Impact of Neonatal Resuscitation Capacity Building of Birth Attendants on Stillbirth Rate at Public Health Facilities in Uttar Pradesh, India

MANOJA KUMAR DAS[1], CHETNA CHAUDHARY[1], SANTOSH KUMAR KAUSHAL[2], RAJESH KHANNA[3] AND SUROJIT CHATTERJI[2]

From [1]The INCLEN Trust International, New Delhi; [2]Save the Children, Lucknow, Uttar Pradesh; and [3]Save the Children, Gurgaon, Haryana; India.
Correspondence to: Dr Manoja Kumar Das, Director Projects, The INCLEN Trust International, F1/5, Okhla Industrial Area, Phase 1, New Delhi 110 020, India. manoj@inclentrust.org.

Objective: To document the impact of neonatal resuscitation capacity building of birth attendants at district and sub-district level on fresh stillbirth within the public health system in India.

Design: An implementation research using pre-post study design.

Setting: 3 high-infant and neonatal mortality districts (Gonda, Aligarh and Raebareli) of Uttar Pradesh, India.

Participants: Pregnant women who delivered at the health facilities and their newborns.

Interventions: An intervention package with (*i*) training on essential newborn care resuscitation; (*ii*) skill laboratories establishment for peer-interactive learning; (*iii*) better documentation; and (*iv*) supportive supervision was implemented at all health facilities in the districts.

Main outcome measures: Impact on fresh stillbirth rates and resuscitation practices were documented at 42 health facilities (Gonda-17, Aligarh-8 and Raebareli-17) over 12-18 months.

Results: Out of the 3.3% (4431/133627) newborns requiring resuscitation, 58.5% (*n*=2599) were completely revived, 19% (*n*=842) had some features of hypoxic insult after birth and 1.4% (*n*=62) were stillbirths. There was 15.6% reduction in still birth rate in the three districts with the intervention package.

Conclusion: The reduction in still birth rate and improvement in newborn resuscitation efforts in the three districts indicated feasibility of implementation and scalability of the intervention package. However sustenance of the impact over longer period needs documentation.

Keywords: *Neonatal mortality, Perinatal mortality, Training.*

Globally about 2.6 million stillbirths occur annually apart from 2.7 million neonatal deaths [1]. The decline in the stillbirth rates has been slower than anticipated over last 2-3 decades [2]. About 10-15% of the newborns require resuscitation assistance at birth [3]. Emergency obstetric and newborn care (EmONC) coupled with neonatal resuscitation has been effective measure for reducing the fresh stillbirths, early neonatal deaths and birth asphyxias. In India, about 18-20% of newborn deaths are due to birth asphyxia [4]. Helping Babies Breathe (HBB) protocol has been used globally for training birth attendants [5]. The impact of HBB or similar program implementation in resource-poor settings has been limited. There have been variation in reports in terms of the settings used (facility- or community-level) and parameters used for documenting impact (perinatal death, early neonatal deaths, neonatal deaths, fresh stillbirths and infant deaths). An implementation project documented the impact of skill building of birth attendants at district and sub-district public health facilities in essential newborn care (ENC) and newborn resuscitation practices (NRP) practices and outcome including fresh stillbirths (FSBs). This article reports the impact of the intervention on fresh stillbirth rate (FSBR) at the health facilities in these districts.

METHODS

This implementation research was conducted in three districts of Uttar Pradesh: Gonda, Aligarh and Raebareli. The districts were chosen in consultation with state government considering the levels of infant and neonatal mortality rates. In these districts, 42 facilities (Gonda 17, Raebareli 17 and Aligarh 8) with at least 100 deliveries per month were selected for documentation of impact. The protocol was reviewed and approved by Institute Ethics Committee at The INCLEN Trust International. As the data involved record review and no direct

information collection from the subjects, no informed consent was required. Appropriate approval from the competent state and district health authorities was obtained.

