first 28 days of life, most of which occurred in low and middle-income countries with limited access to poor quality health care (Dol et al., 2023). There is still a huge

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disparity between regions. In the most developed countries, the number of deaths to every 1,000 live births at birth is only 5, but in most less developed countries, it exceeds 30 and is over 42 in the least developed countries. This is disproportionately borne by South Asia and Sub-Saharan Africa. In India, the Infant mortality rate around 30 per 1,000 of live births with inter-state difference in the rates some union territorial having rate below 10 per 1,000 of live births (Malik et al., 2016).

Low-birth-weight and pre-term birth deaths are avoidable, contributing to preventable mortality of newborns and children under five years of age, which is addressed by the SDG3.2 target that preventable deaths of newborns and children under 5 years of age must be reduced to no more than 12 per 1000 live births and no more than 25 per 1000 under 5 years of age, respectively, by 2030 (nationally). The leading causes of neonatal death - complications from prematurity, intra-partum events (including birth asphyxia), and infections (e.g., sepsis, pneumonia) will need to be addressed continually for these benchmarks to be met. Perhaps most crucially, a great majority of such deaths (Bassani & Jha, 2010) are preventable if action could be taken in time based on evidence, but many of these deaths are detected too late or care-seeking is delayed, leading to deaths at home.

Maternal skills have a direct link to the outcomes for the newborns, and mothers are the first to provide care during this critical time period. Essential Newborn Care (ENC) guidelines focus on strategies to protect against hypothermia, namely skin-to-skin contact and delayed bathing, care of the umbilical cord, early initiation and exclusive breastfeeding, eye care, vaccination and early detection of infections. These principles translate into Home Based Newborn Care (HBNC), which involves mothers and caregivers in providing safe care after leaving the hospital and referring them promptly if there are complications (Sinha et al., 2014). Guidelines are widely available but the knowledge and skills of mothers remain inadequate, including for first-time mothers (primiparous), and deeply embedded cultural norms may prevent adoption of recommended practices like delayed bathing and exclusive breastfeeding (Getachew et al. 2022).

Structured teaching programmes provide systematic and comprehensive education to mothers and there is increasing evidence that they are more effective in inducing lasting behaviour changes than are unstructured or incidental teaching (Rajeswari et al., 2016). The use of digital media, including videos, simulations, and online tools, has also revolutionized health education in low resource areas (Horiuchi et al., 2024). Visual demonstrations make complicated procedures more familiar, adapt to different levels of literacy and heighten understanding and retention. Another advantage of digital platforms is that they are inherently free from geographic and resource constraints, easily scaleable and replicable and can be used at the 'bedside' or within the community with very marginal costs (Evans et al., 2021; Nandi et al., 2016). Nevertheless, robust evidence on the effectiveness of digital media–assisted structured teaching for HBNC among primiparous postnatal mothers in southern Indian district hospital settings remains limited. Most available studies are descriptive, examine general newborn care knowledge, or are conducted in tertiary or international settings, leaving a gap in interventional evidence relevant to busy government secondary-care facilities. The present study addresses this gap by rigorously evaluating a video-based structured teaching intervention delivered to postnatal mothers in a high-volume government hospital.

The primary objective was to assess the effectiveness of structured teaching with digital media on the knowledge and practice of HBNC among postnatal mothers. The secondary objectives were to assess the pre-test level of knowledge and practice, to determine the association between baseline knowledge and practice and selected socio-demographic variables, and to examine the correlation between pre- and post-test knowledge and practice.

Hypotheses. H1: There is a significant difference between pre- and post-test knowledge. H2: There is a significant difference between pre- and post-test practice. H3: There is a significant association between baseline knowledge and practice and selected socio-demographic variables. H4: There is a significant correlation between knowledge and practice on HBNC among postnatal mothers.

2. MATERIALS AND METHODS

2.1 Study design and approach

The quasi-experimental single group pre-test–post-test design was used as a quantitative research approach to assess the effectiveness of the treatment. For observational and quasi-experimental studies (where applicable) reporting is in keeping with the relevant items of the STROBE statement.

