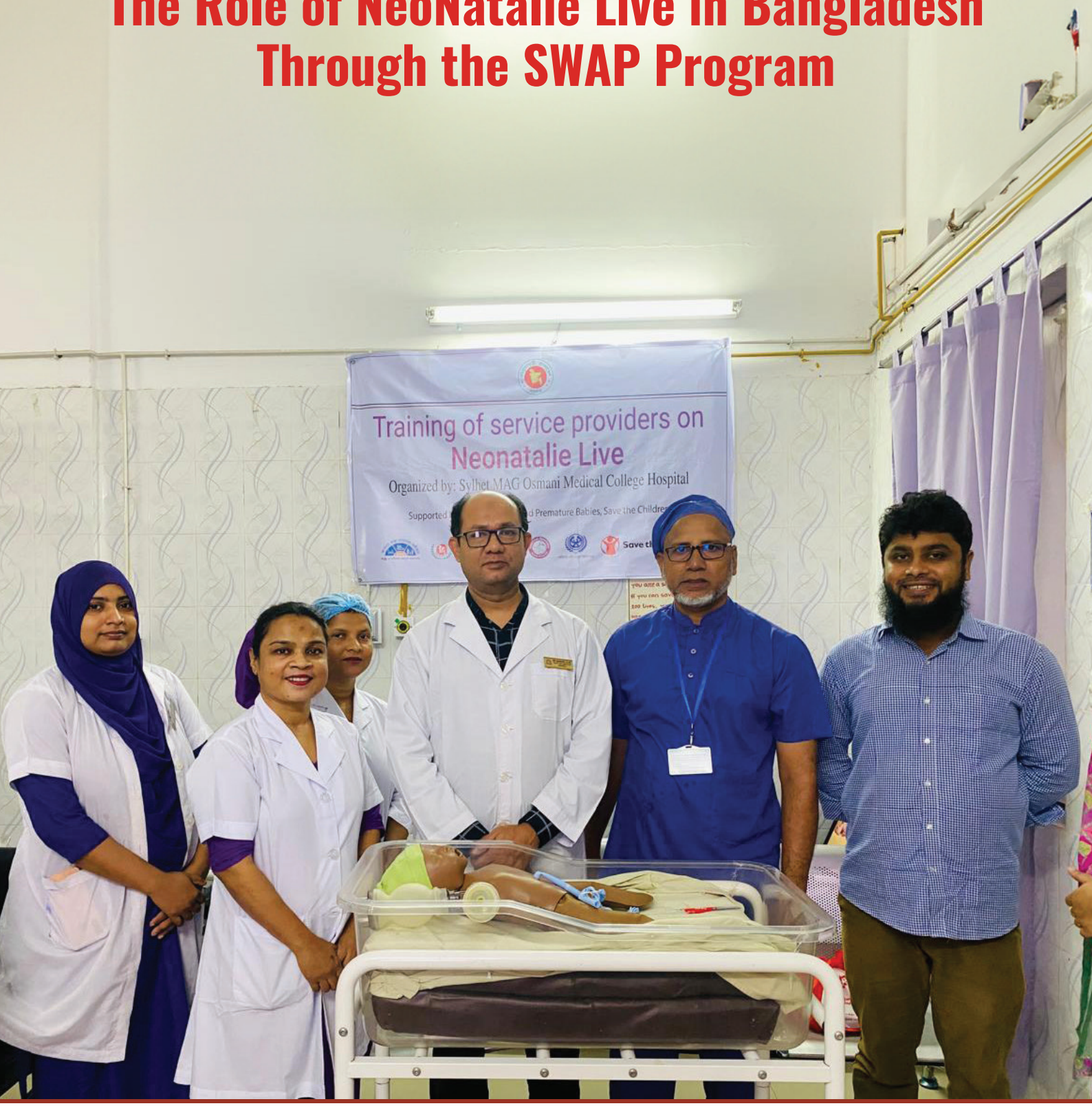
Maintenance of Newborn Resuscitation Skills:

The Role of NeoNatalie Live in Bangladesh Through the SWAP Program



স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয়

পরিবার পরিকল্পনা অধিদপ্তর

National Newborn Health Program

Save the Children

Background

Bangladesh continues to grapple with high neonatal mortality rates, with a significant number of newborn deaths occurring within the first few minutes to days of life (Rahman, 2021). A major contributor to this mortality burden is birth asphyxia, a condition that can be effectively addressed through timely and skilled newborn resuscitation (Soni and Nagalli, 2025). Because this is a relatively rare event, skills retention for newborn resuscitation following training can be problematic (Reisman, 2015). Recognizing this critical gap in the maintenance of this lifesaving skill, the Saving Women and Premature Babies (SWAP) project, led by Save the Children, partnered with the Bangladesh Ministry of Health and Family Welfare (MoHFW) and Laerdal Global Health, introduced an innovative training approach using the **NeoNatalie Live (NNL)** smart manikin.

The NNL smart newborn resuscitation trainer is a data-driven newborn resuscitation training solution, designed to support self-directed, low-dose high frequency skills and simulation training. Users get instant objective performance feedback, log training data and identify skills gaps for targeted training. The newborn manikin connects to an app on a tablet or smartphone via Bluetooth, which collects, stores and uploads all training and feedback data to a secure online report and dashboard.

With patient scenarios based on 1,200 real ventilation cases, NNL demonstrates chest rise, changes in heart rate, and cries when resuscitation is successful, providing learners with a realistic, immersive experience. NNL is responsive to the actions of the learner in real time and supports individual and team trainings. During individual or peer-2-peer trainings, the app gives feedback on the technique of bag mask ventilation, including head-tilt, ventilation pressure, ventilation rate and time spent ventilating. Group trainings using the NNL app are based on WHO's Essential Newborn Care Course – refreshing key steps required for effective newborn resuscitation. This training tool allows healthcare providers (HCPs) to practice, review and refine skills on newborn resuscitation and essential newborn care in a safe, controlled, and repeatable manner.

NNL as a training was rolled out across five strategically selected healthcare facilities representing diverse settings, including tertiary and district-level hospitals operating under both MoHFW's Directorate General of Health Services (DGHS) and Directorate General of Family Planning (DGFP). To assess the impact of this HCP driven continuous practice of resuscitation skills, an assessment was conducted to examine its impact on HCP simulated resuscitation performance.

SWAP Project

The Saving Women and Premature Babies (SWAP) Project, supported by an anonymous donor and implemented by Save the Children, addresses persistent challenges of maternal and neonatal mortality in Bangladesh. The SWAP project assists the Bangladesh Ministry of Health and Family Welfare (MOHFW), including the National Newborn Health Program (NNHP) and Integrated Management of Childhood Illness (IMCI), to improve the quality of care for mothers (particularly those likely to deliver premature/low birthweight babies) and small and sick newborns by supporting provision and institutionalization of evidence-based, life-saving interventions in selected facilities. Implemented in five health care facilities in Dhaka, Sylhet, and Chittagong divisions of Bangladesh, the goals of the program are to improve quality of care and reduce preventable maternal and neonatal deaths from causes such as postpartum hemorrhage, eclampsia, preterm birth complications, and low birth weight, to bring Bangladesh closer to global Sustainable Development Goals. The project works in partnership with Bangabandhu Sheikh Mujib Medical University (BSMMU), Centre for Injury Prevention and Research Bangladesh (CIPRB), Vayu Global Health Foundation (Vayu), and Laerdal Global Health.