The intervention package included: (*i*) training on ENC and NRP using three-day module; (*ii*) development of skill laboratories at four health facilities per district to enable peer-interactive learning; (*iii*) better monitoring and documentation of deliveries and peripartum events; and (*iv*) supportive supervision. The training package had more emphasis on skill building and hands-on practice, compared to the existing two-day package under government program. A cadre of master trainers at state level was created through intense, hands-on training workshop. These master trainers (four trainers for 24 participants per batch) trained the birth attendants from the facilities in batches at district level. The training sessions were monitored by external monitors to ensure quality and uniformity. The implementation was initiated in Gonda and Aligarh in July 2014 and in Raebareli in February 2015. The training of all staffs was completed during July-September 2014 in Gonda and Aligarh and during February-March 2015 in Raebareli. Additional trainings were conducted to address staff turnovers, as per need. The impact documentation was limited to the selected 42 facilities, although all the birth attendants in these districts were trained. Availability of resuscitation kits (bag and masks) were ensured at all the delivery points in the districts. Four skill laboratories were established in each district including the district hospital and three 24×7 first referral units. These skill laboratories situated near labour room or maternity ward were equipped with one radiant warmer, self-inflating resuscitation bags with three size masks, one mannequin (Laerdel Neonatalie), and other teaching and job-aids. These skill laboratories were managed by one maternity nurse with support from one doctor. The details about deliveries were documented by the nurses in the registers and case sheets indicating the mode of delivery, outcome (livebirth or stillbirth–fresh/macerated), resuscitation requirement for the newborn, outcome of resuscitation (complete recovery, features of hypoxia) and requirement of referral. The nurses and doctors from the facilities were trained for appropriate documentation. Non-breathing infants with gestation age weighing >1000 grams without any signs of life (fetal heart rate [FHR] or movement) or maceration and who were not successfully revived were classified as a FSB. The stillbirths were confirmed by the doctor on duty and categorized as antepartum or intrapartum based on the FHR documentation. The documentations in the registers were verified with case sheets (including

partograph) weekly by the dedicated monitors (separate for each district) not involved in service delivery. All early neonatal deaths in these facilities were checked to verify any misclassification. A monthly report was compiled for the key parameters during October 2014 to March 2016 for Gonda and Aligarh and during April 2015 to March 2016 for Raebareli using the delivery registers (post-intervention periods). Additionally, monitoring activities included direct supervision at periodic intervals focusing on the clinical practice adherence (through observation and record review), documentation, availability of equipment and maintenance, death audits, skill laboratory usage (through record review), team building activities, monthly review and feedback (during review meetings). The data for 18 months (April 2013 to September 2014) in Gonda and Aligarh and data for 12 months (April 2014- March 2015) in Raebareli prior to training were collected from the registers and case records, which represented the pre-intervention periods.

Statistical analysis: Double data entry was done using excel sheet followed by quality check to ensure correctness. The data entered was stored in a server with restricted access. Descriptive statistics were used to summarize the proportions and means. FSBR was estimated per 1000 deliveries. The pre-and-post sample means were compared using 2-sample t test. Data was analyzed using Stata version 15.0 (StataCorp LLC, Texas, USA).

We hypothesized that the intervention package would reduce the FSBs by at least 15%. The FSBR in pre-intervention period was 3.2% (2%-4%) of the total deliveries. To document a 15% reduction in FSBR from pre-intervention period with 80% power and 95% confidence level, the required sample size was 17397.

RESULTS

In three districts, a total of 779 birth attendants including 69 doctors, 281 nurses and 429 auxiliary nurse midwives (ANMs) at all level of facilities were trained. At the end of the observation period, 98% of the birth attendants and 93% of the doctors from trained pool were available at the 42 observation facilities. No other training or new activity on perinatal or newborn care was observed during the same period in these districts. The deliveries at the 42 health facilities between April 2013 and April 2016, were comparable.

The need for resuscitation varied from 2.8% to 3.6% of the 4431 newborns who required resuscitation at birth, 2599 (58.5%) newborns were completely successfully resuscitated. The resuscitation efforts were successful in

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WHAT IS ALREADY KNOWN?

• Training of birth attendants in essential newborn care and neonatal resuscitation may contribute to reducing stillbirths and early neonatal deaths.

WHAT THIS STUDY ADDS?

• A three-day essential newborn care and neonatal resuscitation skill-based training coupled with skill laboratories at facility level improved the resuscitation efforts at birth and reduced fresh stillbirths in India

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82%, 35.1% and 39.7% of newborns requiring resuscitation in the districts Gonda, Aligarh and Raebareli, respectively. Post resuscitation, referrals were needed in 17.2%, 61.8% and 59.1% of newborns in Gonda, Aligarh and Raebareli districts respectively. The impact on successful revival with resuscitation could not be assessed due to absence of reliable data for pre-intervention period.