2.2 Study setting

The study was conducted at the Government Headquarters Hospital, Cuddalore, located approximately 7 km from the investigating institution. This 720-bed secondary-care facility includes dedicated antenatal and postnatal wards and a 25-bed neonatal intensive care unit equipped with radiant warmers and phototherapy units for the management of high-risk neonates. The hospital conducts an average of 15 deliveries per day, comprising both normal vaginal and caesarean births, providing a representative population of postnatal mothers.

2.3 Population, sample and sampling

The target population comprised primiparous postnatal mothers admitted to the hospital. A non-probability convenience sampling technique was used to recruit 65 mothers who met the eligibility criteria. The sample size was estimated from a previous comparable study using $\alpha = 0.05$, power $(1 - \beta) = 0.90$, an expected baseline proportion (P1) of 0.76 and post-intervention proportion (P2) of 0.96, yielding a minimum required sample of 65.

Inclusion criteria: primiparous postnatal mothers aged 18–40 years, delivered by normal vaginal birth, with no history of abortion, admitted to the study hospital.

Exclusion criteria: mothers employed in the medical or nursing professions, to avoid the confounding influence of prior professional training.

2.4 Development and description of the tools

A three-part structured instrument was developed following an extensive literature review. Part I captured socio-demographic characteristics: age, education, religion, occupation, monthly income, type of family, and gender and birth weight of the child. Part II was a structured knowledge questionnaire of 30 items spanning six sub-domains of HBNC, namely thermoregulation, breastfeeding, eye care, cord care, immunization, and infection prevention; each correct response scored 1 and each incorrect response scored 0. Knowledge was graded as inadequate (<50%), moderately adequate (50–75%), or adequate (>75%). Part III was a 10-item practice checklist scored identically, with practice graded as poor (1–3), fair (4–7), or good (8–10).

2.5 Validity and reliability

Content validity was established by submitting the tool to experts in paediatric medicine, neonatology, child-health nursing, and statistics; the instrument was refined in response to their recommendations before the main study. Internal consistency, assessed using Cronbach's alpha, confirmed strong reliability, with values of $r = 0.83$ for the practice tool and $r = 0.792$ for the knowledge tool.

2.6 Description of the intervention

Interventions included validated open educational resources (OER) about thermoregulation, breastfeeding, eye care and cord care, immunization, and infection prevention, presented as interactive instructional videos on HBNC. The structured teaching programme was presented in a video lasting about 30 minutes, and then mothers were encouraged to explain what they did not understand to help improve their comprehension and engagement.

2.7 Ethical considerations

Ethical clearance was granted by the Institutional Ethics Committee of Vinayaka Mission's College of Nursing, Puducherry (IEC Reference No. 2024/198). Formal written permission was obtained from the Joint Director of the Government Headquarters Hospital, Cuddalore. All participants signed informed consent before giving signed, informed consent after full explanation of the aims of the study, and all data kept confidential.

2.8 Pilot study

The pilot study was carried out in the same hospital from 15 to 25 November 2024 involving ten primiparous postnatal mothers who were selected using convenience sampling technique. The instrument and procedure demonstrated viability, understandability and applicability; descriptive and inferential statistics were used in analysing the result.

2.9 Data collection procedure

The investigator, after formal permission, approached mothers who are eligible for this study in the postnatal ward and explained the study and then informed consent was obtained. The data were collected for four weeks from 27 November to 27 December 2024. Three to four mothers participated in the pre-test (15–20 minutes) each day and then participated in the 30-minute, video-based structured teaching programme. After 7 days, to determine changes in knowledge and practice, the post-test was performed using the same instrument.