Bangabandhu Sheikh Mujib Medical University

MR Khan Shishu Hospital & Institute of Child Health, Mirpur

Mohammadpur Fertility Services & Training Centre

MAG Osmani Medical College

Lakshmipur Sadar Hospital

NNL Intervention Overview

The NNL was introduced to the five SWAP-supported health facilities in 2024 through a cascade training approach (Figure 1). Discussions were held with the leadership of DGHs and DGFP, and the National Newborn Health Program (NNHP) to advocate and plan for the use of NNL in SWAP project sites: Bangabandhu Sheikh Mujib Medical University (BSMMU) in Dhaka, Dr. M R Khan Shishu Hospital, Mirpur (DMRKSHICH) in Dhaka, Lakshmipur District Hospital [LSH] Mohammadpur Fertility Services & Training Center [MFSTC] in Dhaka, and Sylhet MAG Osmani Medical College Hospital [SMOMCH]. Training of trainers (TOTs) was conducted on the use of the NNL simulator using a low dose, high frequency approach for staff from the Special Care for Newborn Units (SCANU) from the five hospitals. Each hospital was provided with 1 simulator and selected a focal person for the intervention.

The focal person was responsible for encouraging HCPs to practice their resuscitation skills using the NNL, hold review meetings and troubleshoot when issues related to the intervention arise. Following the rollout of training, an evaluation was conducted on NNL use in relation to health care providers skills and knowledge of newborn resuscitation. NNL use was assessed at three different intervals - immediately after training, mid-term and endline.