Compared to the pre-intervention period, fresh still births reduced by 15.6% in post-intervention period (*P*<.001) (**Table I**). The overall risk reduction for FSB was 0.1 (RR 0.90; 95% CI 0.88-0.92) compared to pre-intervention period. The risk reduction for the individual districts ranged from 0.2 (RR 0.80; 95% CI 0.75-0.85) for Aligarh; 0.09 for Gonda (RR 0.91; 95% CI 0.88-0.94) and 0.06 (RR 0.94; 95% CI 0.90-0.98) for Raebareli.

DISCUSSION

This implementation project documented the impact of the intervention package (training on ENC and NRP;

skill laboratories; better documentation and supervision) on FSB and outcome of resuscitation in three districts of Uttar Pradesh, which is considered to have a weak public health system. The overall improvement in the identification of cases requiring resuscitation, successful resuscitation and the degree of reduction in FSB was promising. The variation across the districts probably indicated the level of implementation by the birth attendants and maturity. With time the resuscitation need rate in the districts improved, indicating evolving maturity. Lowest change in Raebareli may be explained by shorter period of implementation. The higher change in Aligarh district may be due to lower number of facilities under study and higher proportion of deliveries occurred at the district and sub-district hospitals, compared to other two districts. The impact in Gonda was comparable to the report from India [9]. Higher referral of newborns post-resuscitation in Aligarh and Raebareli districts could be due to the proximity to a tertiary care facility.

TABLE I IMPACT ON THE STILLBIRTH PRE-AND POST-INTERVENTION ACROSS THE DISTRICTS

District	Parameters	Pre-intervention period*	Post-intervention period@	Difference % (95% CI)	P value
Gonda	Deliveries, n	60192	58196	0.6% (0.38%, 0.81%)	<0.001
	Livebirths, n (%)	57839 (96.1)	56250 (96.7)		
	FSBs, n (%)	2353 (3.9)	1946 (3.3)		
Aligarh	Deliveries, n	37372	37627	0.7% (0.51%, 0.89%)	<0.001
	Livebirths, n (%)	36584 (97.9)	37091 (98.6)		
	FSBs, n (%)	788 (2.1)	536 (1.4)		
Raebareli	Deliveries, n	38346	37804	0.3% (0.05%, 0.54%)	0.016
	Livebirths, n (%)	37101 (96.8)	36707 (97.1)		
	FSBs, n (%)	1245 (3.2)	1097 (2.9)		
Pooled	Deliveries, n	135910	133627	0.5% (0.37, 0.62%)	<0.001
	Livebirths, n (%)	131524 (96.8)	130048 (97.3)		
	FSBs, n (%)	4386 (3.2)	3579 (2.7)		

Note: % of fresh stillbirths (FSBs) estimated using deliveries as denominator (including stillbirths).
*Pre-intervention period included 18 months (April 2013 to September 2014) for Gonda and Aligarh) and 12 months (April 2014- March 2015) for Raebareli; @Post-intervention period included 18 months (October 2014 to March 2016) for Gonda and Aligarh) and 12 months (April 2015- March 2016) for Raebareli.

A study in India (two sites in Karnataka and Maharashtra) and Kenya using the HBB newborn resuscitation intervention documented 16% reduction in stillbirth (pre-intervention and post-intervention 9 and 7.6 per 1000 births respectively) [6]. The changes were not consistent across the sites and birth weight categories. There were also reduction in perinatal deaths, first-day deaths and early neonatal deaths in these area [6]. Implementation of HBB in eight hospitals in Tanzania over 24 months resulted in decline of FSBs by 24%, from 19 to 14.5 per 1000 births (RR 0.76; 95% CI 0.64, 0.90; P = 0.001) [10]. There was also decline in neonatal deaths by 47% (RR 0.53; 95% CI 0.43, 0.65; P = 0.0001) over the same period [7]. An evaluation of Neonatal Resuscitation Program in Malaysia indicated minimal reduction in stillbirth rates, 4.3 to 4.1 per 1000 deliveries between 1996 and 2004 [8]. A NRP programme at 14 teaching tertiary care hospitals in India documented improvement in resuscitation practices and significant decline in asphyxia related deaths [9]. A metaanalysis concluded that neonatal resuscitation training in facility setting reduced intrapartum-related deaths by 30% (RR=0.70; 95% CI 0.59, 0.84) [10]. HBB training in a tertiary care hospital in Nepal resulted in reduction of stillbirth rate from 9 to 3.2 per 1000 deliveries [11].