2.10 Statistical analysis

Data were collected and analyzed through descriptive and inferential statistics. Socio-demographic variables and the level of knowledge and practices were described using the frequency and percentage distribution. The paired t-test was used to evaluate efficacy of the intervention; Karl Pearson's correlation coefficient was used to analyse the relationship between knowledge and practices; and chi square test was used to assess association among baseline outcome and socio-demographic variables. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

A total of 65 primiparous postnatal mothers completed both the pre-test and the post-test, with no attrition. The findings are presented in four parts: socio-demographic characteristics, levels of knowledge and practice, effectiveness of the intervention, and the associations and correlations among study variables.

3.1 Socio-demographic characteristics

Table 1 summarises the socio-demographic profile of the participants. The majority of mothers (76.9%) were aged 18–25 years, half (50.8%) were graduates or above, and most (95.4%) were Hindu. Four in five mothers (84.6%) were homemakers, and just over half (52.3%) reported a monthly family income between ₹5,001 and ₹10,000. More than half lived in joint families (55.4%), and most newborns (40.0%) weighed between 2.6 and 3.0 kg. Figure 1 displays the distribution of key socio-demographic variables.

Table 1. Frequency and percentage distribution of socio-demographic characteristics of postnatal mothers (n = 65)

Demographic variable	Frequency (n)	Percentage (%)
Age (years)		
18 – 25	50	76.9
26 – 30	13	20.0
31 – 36	2	3.1
Education		
1 – 10th standard	11	16.9

Higher secondary	21	32.3
Graduates and above	33	50.8
Religion		
Hindu	62	95.4
Christian	3	4.6
Occupation		
Privately employed	5	7.7
Self-employed	5	7.7
Housewives	55	84.6
Monthly income (₹)		
Less than 5,000	8	12.3
5,001 – 10,000	34	52.3
10,001 – 15,000	10	15.4
More than 15,000	13	20.0
Gender of the child		
Male	29	44.6
Female	36	55.4
Type of family		
Nuclear family	29	44.6
Joint family	36	55.4
Birth weight of the child (kg)		
2.0 – 2.5	20	30.8
2.6 – 3.0	26	40.0
3.1 – 3.5	18	27.7
Above 3.5	1	1.5

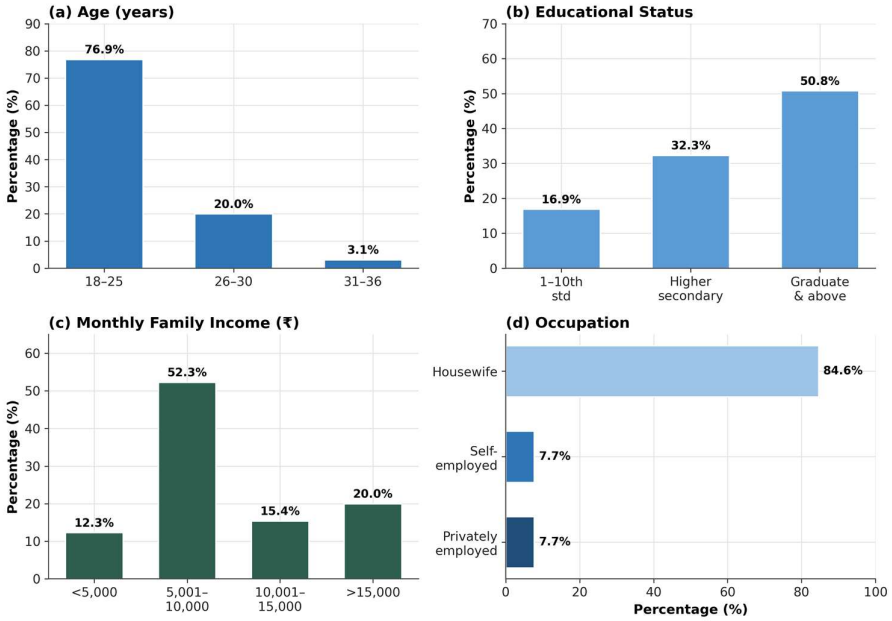

Figure 1. Distribution of selected socio-demographic characteristics of postnatal mothers

3.2 Levels of knowledge and practice

At baseline, knowledge of HBNC was markedly deficient: 83.08% of mothers had inadequate knowledge, 15.38% had moderately adequate knowledge, and only 1.54% had adequate knowledge. After the intervention, the distribution shifted dramatically, with 87.69% attaining adequate knowledge and the remaining 12.31% moderately adequate; no mother remained in the inadequate category (Table 2, Figure 2).