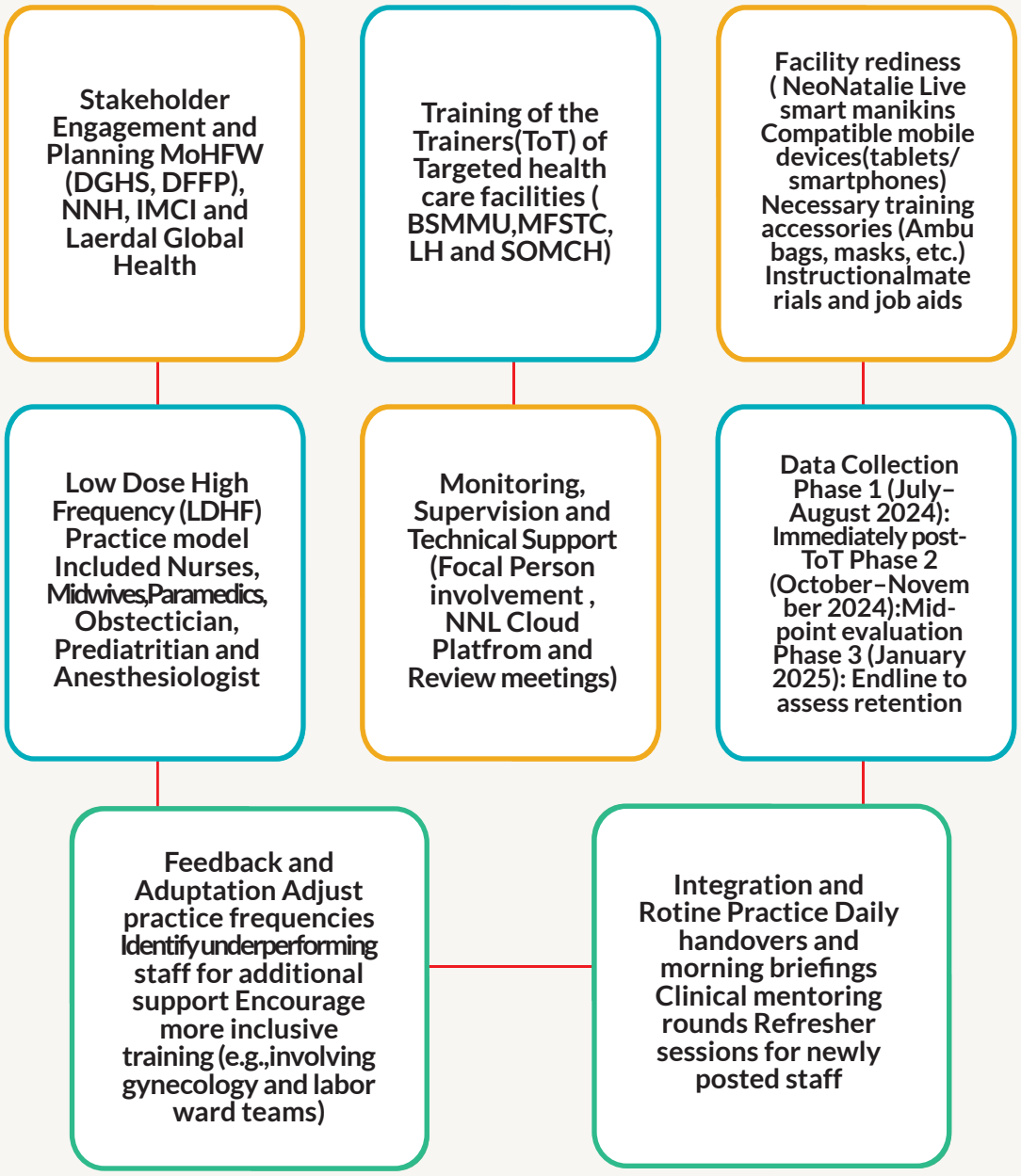


Figure 1. NNL Training and Rollout Process

Evaluation of NNL in SWAP -supported facilities

The evaluation of NNL, which included a review of data from July 2024 to January 2025, focused on levels of **skills and knowledge** of health care providers to conduct newborn resuscitation and other ENC tasks following introduction of NNL. Data for the evaluation came from data stored in the NNL device, drawn from the NeoNatalie Live (NNL) Cloud Platform.

Neonatal resuscitation data was collected immediately after initial training (July–August 2024); data collection was repeated at mid-term post-training (October - November 2024); and at the final assessment in January 2025. Qualitative data was collected during the endline assessment to capture information on ease and challenges of using NNL device, using Focus Group Discussions (FGDs) with HCPs, and Key Informant Interviews (KIIs) with SCANU heads and senior neonatologists. Both methods used semi-structured discussion guides. Interviews were audio recorded and transcribed, and content analysis was performed to identify key themes.

Results

The findings from the NNL simulation stored data is out of all uses of the NNL for practice and thus does not track individuals longitudinally, rather is an overall measurement associated with all health care providers at the facility who use the device for practice. Table 1 presents the resuscitation sessions by facility.

Table 1. Total resuscitation sessions by facility

Facilities	Total Resuscitation Training Events
Bangladesh Medical University (BMU)	465
Dr. MR Khan Shishu Hospital	812
Laskhmipur District Hospital	184
Mohammadpur Fertility Service & Training Centre(MFSTC)	519
Osmani Medical College Hospital, Sylhet	217
Total	**2197**

Successful resuscitation attempts

Using the data generated by users, a rate of successful resuscitation practice (percentage of resuscitation attempts that resulted in the NNL manikin "crying") was calculated. The overall success rate ranges from a high of 79% at MFSTC to a low of 20% at SMOMCH. See Figure 2 for more detailed on successful resuscitation rates overall over the three phases of the implementation period.

