

Neonatal Birth Asphyxia: Results of Intervention in a Community Based Randomised Control Trial in Rural Zambia

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Received: July 17, 2018; Published: August 24, 2018

Abstract

Background: Newborn care continues to challenge the priorities in children's health care in the developing world. A pilot community based, continuum of mother-neonatal care was delivered by trained rural community health workers and traditional birth attendants. Three papers have been published on care of the mother and infant and prevention of mother to child transmission. This paper addresses the results for the care of birth asphyxia by community health agents.

Methods: A baseline knowledge attitude and practice survey (KAP) and Randomised Control Trial (RCT) were conducted sequentially, 2007 to 2013. The KAP provided baseline information. The RCT recruited 3846 pregnant women in Mpongwe and Chongwe, following them to postnatal care. Training was conducted for all community based agents in control and intervention sites. Intervention agents were equipped, supervised, and retrained every four months. Control sites provided MOH standard care. 2000 infants were delivered in the year of follow up.

Findings: Priorities for intervention were itemised. Community Based agents identified danger signs, and implemented specific care, particularly where they were equipped. They were able to improve morbidity, and save lives, of mothers and babies.

Interpretation: Trained, equipped and supervised Community health care agents are capable of providing specific care for birth asphyxia to improve morbidity and save life.

Keywords: Cluster Randomised Trial; Community Based Care for Newborn Babies; Birth Asphyxia Intervention Zambia

Background

History has taught us that we do not need expensive technologies to facilitate the reductions of either maternal or newborn deaths. The European nations during their industrial phases were burdened with high maternal mortality rates (MMR) and neonatal mortality rate (NMR), but managed to reduce these before the introduction of sophisticated and expensive technologies. This was achieved by improving hygiene practices. Some European countries reduced their NMR from hundreds, to less than ten within a century, with inexpensive technologies.

Neonatal mortality and morbidity are harsh realities that continue to be present in our communities, being highest in the poorest and most remote areas. In the face of evidence and the successes of community based newborn care in India, Nepal, South Africa, Malawi, and Zambia, it is inexcusable to continue with persistently high mortality rates in the region and globally. The successes of Community based newborn care (CBNBC) lies in the simplicity of using resources that are present and available; and community based agents that are trained and supported within the community. Inaccessibility to health centers and poor health seeking behaviors, contribute to the barriers to health care for the newborn. Birth asphyxia is an important cause of perinatal mortality in developing countries. The World Health Organisation estimates that 4 - 9 million newborns suffer from birth asphyxia annually. Of these 1.2 million die or are stillborn and a similar proportion suffer with complications [1-3]. In Nepal, Kathmandu 10.8 cases per 1000 total births were due to birth asphyxia at a hospital where there were 14,371 deliveries per annum [4].

In Nigeria up to 25% newborns suffer birth asphyxia and near to Zambia, in South Africa, rural areas record 26.4% cases of birth asphyxia. Industrialised nations on the other hand, record 0.1% newborns with asphyxia.

Birth asphyxia is the third major cause of death in newborns. Up to 75% of these deaths could be prevented if basic resuscitation is correctly conducted using simple inexpensive tools and techniques.

Aim of the Study

The aim of the study was to develop and implement a home based, primary continuum of neonatal care package which is delivered by community based agents from the antenatal period to within the first month of life, in the rural districts of Chongwe and Mpongwe.

Specifically

To determine if CBAs can recognise and manage birth asphyxia, in two rural communities of Zambia.

Methodology

A preliminary knowledge, attitude and practice survey indicated that birth asphyxia was a priority for intervention in the communities Chongwe and Mpongwe, Zambia. The subsequent randomized community based study, identified pregnant women and tracked them to delivery and 28 days of the newborn period. The intervention was delivered by trained rural community based health agents, equipped and supported in the intervention site and allowed to provide routine care in the control site. The paper discusses the outcome of Birth Asphyxia among the newborn births.

Study Sites

Chongwe and Mpongwe share similar health and demographic profiles. Chongwe is nearer urban activity, being 50 km outside the capital city, Lusaka. Population of Chongwe is 196, 999 of which 22% are women in the child bearing age, 15 - 49 years.

Mpongwe is 300 kilometres from Lusaka with a population of 93,258, but closer to Zambia's second city, Ndola. Based on the crude birth rate and sample size calculated for the preceding KAP baseline survey, an estimated sample size, of 3,000 and 4000 pregnant women aged 15 - 49 was made for the Randomized Control Trial.