Table 2. Pre-test and post-test levels of knowledge on HBNC among postnatal mothers (n = 65)

Level of knowledge	Pre-test		Post-test	
	n	%	n	%
Inadequate (<50%)	54	83.08	–	–

Moderately adequate (50–75%)	10	15.38	8	12.31
Adequate (>75%)	1	1.54	57	87.69

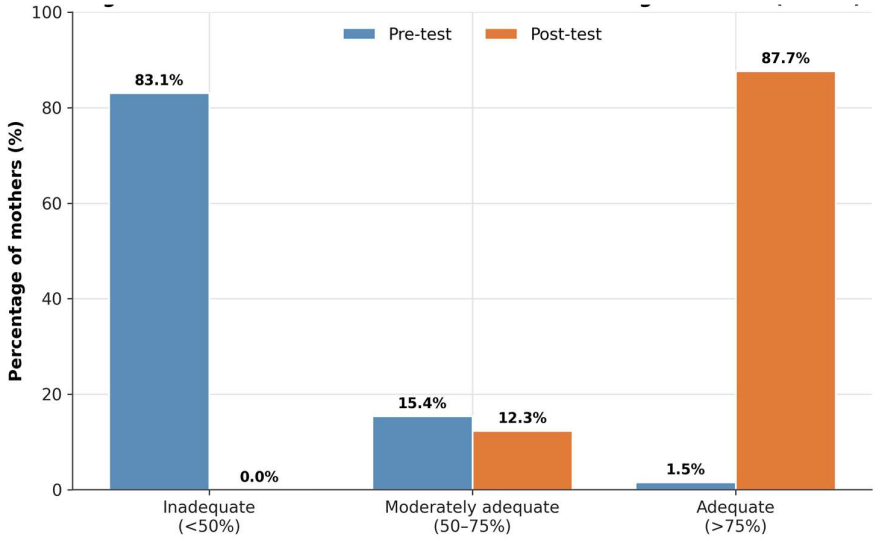

Figure 2. Comparison of pre-test and post-test levels of knowledge on HBNC among postnatal mothers

Table 3. Pre-test and post-test levels of practice on HBNC among postnatal mothers

Level of practice	Pre-test		Post-test	
	n	%	n	%
Poor (<50%)	50	76.92	–	–
Fair (50–75%)	15	23.08	4	6.15
Good (>75%)	–	–	61	93.85

In practice there was a parallel improvement recognised. Before the intervention, 76.92% of mothers exhibited poor practice and 23.08% fair practice, with none achieving good practice. After the intervention, 93.85% demonstrated good practice and 6.15% fair practice, and no mother remained in the poor category (Table 3, Figure 3).

