ORIGINAL ARTICLE

A Cross-Sectional Study to assess neonatal Resuscitation Practices among Trained and Untrained Health Care Workers in Indore District, Madhya Pradesh

Saifaly Gupta[1], Vishwambhar Puri Goswami[2], Parakh Jatav[3], Piyush Kumar Sharma[4], Deepa Raghunath[5], Aditya Kumar Khatri[6]

[1,2,3]Department of Community Medicine, ESIC Medical College & Hospital, Indore (M.P.)
[4]Department of Immunohematology & Transfusion Medicine, MGM Medical College, Indore (M.P.)
[5]Department of Community Medicine, MGM Medical College, Indore (M.P.)
[6]Department of Community Medicine, Index Medical College

CORRESPONDING AUTHOR
Dr. V.P. Goswami, Associate Professor, Department of Community Medicine, ESIC Medical College & Hospital, Indore (M.P.)
Email: drvpgoswami@gmail.com

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ABSTRACT

Background: Neonatal mortality contributes substantially to under-five mortality in India. Despite implementation of skill-based training programs such as Navjaat Shishu Suraksha Karyakram (NSSK), addressable gaps persist in neonatal resuscitation practices at delivery points. Evaluation of healthcare workers' practices is crucial for improving neonatal outcomes. **Aims & Objectives:** To assess neonatal resuscitation and essential new-born care practices among trained and untrained HCWs various levels of healthcare delivery. **Methodology:** A facility-based cross-sectional study was conducted among 150 HCWs (trained n=80; untrained n=70). Practices were assessed using a structured manikin-based neonatal resuscitation practice checklist. Group differences were analysed using χ^2 test; $p<0.05$ was considered statistically significant. **Results:** Trained HCWs demonstrated significantly better performance for several preparation and ventilation steps. For example, trained HCWs more often identified a helper and explained roles (51.2% vs 34.3%, p=0.036), prepared equipment and supplies (73.7% vs 48.6%, p=0.002), checked bag and mask function (66.2% vs 50.0%, p=0.044), and performed ventilation correction steps such as increasing pressure to move the chest (65.0% vs 47.1%, p=0.031). **Conclusion:** Important gaps in neonatal resuscitation practice were observed in both groups, with consistently better performance among trained HCWs. Periodic skill-based training, mentoring, and facility readiness measures are required to strengthen delivery-room resuscitation.

KEYWORDS

Neonatal Resuscitation; Neonatal Mortality; New-Born Care; Navjaat Shishu Suraksha Karyakram; Cross-Sectional Study.

INTRODUCTION

Neonatal mortality remains a major public health concern in India, accounting for nearly half of under-five deaths and two-thirds of infant mortality (1). According to NFHS-5, neonatal mortality rate (NMR) in India is 24.9 per 1000 live births, while Madhya Pradesh reports a higher NMR of 29.0.(2) Despite considerable progress in institutional deliveries, early neonatal deaths continue due to preventable causes such as birth asphyxia, hypothermia, infections, and prematurity (3).

The first minute after birth, known as the "golden minute," is crucial for neonatal survival. During this time, the newborn must initiate breathing and adapt to life outside the womb. Delays in this transition can lead to hypoxia and increase the risk of mortality, particularly from birth asphyxia..(4)

To address this, the Government of India introduced the Navjaat Shishu Suraksha Karyakram (NSSK. However, variability in training coverage, retention of skills, and facility preparedness may limit program effectiveness.(5) Despite these efforts, the desired outcomes have not been fully achieved. The rate of decline in India's neonatal mortality rate has been slow.(6)

This study assessed neonatal resuscitation practices among trained and untrained health care workers. The findings aim to improve training, mentoring, and quality improvement activities in delivery and newborn care areas.

Aim & Objective(s)

To assess and compare neonatal resuscitation practices between trained and untrained healthcare providers to determine the impact of structured training on adherence to standard resuscitation guidelines.

Primary Objective

- To assess neonatal resuscitation practices among trained and untrained healthcare workers.

Secondary Objectives

- To compare essential newborn care practices between trained and untrained healthcare workers
- To identify major practice gaps.