The study was unblinded and CBAs were randomized to intervention or control groups

Sampling and inclusion criteria

The following were eligible for recruitment and follow up:

- All pregnant women aged 15 - 49 years identified by the community, within the NHC to provide antenatal, perinatal and post-natal information
- Newborn babies in the early neonatal (0 - 7 days) to late neonatal period (8 - 28 days).

	Chongwe District		Mpongwe District	
	Control	Intervention	Control	Intervention
NHC Sites	8	12	7	13
TBAs	2	9	5	7
CHWs	8	5	4	8

Table 1: Study sites: Distribution of NHCs and CBAs into Control and Intervention sites.
NHCs: Neighbourhood Health Committee within the District Health care system; CBAs: Community Based Agents

In this study the term Community Based Agent (CBA) was used to collectively address both the Community Health Workers (CHW) and Traditional Birth Attendants (TBA). CHWs are usually male and TBAs, usually female, are chosen by the community, and are trained by the health system to provide basic curative skills for a variety of ailments, as well as basic safe motherhood services.

Mapping, randomization and masking: The basic unit of randomization was the Neighbourhood Health Committee (NHC). Central Statistical Office has no maps of NHCs. The study team mapped these in each of the two districts, together with the district Environmental Health Technician (EHT). Each cluster comprised of a NHC within the community, serving 150 - 200 households or a population of 900 to 1200 persons.

NHCs were assigned to Health Centres to supervise them and 40 NHCs were selected for the study.

The epidemiologist in the study team listed all the Rural Health Centres (RHCs), in each district by name and placed the names in a closed box. Each district representative randomly selected a total of 5 RHCs.

A second list was made, with NHCs separated by a distance of 10 km between sites, to avoid cross contamination between control and intervention sites. Approximately 3 - 5 NHCs were allocated to each RHC.

Community based agents were equipped, supervised and retrained every four months. A methodological paper is available and describes in detail our approach. The control site agents were trained together with the intervention group, but were urged to practice routine Ministry of Health prescribed care, while intervention teams implemented the new activities.

All CBAs were supplied with questionnaires, stationery, bags and kits including raincoats and boots.

The Health Centre provided supportive supervision to the Neighborhood Health Committee, while the study team visited the districts on a monthly basis.

Data collection

Data was collected in the two sites using self-administered questionnaires and through focus group discussions in three sites per district. The questionnaire was developed on the basis of the study objectives, in this case Birth Asphyxia.

Focus group discussions (FGDs) were conducted with TBAs and other community based health agents both men and women in groups of 12 participants. These were conducted by trained moderators.

Questionnaires were checked by the district data manager for completeness and couriered to national level by the data manager or the forms were handed to the national team during monitoring visits to the district. The data were collated and entered by data entry clerks at national level onto EPI-info software. Data cleaning was also done at national level. Quality assurance was provided by a mathematician and statistician from the University of Zambia. Hard copies have been stored in a locked cupboard.

This trial is registered with the University of Zambia BioMedical Research and Ethics Committee, clearance number FWA00000338. Permission was obtained from all levels, national, district, community and individual participants.

Birth asphyxia: is defined as a failure to initiate and sustain breathing in the newborn at birth by The World Health Organization (2007). UNICEF, ESARO (2007) defined asphyxia as having any one of the following at birth:

- Weak cry
- No cry
- Gasping
- Weak breathing
- No breathing

The study definition of asphyxia: For community based care the accepted definition of birth asphyxia is an infant who at birth does not breathe or breaths weakly, cries or gasps for breath. Approximately 3% of all births in developing countries develop birth asphyxia and require resuscitation. In the absence of intervention, roughly one quarter of these newborns perish or develop other complications.

Training

Both intervention sites and control sites were trained on birth asphyxia identification, danger signs preluding to birth asphyxia, incentivized and supervised equally. The intervention group was equipped while the control group went to communities as per routine health system practice.

The community based agents received the following training:

- A seven day participatory training workshop.
- One month attachment at the RHCs for practical hands on training on basic clinical skills i.e. taking temperatures, weighing babies, counting respirations and health education (only for the intervention group).
- Five days refresher training every four months in both districts to maintain the knowledge and skills imparted during the initial training.
- At least two supervisory visits per month by district clinical and data officers.
- And monthly national supervisory visits during which difficulties and training materials were reviewed one on one or in group discussions.

Intervention expected of community based agents for birth asphyxia

- Drying and wrapping immediately
- Positioning infant to maximise breathing
- Stimulating breathing by touching
- Clearing the breathing passages with a mucus extractor
- Inducing/assisting breathing with an ambu bag and mask

Results

A total of 1996 neonates were born in the 40 Neighborhood Health Committees during the study period, out of which 1925 (96%) were studied (see composite flow chart).