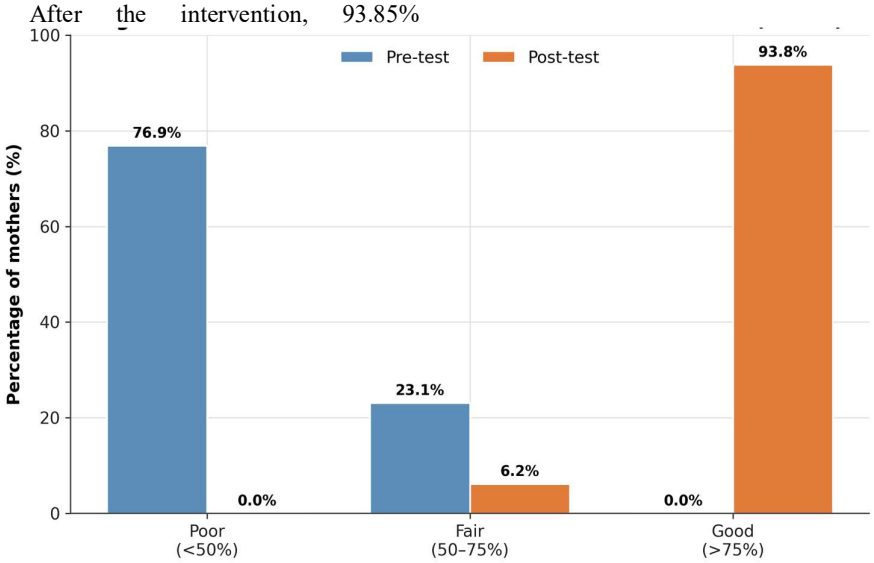

Figure 3. Comparison of pre-test and post-test levels of practice on HBNC among postnatal mothers

3.3 Effectiveness of the intervention

Table 4 presents the paired t-test analysis. Mean knowledge scores increased from 11.83 ± 3.65 at pre-test to 28.58 ± 2.83 at post-test, a mean gain of 16.75 points ($t = 48.52$; $p < 0.001$). Mean practice scores increased from 3.21 ± 1.37 to 9.65 ± 0.79, a mean gain of 6.43 points ($t = 33.87$; $p < 0.001$). Both differences were highly significant, confirming the effectiveness of the

intervention and supporting hypotheses H1 and H2. Figure 4 visualises these gains with standard-deviation error bars.

Table 4. Mean, standard deviation and paired t-test of knowledge and practice scores before and after the intervention

Variable	Test	Mean	SD	Mean difference	Paired t (p-value)
Knowledge	Pre-test	11.83	3.65	**16.75**	**48.52 (p < 0.001)*** **
	Post-test	28.58	2.83		
Practice	Pre-test	3.21	1.37	**6.43**	**33.87 (p < 0.001)*** **
	Post-test	9.65	0.79		

*Note. ***Highly significant at p < 0.001. Maximum attainable score: knowledge = 30, practice = 10.*

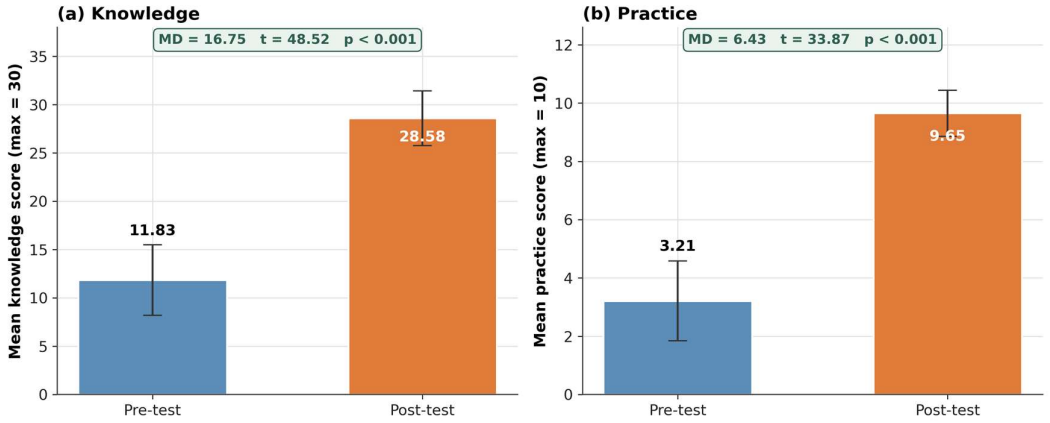

Figure 4. Comparison of mean pre-test and post-test (a) knowledge and (b) practice scores with standard-deviation error bars and paired t-test results

3.4 Association with socio-demographic variables

As seen in Tables 5 and 6 the chi-square analysis showed no significant association between the baseline knowledge or the practice with respect to the socio-demographic variables which included age, education, religion, occupation, monthly earnings, gender of the child, type of family, birth weight while p values were greater than 0.05. Hypothesis H3 was thus not confirmed as deficits in HBNC competence were found across large parts of the sample, regardless of background variables.