Our project has several strengths including a district-wide implementation in three districts at different level of newborn and infant mortality rates. The district-wide implementation over one year with minimal external input simulated real-field scenario. The training system also simulated the real-field situation in these districts. Thus the results can be generalized to many Indian states and districts with reasonably high neonatal mortality. Non-availability of information on changes according to birthweights and early neonatal deaths are the limitations. Also the potential effect of change in birth attendant's number and competency on resuscitation effort, outcome and stillbirths could not be documented. The determinants of variability of impact on fresh stillbirths across the districts were not documented, which may be a limitation. The quality and rigor of documentation during pre-intervention period may be different compared to the observation period. This project documented the feasibility of implementation of the newborn resuscitation program at scale with good impact on the fresh stillbirths and possible newborn outcome.

In conclusion, rapid scaling up of the essential newborn care and neonatal resuscitation is critical for newborns survival and reducing fresh stillbirths. This successful experience of implementation within the existing public health system in three districts, rise in resuscitation attempts and positive impact on fresh stillbirths demonstrated feasible and successful scaling up of the intervention package. However additional documentation may be undertaken to document the degree of cost-benefit for the investments and long-term impact.

REFERENCES

1. Wang H, Liddell CA, Coates MM, Mooney MD, Levitz CE, Schumacher AE, *et al*. Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990-2013: A systematic analysis for the global Burden of Disease Study 2013. Lancet. 2014; 384:957-79.
2. Blencowe H, Cousens S, Jassir FB, Say L, Chou D, Mathers C, Hogan D, *et al*. National, regional, and worldwideestimates of stillbirth rates in 2015, with trends from 2000: A systematic analysis. Lancet Global Health. 2016;4:e98-108.
3. WHO, UNFPA, UNICEF, AMDD. Monitoring emergency obstetric care: A handbook. Geneva: WHO; 2009. *http://whqlibdoc.who.int/publications/2009/* 9789241547734 _eng.pdf? ua=1. Accessed on August 25, 2017.
4. Bassani DG, Kumar R, Morris SK, Jha P, *et al*, for the Million Death Study Collaborators. Causes of neonatal and child mortality in India: A nationally representative mortality survey. Lancet. 2010:376:1853-6.
5. Singhal N, Lockyer J, Fidler H, Keenan W, Little G, Bucher S, *et al*. Helping Babies Breathe: Global neonatal resuscitation program development and formative educational evaluation. Resuscitation. 2012;83:90-6.
6. Bellad RM, Bang A, Carlo WA, McClure EM, Meleth S, Goco N, *et al*. A pre-post study of a multi-country scaleup of resuscitation training of facility birth attendants: does Helping Babies Breathe training save lives? BMC Pregnancy and Childbirth. 2016; 16:222-31.
7. Msemo G, Massawe A, Mmbando D, Rusibamayila N, Manji K, Kidanto HL, *et al*. Newborn mortality and fresh stillbirth rates in Tanzania after helping babies breathe training. Pediatrics. 2013;131:e353-60.
8. Boo NY. Neonatal resuscitation programme in Malaysia:

an eight-year experience. Singapore Med J. 2009;50: 152-9.

9. Deorari AK, Paul VK, Singh M, Vidyasagar D. Impact of education and training on neonatal resuscitation practices in 14 teaching hospitals in India. Ann Trop Paediatr. 2001;21:29-33.

10. Lee AC, Cousens S, Wall SN, Niermeyer S, Darmstadt GL, Carlo WA, *et al*. Neonatal resuscitation and immediate

newborn assessment and stimulation for the prevention of neonatal deaths: A systematic review, meta-analysis and Delphi estimation of mortality effect. BMC Public Health. 2011;11:S12.

11. KC A, Wrammert J, Clark RB, Ewald U, Vitrakoti R, Chaudhary P, *et al*. Reducing perinatal mortality in Nepal using Helping Babies Breathe. Pediatrics. 2016;137; e20150117.