A total of 114 (5.9%) birth asphyxia cases were reported from 1925 births during the study. The intervention sites reported 97 (85%) of the birth asphyxia, while only 17 (14.9%) cases of birth asphyxia were reported in the control sites.

Danger signs precluding birth asphyxia

Among the participants, 32 presented with ante partum and 39 with peri partum danger signs respectively, and delivered asphyxiated infants. Though individually, the intervention site identified and recorded over twice the number of participants with danger signs than the control site, during the ante and perinatal periods, the control site recorded significantly more danger signs ($p = 0.007$).

	Intervention	Control	P-Value
Women with Antenatal danger signs	22	10	
Women with Perinatal danger signs	33	6	
Total	55 (56.7%)	16 (94.1%)	0.007

Table 2: Total number of danger signs seen during ante and perinatal period.

In this study the danger signs that were frequently recognized and recorded in relation to birth asphyxia were bad obstetric history, teen pregnancies, prolonged labour and severe vaginal bleeding during delivery.

Accordingly some danger signs were categorized according to the table indicated below. Most mothers were aged 19 to 35 years in both control and intervention sites.

Miscarriages, still births, prolonged labour, first pregnancy and over five pregnancies were identified as important danger signs in both the intervention and control sites by the community health agents.

	Intervention	Control
Age		
Under 18	0 out of 19	1 out of 6
19 - 35	8 out of 68	2 out of 11
Over 36	0 out of 15	0 out of 2
History		
First Pregnancy	8	3
Prolonged labour	16	4
Over 5 pregnancies	8 out of 30	2 out of 2
Miscarriages	18	1
Still births	16	5
Antenatal Events		
Severe vaginal bleeding	1	-
Hypertension	2	3
Malaria	2	1
Under age	8	2
Over age	-	2
Over 5 pregnancies	8	2
Other	1	-
Total	22	10
Perinatal Events		
Pre term (< 28 weeks)	0 out of 96	0 out of 68
Prolonged labour	11	2
Severe vaginal bleeding	10	-
Retained placenta	8	-
Hypertension	1	1
Convulsions	1	2
Fever	1	-
Other	1	1
Total	33	6

Table 3: Detail of Danger signs found in the mother precluding birth asphyxia.

	Intervention	Control	P-Value
Difficulty/Fast Breathing	9 (32.1%)	-	0.93
Difficulty feeding	7 (25%)	5 (33%)	0.13
Death/Still birth (no breathing)	12 (42.9%)	10 (66%)	0.50

Table 4: Symptoms used to identify birth asphyxia.

A simple requirement of the CBAs made it easy for them to identify birth asphyxia. No significant difference was recorded between intervention and control sites.

Severity of symptoms of birth asphyxia

The intervention site reported 7.54% of the births to have moderate to severe asphyxia. The control site had reported 2.96%, significantly less than the intervention site, possibly due to under recognition and or under reporting (p-value = 0.0002).

Intervention			
	Mild/Moderate Morbidity	Severe Morbidity	Total Morbidity
At 30 Seconds {n=102}	63 (64%)	34 (35%)	97
At 5 Minuets {n=50}	31 (62%)	19 (38%)	50
Control			
At 30 Seconds {n=17}	5 (29%)	12 (70.5%)	17
At 5 Minuets {n=17}	6 (35.29%)	9 (64.71%)	15

Table 5: Severity of birth asphyxia soon after birth.

Overall, the intervention site observed milder cases of asphyxia. Severe cases of birth asphyxia were reported in the control sites. Among 17 cases of birth asphyxia in the control group, over 70% (n = 12) were severe asphyxia, i.e. did not cry immediately in the first 30 seconds after birth.

Improvement was noted after five minutes with 25% (n = 9), severe cases in the control group showing improvement. They transitioned to mild symptoms remaining with a weak cry, or produced a forceful normal cry.

At the intervention sites 35% (n = 34) reported severe birth asphyxia. Of these 44% improved to mild morbidity or were breathing normally and crying forcefully.

The intervention site reported 12.3% of the asphyxia cases resulting in mortality and 16.4% resulted in other complications with symptoms of fast breathing (n = 7), difficulty breathing (n = 2) and difficulty breastfeeding (n = 7).

In the control group 41.2% of the asphyxia cases resulted in deaths (p = 0.009), a significantly higher mortality than the intervention site.

Place of birth and attending CBA

For those born at home, birth asphyxia was found in 77.2% (n=88). Among them, 80.4% (n=78) were in the intervention site, and 58.8% (n=10) in the control group.