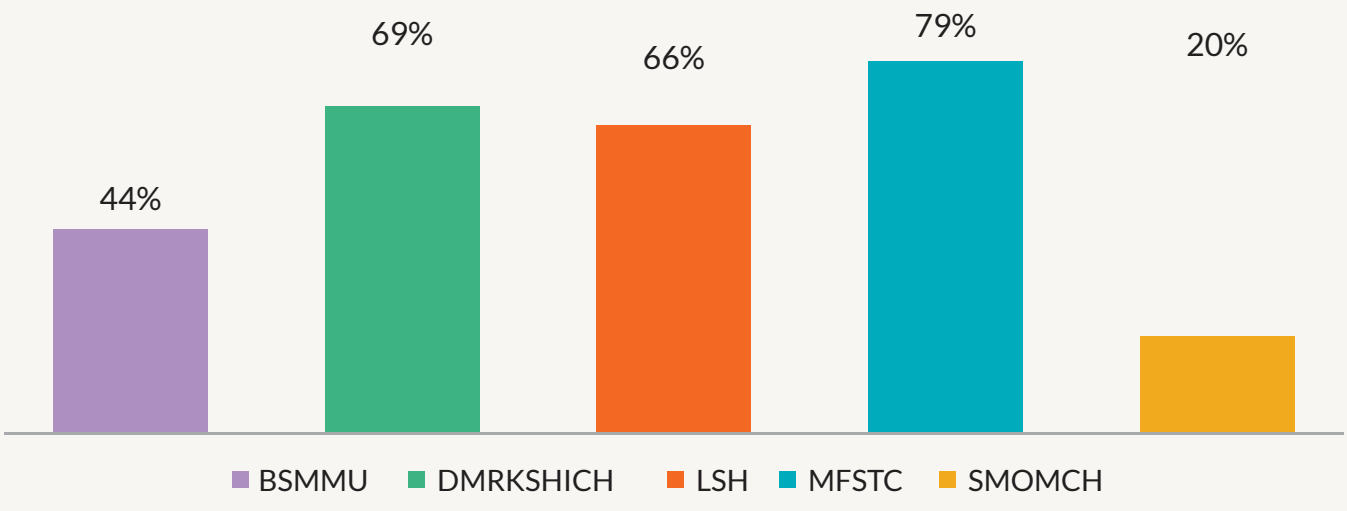


Figure 2. Successful resuscitation rates by facility

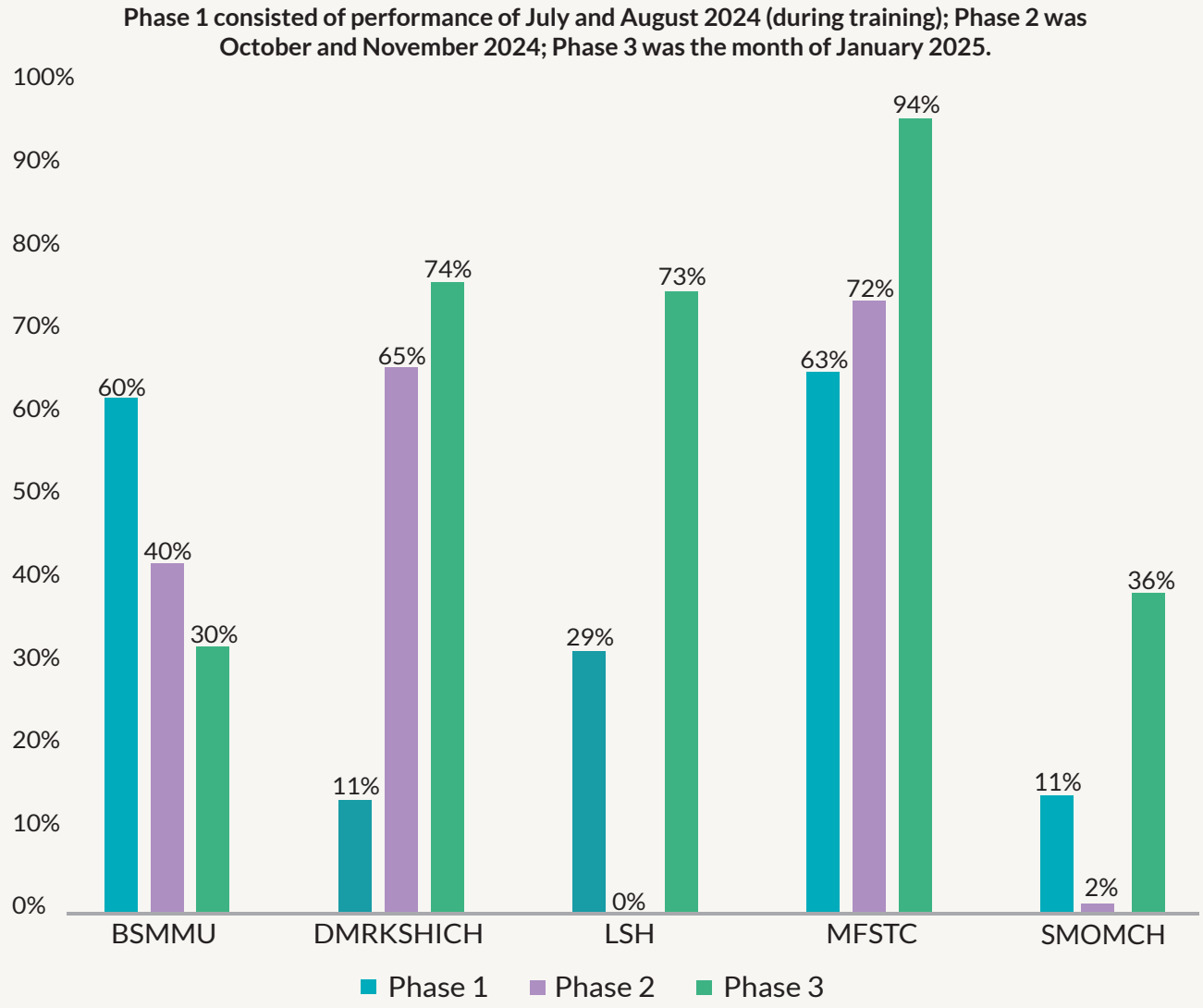


Figure 3. Successful resuscitation rates over the three phases of implementation of NNL

As shown in Figure 2, four out of five facilities demonstrated improvement over time. Lakshmipur Sadar Hospital (LSH) didn't have the use of NNL during Phase 2 due to technical issues. Bangabandhu Sheikh Mujib Medical University did not sustain an increase in successful resuscitation attempts. The reasons for this were not clear from the assessment.
NNL has four simulated resuscitation case scenarios (Table 2).

Table 2. Simulated resuscitation case scenarios for NNL

	Case Description
Case 1	Soft lungs, normal heart rate
Case 2	Soft lungs, low heart rate
Case 3	Initially stiff and fluid-filled lungs, low heart rate
Case 4	Initially stiff and fluid-filled lungs, low heart rate,slow response to ventilations.

Found at: https://shop.laerdalglobalhealth.com/wp-content/uploads/Att-2-to-00067162-1.pdf.

At all health facilities, success rate varied by scenario. Almost across the board, Case 2 (soft lungs, low heart rate) was the scenario most likely to result in successful resuscitation.