MATERIAL & METHODS

Study type & Study Design: Facility-based cross-sectional study.

Study Setting: A facility-based cross-sectional observational study was conducted at various level of health care delivery systems in Indore district. The study assessed performance on a structured neonatal resuscitation practice checklist aligned with NSSK and standard neonatal resuscitation steps.

Study Population: Healthcare workers involved in delivery and newborn care, comprising trained (n=80) and untrained (n=70) personnel. Trained HCWs were those who had previously received formal neonatal resuscitation training (e.g., NSSK/HBB/NRP), whereas untrained HCWs had not received such structured training.

Study duration- 1 year

Sample Size calculation

For health care workers $n = \frac{(Z_\alpha)^2 * P * Q}{d^2}$

$Z_\alpha = confidence\ limit\ at\ 95\%\ (standard\ value\ of\ 1.96 \cong 2)$

P = Prevalence (75%) *

According to NSSK guidelines, trainees are expected to achieve scores between 80–100% after training. This study also included untrained participants with baseline knowledge around 50%; therefore, the mean prevalence was estimated at 75%.(7)

q = 100-P

d = Absolute error (7.5 %)

n = 134 = 150 (with 10% 0f participant unresponsiveness).

(minimum sample size – 150)

Inclusion Criteria

HCWs directly involved in newborn care

Willing to participate in the study

Exclusion Criteria

HCWs not involved in neonatal care

Those unwilling to participate

Strategy for data collection: A structured questionnaire and observation manikin-based checklist adapted from NSSK training modules was used to assess socio-demographic characteristics, training status, knowledge, attitude, and practices related to neonatal resuscitation.(1)

Practice was assessed using a checklist that included: (i) preparation for birth and routine care, (ii) steps when baby is crying/breathing well, (iii) initial steps when baby is not crying/breathing well, (iv) brief ventilation steps, (v) actions when chest is not rising, (vi) actions when baby starts breathing after initial steps, (vii) prolonged ventilation with normal heart rate, and (viii) actions based on heart rate response.

Ethical Considerations & Informed Consent: Ethical clearance was obtained from Institutional Review Board & Scientific Review Committee, M.G.M Medical College, Indore with letter no. EC/MGM/DEC-22/62. Written informed consent was taken from all participants, and confidentiality was maintained.

Data Analysis: Data were entered in MS Excel and analysed using SPSS version 25.0(Trial version).

RESULTS

A total of 150 HCWs were assessed (trained n=80, untrained n=70) involved in delivery and immediate newborn care. Trained HCWs were those who had previously received formal neonatal resuscitation training (e.g., NSSK/NRP), whereas untrained HCWs had not received such structured training. The study assessed performance on a structured neonatal resuscitation practice manikin-based checklist aligned with NSSK and standard neonatal resuscitation steps

Overall, trained HCWs performed better than untrained HCWs across most neonatal resuscitation steps, with higher correct practice in routine care (e.g., helper identification 51.2% vs 34.3%, ventilation area preparation 75.0% vs 58.6%, equipment preparation 73.8% vs 48.6%, bag–mask check 66.2% vs 50.0%, meconium assessment/suction 70.0% vs 47.1%, drying/removing wet linen 47.5% vs 30.0%). Hand hygiene was high in both groups (85.0% vs 75.7%), and calling out time of birth was similar (42.5% vs 40.0%).

For babies crying/breathing well, trained HCWs showed higher correct practice in warmth provision (82.5% vs 58.6%) and identity labeling (56.2% vs 38.6%), while other steps were comparable such as head positioning (72.5% vs 75.7%), airway clearing (83.8% vs 78.6%), cord cutting (86.2% vs 81.4%), and breastfeeding initiation (77.5% vs 75.7%).

In the resuscitation sequence, trained HCWs generally performed better in initial steps (28.7% vs 15.7%, 73.7% vs 52.9%, 73.7% vs 57.1%, 76.2% vs 60.0%) and brief ventilation steps like mask selection (73.7% vs 67.1%), mask positioning (61.2% vs 44.3%), and checking chest rise (68.7% vs 38.6%), while "begins ventilation" was similar (66.2% vs 71.4%).