	Intervention		Control	
	No. Delivered	No. Dead	No. Delivered	No. Dead
Skilled TBA/CHW	44	1 (2.3%)	5	-
Unskilled TBA	34	5 (14.7%)	6	4 (66.7%)
Health Center Staff	19	6 (31.5%)	6	3 (50%)
Total	97	12	17	7

Table 6: Attendants during delivery.

There was higher survival in the babies delivered and assisted by skilled TBAs than any other group in both the intervention and control sites.

Respiratory care provided to newborn by community based agents

Over 80% (I = 86.1; C = 88.9) of the asphyxiated newborns were dried and wrapped immediately after birth, over 70% (I = 74.4%; C = 75%) were positioned to maximize breathing and touched to stimulate breathing (I = 73.3%; C = 50%). These activities were carried out in both intervention and control sites with no notable difference in the two sites ($p > 0.05$).

	Intervention	Control	P-value
Dried and wrapped immediately	86.1%	88.9%	0.323
Positioned to maximize breathing	74.4%	75%	0.779
Touched to stimulate breathing	73.3%	50%	0.699
Mucus extractor	31.7%	-	-
Ambu bag and Mask	47.7%	-	-

Table 7: Type of respiratory care provided by community based agents.

At the intervention site mucus extractors and ambu bags and mask were used on 25 and 36 neonates respectively. Pressure with bag and mask was applied at 40 Breaths per minute.

45.3% (n = 44) of the asphyxia cases were delivered and or attended to by CBAs that had received resuscitation training. No information was provided on resuscitation for four newborns except that they had improved breathing after five minutes and were alive. 79.5% the newborns tended by the intervention CBAs either received intervention with mucus extractor (4), ambu bag and mask (17) and both mucus extractor and ambu bag and mask (14). One death was reported in the neonates that had received care from a trained CBA.

31 newborns tended by CBAs received care with ambu bag and mask, 28 of these cases resuscitation on average needed 2 - 5 minutes to improve. Some continued with the longest going for 45 minutes.

	Number	Dead
No resuscitation tools used	5	0
Mucus Extractor Only	4	0
Both Mucus Extractor and bag and Mask	14	1
Bag and Mask Only	17	0

	Number	Dead
Less than 1 Minute	5	1
2 - 5 Minutes	14	0
11 - 20 Minutes	3	0
21 - 30 Minutes	4	0
Over 30 Minutes	2	0
Total	28	1

Table 8: Use of Ambu bag and mask to resuscitate asphyxiated newborns.

There were no adverse events reported from the CBAs providing these respiratory interventions. One death occurred in a newborn that received mucus extractor and bag and mask for less than one minute.

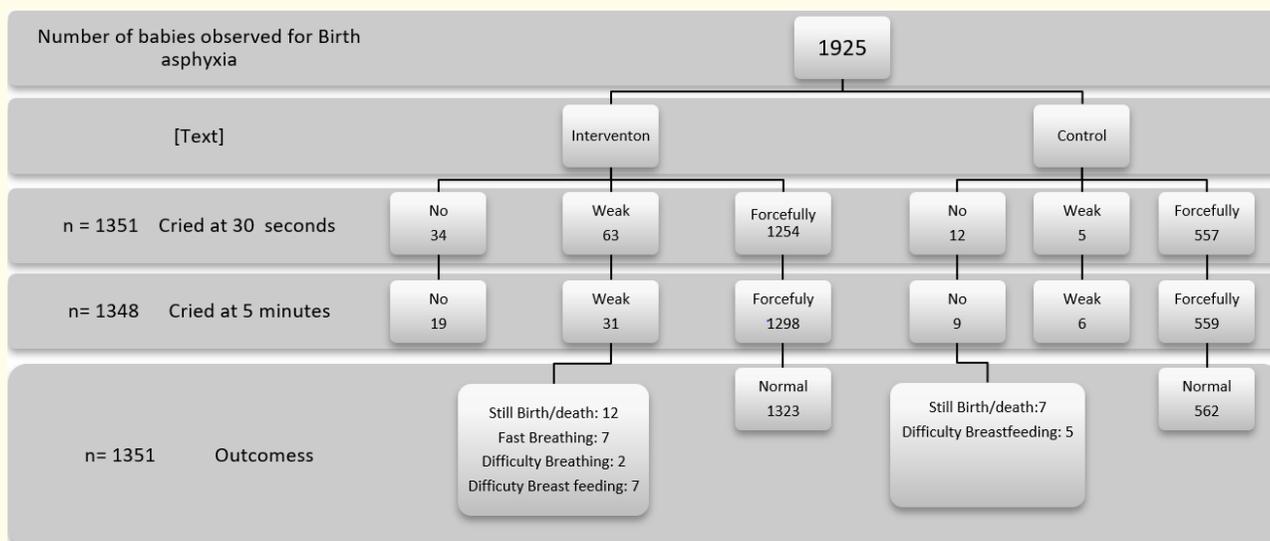


Figure 1: Flow diagram of progression of peri-natal asphyxia in intervention and control sites. n = 1351 in intervention site n = 574 in control site.

