Care of the Mother-Infant Dyad: a Novel Approach to Neonatal Resuscitation Simulation Training in Bihar, India

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Background

- The percentage of under-5 mortality attributable to early neonatal mortality is increasing globally (31.9% in 2013)[1]
- 27% of early neonatal deaths are due to perinatal asphyxia[2]
- India has the highest absolute number of neonatal deaths in the world (790,000 in 2012)[2] and an early neonatal mortality rate (22.4 per 1000 live births) comparable to sub-Saharan Africa[1]
- Bihar has one of the highest neonatal mortality rates in India (32.2 per 1000 live births)[3]
- The odds of neonatal death in Bihar more than double (OR 2.17) with the presence of maternal intrapartum complications[3]
- In 2015 Bihar's community health centers had a total of 13 pediatricians and 16 OBGYNs[4]
- Traditional neonatal resuscitation (NR) simulation trainings such as the Neonatal Resuscitation Program and Helping Babies Breathe are focused solely on the infant, and thus are limited in their ability to replicate the reality of low-resource settings where few providers face competing demands for their attention
- PRONTO training is conducted in-situ and teaches trainees to simultaneously attend to maternal and neonatal emergencies

Aims

- To assess the impact of PRONTO simulation training on health worker competency in NR in Bihar, India in Round 1 of an ongoing implementation evaluation
- To capture the unique mission of the PRONTO training competence was evaluated in the context of increasing complexity of simulated scenarios requiring care of the infant only, the infant and mother sequentially, or the infant and mother simultaneously

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Methods

Study Population

- 658 nurse trainees from 80 primary health centers (PHC)

Nurse Mentor Training

- CARE India and the government of Bihar are implementing a quality improvement project, called AMANAT, with the goal of reducing both maternal and neonatal mortality
- Nurses from the AMANAT program were selected to serve as mentors in the implementation of the PRONTO training
- CARE India, the government of Bihar, and PRONTO International trained mentors in team building, teamwork and communication skills, debriefing, and simulation

PRONTO Simulation Training

- Nurse mentor pairs visited PHCs across Bihar an average of 7 times (for one week at a time) over a 9-month period
- Week 1: Team building
- Week 2: Normal spontaneous vaginal delivery (NSVD)
- Week 3: NR + post partum hemorrhage (PPH)
- Weeks 4-7: NSVD + NR + PPH
- Complexity of NR simulations are defined as follows
  - **Level 1**: requires resuscitation of a non-vigorous infant only
  - **Level 2**: requires management of a maternal complication followed by resuscitation of a non-vigorous infant
  - **Level 3**: requires simultaneous management of a maternal complication and resuscitation of a non-vigorous infant

Simulation Video Monitoring

- All simulations were videotaped to assist with debriefing
- Selected videos from weeks 3, 5, 7 of training period were coded using Studiocode software for predefined clinical skills
- Ethics approval was granted from the University of California San Francisco and the Indian Institute of Health Management Research

Results

***Table 1*: Percent Completion of Key Steps of Newborn Care and Neonatal Resuscitation Algorithm by Simulation Difficulty**

		Level 1	Level 2	Level 3	
Key NR Step	n[a]		%[b]		p-value
Baby moved to warmer	282	94.4	92.1	86.7	0.48[c]
Baby stimulated and dried	282	94.4	84.2	88.9	0.70[c]
Breathing assessed	298	5.9	10.5	8.4	1.00[c]
Breathing reported	298	5.9	10.5	8.8	0.75[c]
Heart rate assessed	298	79.4	78.9	69.0	0.22[d]
Heart rate reported	298	50.0	60.5	50.0	1.00[d]
PPV	298	94.1	89.5	90.3	0.75[c]

a- Total number of simulations with step required, including all levels of complexity
b- Percent of simulations in which step was completed
c- Fisher's exact test comparing Level 1 vs. Level 3
d- Pearson's chi-square test comparing Level 1 vs. Level 3

***Table 2*: Time to Completion of Key Steps of Newborn Care and Neonatal Resuscitation by Simulation Difficulty**

		Level 1	Level 3	
Key NR Step	n[a]	*Mean in seconds (95% CI)*		p-value
Time- delivery to warmer	225	71 (45-97)	54 (48-59)	0.27
Time- delivery to baby dried	225	39 (17-62)	20 (17-24)	0.12
Time- delivery to PPV	225	114 (82-146)	94 (87-100)	0.12

a- Total number of simulations with step required, including all levels of complexity
b- Mann Whitney-U Test comparing medians of Level 1 vs. Level 3

***Table 3*: Time to Completion of Key Steps of Newborn Care and Neonatal Resuscitation in Simulations with 1-2 Participants**

		Level 1	Level 3	
Key NR Step	n[a]	*Mean in seconds (95% CI)*		p-value
Time- delivery to warmer	108	67 (32-101)	55 (47-63)	0.97
Time- delivery to baby dried	108	37 (14-60)	24 (17-30)	0.17
Time- delivery to PPV	108	116 (77-156)	92 (84-99)	0.10

a- Total number of simulations with step required, including all levels of complexity
b- Mann Whitney-U Test comparing medians of Level 1 vs. Level 3

Conclusion

As the complexity of simulations increased from level 1, requiring care of the infant only, to level 3, requiring co-management of maternal and neonatal emergencies:

- There was no change in the percentage of simulations in which trainees completed key NR steps suggesting maintenance of skills despite increased clinical complexity
  - True even with only 1-2 participants in the simulation

- Trends indicated trainees performed key steps of NR with increased efficiency
  - Infant moved to warmer an average of 17 sec faster in level 3 simulations compared to level 1
  - Infant dried 19 sec faster
  - PPV initiated 20 sec faster
  - Similar trends with only 1-2 participants in the simulation

The PRONTO methodology focused on in-situ care of the mother-infant dyad has the potential to effectively train health workers in efficient use of evidence-based NR skills immediately relevant to the clinical reality of low-resource settings and offers a new approach to reducing early neonatal mortality.

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