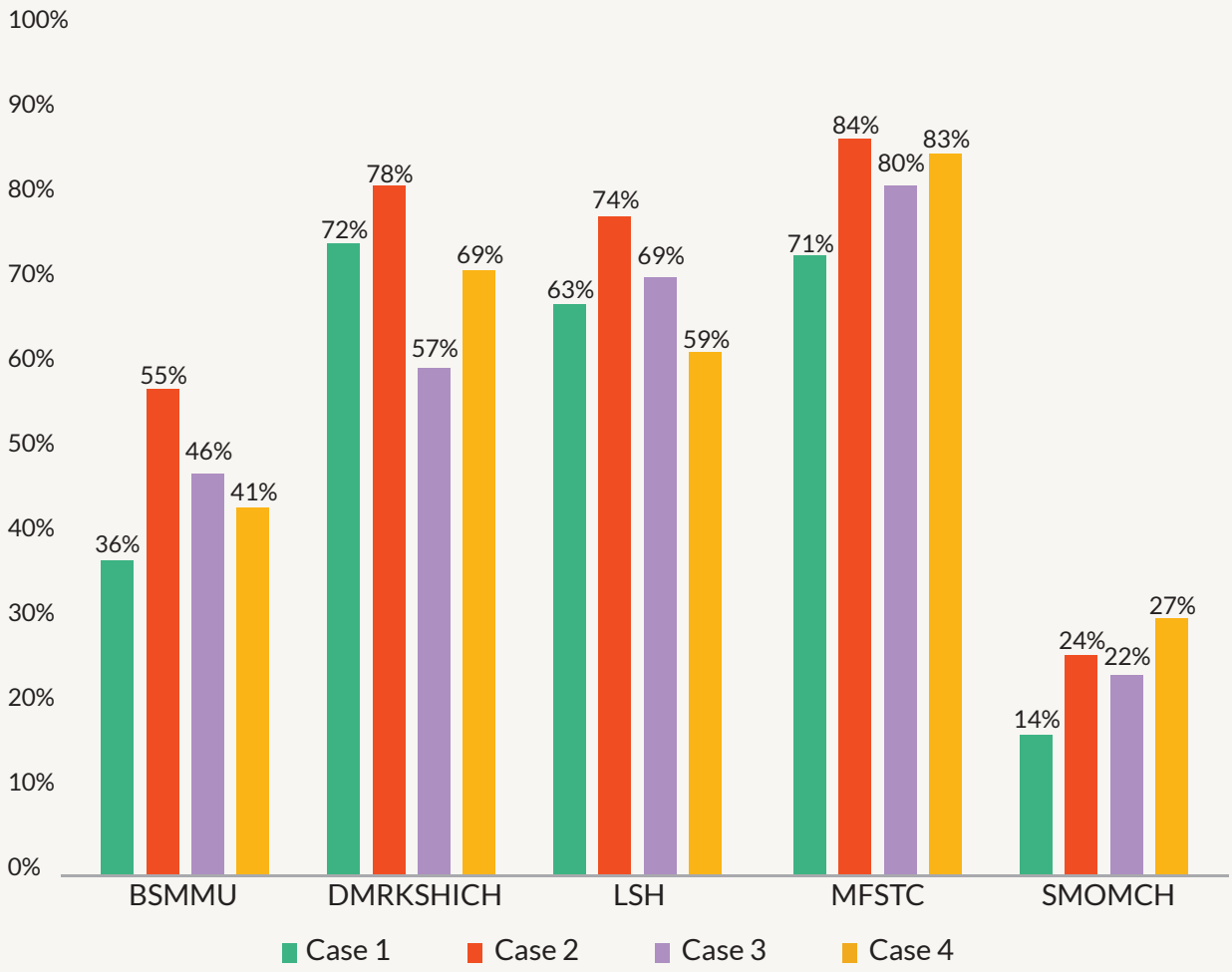


Figure 3. Success rate by scenario

Accuracy of clinical management in resuscitation practice sessions

The NNL provides measurement of clinical parameters such as ventilation rate, air pressure, tilt of the head to keep the airway open, and the time it takes to elicit spontaneous breathing.

Table 2. Average ventilation rate during resuscitation attempts (recommended is 40 breaths per minute)

Facilities	Total	Phase 1	Phase 2	Phase 3
BSMMU	49.3	43.9	49.4	53.9
DMRKSHICH	41.4	77.2	43.5	37.1
LSH	38.9	49.4	N/A	37.1
MFSTC	42.3	49.0	43.1	39.3
SMOMCH	52.3	48.2	57.7	45.9

Average Ventilation Rate [vent/min]

The average ventilation rate ranges from about 39 breaths per minute to 52 breaths per minute. Over time,three of the hospitals showed improvement in HCPs average ventilation rate .

Table 3. Percent of ventilation with insufficient pressure

Facilities	Total	Phase 1	Phase 2	Phase 3
BSMMU	3.7	5.6	2.6	3.6
DMRKSHICH	4.1	0.00	6.2	1.9
LSH	9.9	8.9	N/A	10.1
MFSTC	4.00	7.0	5.3	1.0
SMOMCH	4.00	15.1	3.1	2.5

Percent of Ventilations with Insufficient Pressure [%]

The range of resuscitation attempts with insufficient pressure ranged from 3.7% to 9.9% (Table 3). All hospitals showed decline in the percent of ventilation attempts with insufficient air pressure, with the exception of LSH.

Table 4. Percent of ventilation attempts with correct head tilt

Facilities	Total	Phase 1	Phase 2	Phase 3
BSMMU	92.4	97.8	85.5	98.1
DMRKSHICH	99.2	100.0	99.3	99.0
LSH	98.1	90.3	N/A	99.4
MFSTC	99.1	96.4	99.2	99.5
SMOMCH	98.7	89.9	100.0	99.2

Correct tilting of the head during resuscitation is essential to keep the airway open and allow adequate air to enter the lungs of the newborn. The head was tilted correctly during the resuscitation attempt was high in most facilities, and almos universal at Dr. MR Khan and MFSTC.