Table 5. Association of pre-test knowledge with selected socio-demographic variables

Demographic variable	χ^2 value	df	p-value
Age	3.104	4	0.541 (NS)
Education	4.992	4	0.288 (NS)
Religion	0.641	2	0.726 (NS)
Occupation	8.999	4	0.061 (NS)
Monthly income	5.728	6	0.454 (NS)
Gender of the child	1.853	2	0.396 (NS)
Type of family	1.448	2	0.485 (NS)
Birth weight of the child	4.765	6	0.574 (NS)

Note. df = degrees of freedom; NS = not significant (p > 0.05)

Table 6. Association of pre-test practice with selected socio-demographic variables

Demographic variable	χ^2 value	df	p-value
Age	2.791	2	0.248 (NS)
Education	2.521	2	0.283 (NS)
Religion	3.366	1	0.067 (NS)
Occupation	0.882	2	0.643 (NS)
Monthly income	1.109	3	0.775 (NS)
Gender of the child	0.600	1	0.439 (NS)
Type of family	0.033	1	0.855 (NS)
Birth weight of the child	4.184	3	0.242 (NS)

Note. df = degrees of freedom; NS = not significant (p > 0.05)

3.5 Correlation between knowledge and practice

Karl Pearson's correlation (Table 7) showed a weak, non-significant positive correlation between knowledge and practice at baseline (r = 0.235; p = 0.060). Following the intervention, this relationship became a statistically significant positive correlation (r = 0.522; p < 0.001), showing that mothers were more likely to demonstrate good practice if their post-test knowledge was high. This confirms the hypothesis H4 as shown in Figure 5.

Table 7. Correlation between knowledge and practice on HBNC among postnatal mothers

Test	Variable	Mean	SD	r (p-value)
Pre-test	Knowledge	11.83	3.65	**0.235 (p = 0.060, NS)**
	Practice	3.21	1.37	
Post-test	Knowledge	28.58	2.83	**0.522 (p < 0.001)*** **
	Practice	9.65	0.79	

*Note. r = Karl Pearson's correlation coefficient; SD = standard deviation; NS = not significant; ***Significant at p < 0.001.*

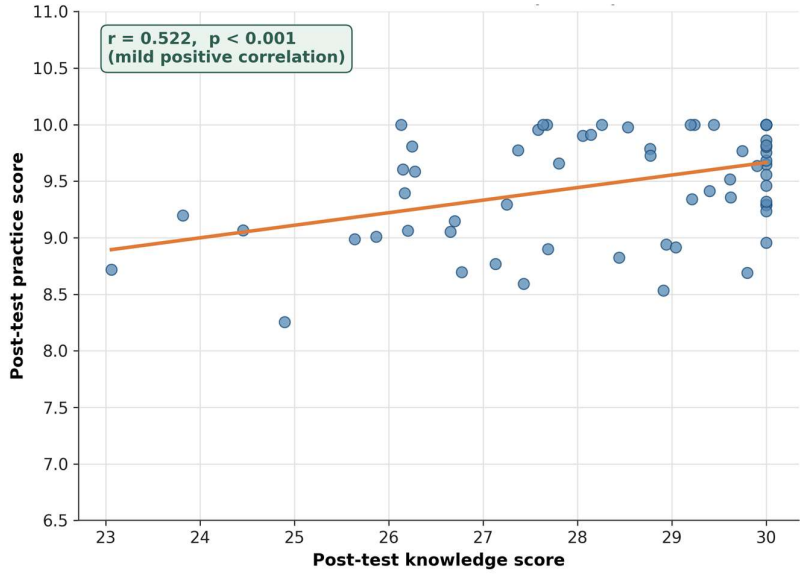

Figure 5. Scatter plot of post-test knowledge and practice scores

4. DISCUSSION

This quasi-experimental study found that primiparous postnatal mothers' knowledge and practice of Home-Based Newborn Care improved significantly after one brief, video-based education program. The proportion of mothers with appropriate knowledge climbed from 1.54% to 87.69% and those with good practice from none to 93.85%. The mean knowledge score rose by 16.75 points and practice score by 6.43 points. These magnitudes of change demonstrate first-time mothers' significant baseline disadvantage and its response to a well-designed, low-cost digital intervention.