When the chest was not rising, trained HCWs again showed higher correct practice for corrective steps (e.g., 71.2% vs 52.9%, 65.0% vs 47.1%, 67.5% vs 50.0%), although some actions were similar (70.0% vs 65.7%, 68.7% vs 68.6%).

Finally, for HR <100, both groups performed almost identically in continuing ventilation and arranging referral (75.0% trained vs 74.3% untrained; no significant difference).

Table 1: Practices if baby is crying or breathing well after routine care (n=150)

Practice	Trained HCWs (n=80)	Untrained HCWs (n=70)	Total (n=150)	p
Position head in slightly extended position	58 (72.5%)	53 (75.7%)	111 (74.0%)	0.654
Provides warmth (covers head & skin-to-skin contact)	66 (82.5%)	41 (58.6%)	107 (71.3%)	0.001
Clear airway (first mouth then nose)	67 (83.8%)	55 (78.6%)	122 (81.3%)	0.417
Wipes both eyes	48 (60.0%)	31 (44.3%)	79 (52.7%)	0.054
Ties and cuts cord in 1–3 min	69 (86.2%)	57 (81.4%)	126 (84.0%)	0.422

Practice	Trained HCWs (n=80)	Untrained HCWs (n=70)	Total (n=150)	p
Places identity label	45 (56.2%)	27 (38.6%)	72 (48.0%)	0.031
Keeps baby with mother & initiates breastfeeding	62 (77.5%)	53 (75.7%)	115 (76.7%)	0.796

Table 2: Initial steps if baby is not crying or breathing well after routine care (n=150)

Practice	Trained HCWs (n=80)	Untrained HCWs (n=70)	Total (n=150)	p
Indicates that baby will require initial steps of resuscitation	23 (28.7%)	11 (15.7%)	34 (22.7%)	0.057
Places baby on ventilation area after tying and cutting the cord	59 (73.8%)	37 (52.9%)	96 (64.0%)	0.008
Positions baby with neck slightly extended	57 (71.2%)	50 (71.4%)	107 (71.3%)	0.981
Suction mouth then nose	59 (73.8%)	40 (57.1%)	99 (66.0%)	0.032
Stimulates baby to breathe	62 (77.5%)	54 (77.1%)	116 (77.3%)	0.958
Repositions baby	61 (76.2%)	42 (60.0%)	103 (68.7%)	0.032

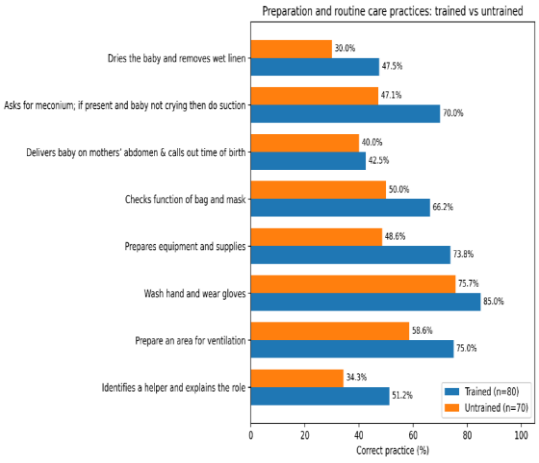
Table 3: Brief ventilation and ventilation correction steps, if baby is not crying or breathing well after initial steps (n=150)

Practice	Trained HCWs (n=80)	Untrained HCWs (n=70)	Total (n=150)	p
Selects appropriate-sized mask	59 (73.8%)	47 (67.1%)	106 (70.7%)	0.375
Positions mask properly on baby	49 (61.3%)	31 (44.3%)	80 (53.3%)	0.038
Begins ventilation	53 (66.2%)	50 (71.4%)	103 (68.7%)	0.495
Looks for chest rise during ventilation	45 (56.2%)	27 (38.6%)	72 (48.0%)	0.031
Reapplies mask and repositions head (if chest not rising)	57 (71.2%)	37 (52.9%)	94 (62.7%)	0.020
Clears airway and ventilates with mouth slightly open	56 (70.0%)	46 (65.7%)	102 (68.0%)	0.575
Increases pressure to move chest	52 (65.0%)	33 (47.1%)	85 (56.7%)	0.028
Ventilates for 30 seconds at 40–60 breaths/min	54 (67.5%)	35 (50.0%)	89 (59.3%)	0.029
Assesses breathing	55 (68.8%)	48 (68.6%)	103 (68.7%)	0.981