Table 4. Average number of seconds to spontaneous breathing during ventilation attempts (recommended is 60 seconds)

Facilities	Total	Phase 1	Phase 2	Phase 3
BSMMU	76.1	77.0	78.9	71.2
DMRKSHICH	73.5	50.4	74.5	73.6
LSH	87.3	72.4	N/A	89.9
MFSTC	69.6	72.1	70.0	68.3
SMOMCH	84.0	92.6	96.3	65.0

Average number of seconds to spontaneous breathing

The primary goal of newborn resuscitation is to initiate breathing within the first 60 seconds of life, and to get the newborn breathing spontaneous as soon as possible. The average time to spontaneous breathing remained higher than the recommended time to spontaneous breathing. However 2 facilities (MFSTC and SMOMCH) were close to achieving this standard by phase 3.

Qualitative Findings

Health care providers noted an increase in confidence from using the NNL. Universally, respondents found the simulations more interesting compared to traditional training. They also mentioned that the baby's (manikin) cry upon a successful resuscitation to be compelling. As stated by one respondent, "This is about saving a life. When a baby starts crying, it feels like a life has been saved. It's a life coming back. It's definitely exciting and joyful." Several providers recounted successful real-life resuscitation cases where training outcomes were directly applied.

Providers felt empowered by receiving real-time feedback during practice, enabling self-assessment and correction of techniques such as head tilt, chest rise, and ventilation pressure. As mentioned by one respondent, "We cannot complete or learn this training with a live baby. With this dummy, we can practice and learn. We can use it anytime. It's very helpful for those who are new or inexperienced."

Repetition of scenario-based simulations helped internalize clinical protocols, and enhanced team coordination during high-pressure situations. The LDHF (Low-Dose High-Frequency) model was seen as instrumental in sustaining skill retention. Participants preferred frequent, short practice sessions over single-event, intensive training.

Institutional Readiness & Implementation of NNL Training

Overall, most facilities demonstrated strong institutional commitment and readiness to implement the NNL training. Leadership engagement, particularly from neonatology departments, played a pivotal role in establishing training schedules, ensuring staff participation, and integrating training within regular clinical duties.

- **Several facilities** had structured implementation plans, with designated focal persons, rotational practice rosters, and regular supervision. The academic environment at one facility in Dhaka enabled smooth adaptation, while other facility ensured participation across cadres including gynecologists, obstetrics and pediatricians.

- **However, two out of the five facilities** faced challenges due to limited manpower and staff rotations. Frequent staff turnover in public facilities impeded consistency in training follow-up.

- **Some sites experienced barriers** such as unstable internet and limited access to Wi-Fi, which delayed training and impacted manikin functionality during sessions.

Despite some logistical setbacks (e.g., political unrest, internet issues), all facilities recognized the importance of integrating simulation-based training into clinical practice.

Implementation Challenges

There were a number of challenges that were documented during introduction of the NNL simulator in the health facilities. High patient load limited the time HCPs had for regular resuscitation practice sessions, particularly in the tertiary hospitals. Routine rotation of HCPs from one unit to the other within the hospitals was frequent and interrupted their ability to continue with their practice sessions. Consistent internet connectivity was a problem in some hospitals. Finally, HCPs shared their login information making it difficult to track individual performance as was the original intention upon introduction.

Conclusion and recommendation

The resuscitation skills practice with the NeoNatalie Live simulator is a promising approach to strengthen HCPs skills and performance in neonatal resuscitation in Bangladesh. The combination of realistic case scenarios and responses, low dose high frequency practice sessions, and immediate feedback led to demonstrable improvements in technical performance and reported confidence levels. This is a tool and approach that other health facilities, both public and private offering childbirth services, may consider to support staff to acquire or maintain newborn resuscitation skills. It should be noted that there is a need for consistent and reliable internet to ensure the operation of the feedback mechanism of the simulator. To get the maximum benefit from NNL simulators, health facility managers must facilitate opportunities staff to undertake regular practice, as well as reducing rotation of staff from the newborn and maternity units as feasible.

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