The large baseline gap matches the literature. Several descriptive studies of Indian and African postnatal populations have found that mothers lack awareness of cord care, temperature protection, and danger signs. In rural Bangalore, Mohini and colleagues found that a large proportion of mothers had inadequate baseline knowledge of HBNC (Mohini & Shetty, 2017), while in Bhubaneswar, Odisha, fewer than half of postnatal mothers had good knowledge (Kabita Puhan et al., 2022). Before any systematic intervention, more than three-quarters of mothers in this cohort had poor newborn-care practice, similar to Ethiopian postnatal cohorts (Leta, 2022).

The intervention matches interventional research in efficacy. A structured teaching program in Puducherry and an educational-technology video intervention in Rio de Janeiro evaluating term newborn home bathing showed similar increases in mean post-test scores (Rajeswari et al., 2016; Corrêa et al., 2024; Memon et al., 2019). Taiwanese postnatal mothers also learned more via online newborn-care instruction (Kuo et al., 2009). These findings suggest that visually-rich, structured digital education is an effective way to teach newborn-care competencies because video demonstration reduces cognitive load, models procedural skills directly, and accommodates different literacy levels better than verbal or text-based instruction. It is theoretically significant that the knowledge–practice connection improved from a weak, non-significant association at baseline (r = 0.235) to a substantial positive correlation post-intervention (r = 0.522). It suggests that the intervention raised knowledge and practice independently and linked them, helping mothers apply new information. This connection is the goal of any

health-education program and indirectly proves the gains were real.

Several mechanisms may explain the effectiveness. Validated open educational resources provided content accuracy and reproducibility; bedside delivery captured moms during the postnatal window when infant-care information is most receptive; and the ability to address doubts after viewing improved retention. In a systems-theory perspective, structured digital input is digested throughout the postnatal stay (throughput) and emerges as enhanced knowledge and practise (output), with feedback loops maintaining behaviour change following discharge.

5. CONCLUSION

Structured teaching delivered through digital media was highly effective in improving both the knowledge and the practice of Home-Based Newborn Care among primiparous postnatal mothers. Post-intervention, the overwhelming majority of mothers attained adequate knowledge and good practice, the mean gains were statistically significant for both outcomes, and post-test knowledge correlated positively with practice. These results affirm the value of low-cost, scalable digital education as a routine component of postnatal care and as a practical strategy to strengthen home-based newborn care and support neonatal survival, particularly in resource-limited settings.

6. RECOMMENDATIONS

Nursing practice. Digital structured teaching should be embedded in routine postnatal care, reinforced by follow-up sessions and extended to rural communities through community health nurses.

Nursing education. Nursing curricula should incorporate training in digital health-education methods so that future nurses can design and deliver effective patient teaching.

Nursing administration. Hospital administrators should institutionalise digital education in postnatal wards, allocate resources for content development and staff training, and partner with governmental and non-governmental organisations to scale these programmes.

Future research. Randomised controlled trials with longer follow-up, larger and multi-centre samples, rural–urban comparisons, evaluation of different digital modalities, and cost-effectiveness analyses are warranted to confirm and extend these findings.

7. LIMITATIONS

Several limitations should be acknowledged. The single-group pre-test to post-test design without a control group limits causal inference and cannot fully exclude maturation or testing effects. The relatively small convenience sample of 65 mothers from a single hospital constrains generalisability. The short follow-up interval of seven days precludes assessment of long-term knowledge retention and sustained behaviour change, and self-reported practice may be subject to social-desirability bias. Future controlled, multi-centre studies with extended follow-up are recommended.

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