Table 4: Prolonged ventilation with normal heart rate, if baby is not crying or breathing well after brief ventilation (n=150)

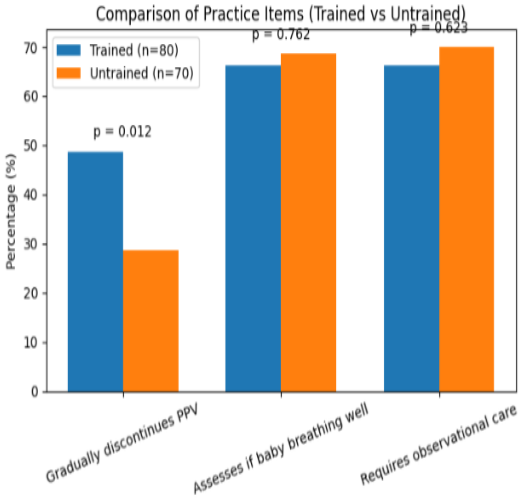
S.No.	Practice	Trained HCWs (n=80)	Untrained HCWs (n=70)	Total (n=150)	p
1	Calls for help & continues ventilation	59 (73.8%)	46 (65.7%)	105 (70.0%)	0.284
2	Adds oxygen if available	55 (68.8%)	34 (48.6%)	89 (59.3%)	0.012
3	Asks helper to assess heart rate (HR >100 bpm)	57 (71.2%)	43 (61.4%)	100 (66.7%)	0.203

Figure 1: Preparation and routine care practices among trained and untrained healthcare workers



Values represent the proportion (%) of participants reporting correct practice in each item. Trained group (n=80) and untrained group (n=70), association was found to be significant except wash hand and wear gloves & Delivers baby on mothers' abdomen & calls out time of birth.

Figure 2: Actions if baby starts to breathe after initial steps (n=150)



Values represent the proportion (%) of participants reporting correct practice in each item. Trained group (n=80) and untrained group (n=70)

Figure 3: Actions if heart rate >100 bpm (n=150)

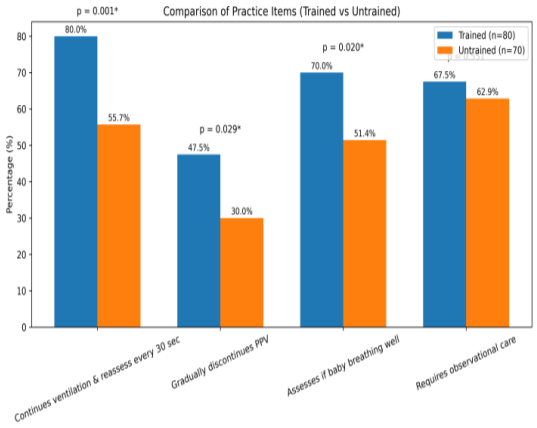
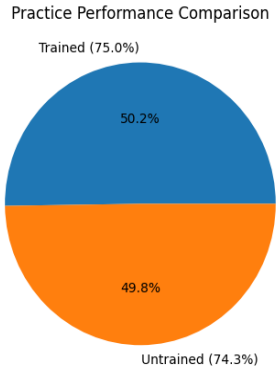


Figure 4: Actions if HR <100 bpm (n=150)



DISCUSSION

The most important finding of this study was that trained HCWs consistently demonstrated higher correct neonatal resuscitation practices than untrained HCWs, particularly for steps that determine preparedness and effective ventilation. For example, during preparation and routine care, trained HCWs more often prepared a ventilation area (75.0% vs 58.6%), prepared equipment (73.7% vs 48.6%), checked bag–mask function (66.2% vs 50.0%), assessed meconium and performed suction when indicated (70.0% vs 47.1%), and dried the baby appropriately (47.5% vs 30.0%). These differences highlight that training improves critical resuscitation readiness rather than only routine tasks.