Discussion

Both the Knowledge Attitude and Practice study and the Randomised Control Study in the same communities of Mpongwe and Chongwe show that Birth Asphyxia is considered a priority intervention by the communities. In the KAP baseline study, 13% of the women interviewed, reported that their last child had not cried at birth. The intervention group identified 85% of cases of birth asphyxia and reported them against 14.9% in the control group. They were able to also recognize danger signs such as bad obstetric history, adolescence, first pregnancy or multiparous pregnancies and bleeding during pregnancy.

The objective of our study was met. Community based agents were able to accurately identify birth asphyxia using symptoms suggested in the training, and more importantly intervene effectively.

Besides the communities appreciating the importance of early intervention, WHO, UNICEF and others such as Helping Babies Breathe, have provided a great deal of literature for birth asphyxia [1,5-12].

The World Health Organisation (WHO), reports that 4 - 9 million newborns globally are affected by birth asphyxia, with one quarter dying or still born and another quarter showing complications such as cerebral palsy and epilepsy [1-3].

The Nepalese study in a Kathmandu hospital demonstrates the importance of birth asphyxia in perinatal and newborn morbidity and mortality. Our study further demonstrates how the bare foot community health provider when trained, equipped and supervised is able to identify danger signs and save life [4,13-15].

The South African Study shows that there is an inverse relationship between a decreased density of healthcare units and increased mortality in newborns. Intrapartum-related birth asphyxia in South Africa is typical of cases in other underdeveloped countries, with the most serious deficiencies in rural areas. Intrapartum-related birth asphyxia leading to perinatal mortality contributed 10.8%, to 26.4% [16]. Our study identifies with the lower limit cited.

These deaths are avoidable and their reduction presents an important challenge to providers of perinatal care in this region. Our study suggests prevention efforts should focus on danger signs in the mother, precluding the birth asphyxia.

Under reporting was a feature of the control group, who represent routine care practice in communities and health centres. The control group also experienced higher mortality. This means the intervention was making a difference to morbidity and mortality.

Although skilled attendants obtained better results than untrained attendants, we do not recommend home delivery. We observed higher levels of birth asphyxia in this group.

The identification of danger signs in the mother, precluding Birth Asphyxia was a notable achievement demonstrating that prevention is possible when immediate action is applied. The study therefore contributes this aspect to care in the community.

Community based agents were able to practice the requisite actions for birth asphyxia care. They dried, wrapped, positioned and stimulated breathing by touch, going through to use of mucous extractor, Ambu bag and mask in up to 47.7% of cases. Babies improved in 2 to 5 minutes and no adverse events were recorded with use of intervention tools. This is an example of “targeted prevention and personalised treatments, for asphyxiated newborns,” which should be given the extraordinary priority in paediatrics” [1,3,11,12,17]. CBAs participated in offering targeted prevention and personalised care to each woman and newborn they attended to.

Our study demonstrates a continuum of care, from mother to infant, identification of morbidity with danger signs, appropriate interventions for birth asphyxia prevention and treatment. We provide evidence that community based agents are capable of providing care, where there is no alternative healthcare provider available [18-28].

Conclusion

In rural communities, community based healthcare providers are able to intervene quickly to prevent and or treat life threatening birth asphyxia, in the community. They need to be trained, appropriately equipped, provided with incentives and supervised.

Study Limitations: The study should have been 18 months long, to allow all women identified to deliver their babies. We stopped recruitment at one year.

Acknowledgement

We acknowledge The Ministry of Health Zambia, UNICEF Zambia and ESARO offices for providing Funds, and the Chongwe and Mpongwe DHMT and communities, without whom we could not have done this work.

Funding

UNICEF Country Office Zambia and ESARO provided funds and equipment. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

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Citation: Mary Shilalukey Ngoma, *et al.* "Neonatal Birth Asphyxia: Results of Intervention in a Community Based Randomised Control Trial in Rural Zambia". *EC Paediatrics* 7.9 (2018): 851-861.

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Volume 7 Issue 9 September 2018

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