This pattern is strongly supported by previous studies. Usman et al reported that only 5% of respondents demonstrated good neonatal resuscitation practice overall, and good practice was significantly associated with prior training.(8)In India, Lodhiya et al similarly observed that trained staff achieved significantly higher scores than untrained staff, although gaps remained in some technical steps.(9) Bansal et al also found that participants with NRP training were more likely to follow correct practices, especially in managing meconium-stained liquor (80% vs 53.1%).(10)

These findings match the current observation where meconium assessment and suction showed a large training advantage (70.0% vs 47.1%).

When the baby was breathing well, both groups performed relatively well for some steps, such as airway clearing (83.5% vs 78.6%) and cord cutting within 1–3 minutes (86.2% vs 81.4%). However, trained HCWs were substantially better in providing warmth (82.5% vs 58.6%) and placing an identity label (56.2% vs 38.6%). Similar gaps in comprehensive essential newborn care have been reported by Atiqzai et al, where drying and sterile cord cutting were high, but early breastfeeding support was much lower (38.4%).(11)

The most critical differences emerged during ventilation. Trained HCWs performed better in correct mask positioning (61.2% vs 44.3%) and checking chest rise (68.7% vs 38.6%). When the chest did not rise, trained HCWs more often reapplied the mask and repositioned the head (71.2% vs 52.9%) and increased pressure (67.5% vs 50.0%). Comparable issues were reported by Atiqzai et al, where monitoring chest movement during ventilation was done in only 74.6% of cases, and calling for help occurred in just 26.4%.(11) Shikuku et al also found that correct suctioning in meconium cases was only 40%, reinforcing that advanced steps remain weak even when ventilation is initiated.(12,13) These findings are important because inadequate mask seal, poor head position, and failure to assess chest rise are well-recognized causes of ineffective ventilation.

Overall, the findings support existing evidence that structured neonatal resuscitation training improves performance, but persistent deficits in ventilation technique and troubleshooting indicate the need for repeated simulation-based refreshers and competency assessment. (10,14,15)

CONCLUSION

Neonatal resuscitation practices were significantly better among NSSK-trained healthcare workers. Regular refresher training, supportive supervision, and facility strengthening are critical for sustaining skill retention and improving neonatal survival.

Neonatal resuscitation practice gaps were observed among both trained and untrained HCWs, with trained HCWs showing significantly better performance for multiple preparation, routine care, and ventilation-related steps. Strengthening competency-based training, ensuring regular refresher practice, and improving facility readiness through guidelines and equipment checklists are recommended.

RECOMMENDATION

To decrease the neonatal mortality rate and ensure quality training, regular competency-based neonatal resuscitation training with periodic simulation refreshers should be mandatory. Health facilities must ensure availability and routine checking of functional resuscitation equipment before every delivery. Adoption of standardized checklists and supportive supervision can enhance adherence to protocols and teamwork during resuscitation.

LIMITATION OF THE STUDY

- Being a single-district study, generalizability is limited.
- Manikin-based assessment may not fully reflect real-life performance.
- Time and resource constraints may have limited sample representativeness.

RELEVANCE OF THE STUDY

This study is relevant as neonatal mortality remains high in Madhya Pradesh, largely due to preventable causes like birth asphyxia, septicaemia, and delay in transport, hypothermia, hypoglycaemia & other preventable causes. By identifying gaps between trained and untrained healthcare workers, it highlights areas needing improvement in delivery-room practices. The findings support strengthening skill-based training and facility readiness to improve neonatal survival.

AUTHORS CONTRIBUTION

SG - substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data. VPG - final approval of the version to be published. PJ - substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data. PS - substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data. DR - drafting the article or revising it critically for important intellectual content. AKK - drafting the article or revising it critically for important intellectual content.

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Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

We have not used any generative AI/AI assisted technologies in the writing process

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