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Training Zambian traditional birth attendants to reduce neonatal mortality in the Lufwanyama Neonatal Survival Project (LUNESP)

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Abstract

Objective—To provide relevant details on how interventions in the Lufwanyama Neonatal Survival Project (LUNESP) were developed and how Zambian traditional birth attendants (TBAs) were trained to perform them.

Methods—The study tested 2 interventions: a simplified version of the American Academy of Pediatrics' neonatal resuscitation protocol (NRP); and antibiotics with facilitated referral (AFR).

Results—Key elements that enabled the positive study result were: focusing on common and correctable causes of mortality; selecting a study population with high unmet public health need; early community mobilization to build awareness and support; emphasizing simplicity in the intervention technology and algorithms; using a traditional training approach appropriate to students with low literacy rates; requiring TBAs to demonstrate their competence before completing each workshop; and minimizing attrition of skills by retraining and reassessing the TBAs regularly throughout the study.

Conclusion—An effective NRP training model was created that is suitable for community-based neonatal interventions, in research or programmatic settings, and by practitioners with limited obstetric skills and low rates of literacy.

Keywords

Birth asphyxia; LUNESP; Neonatal hypothermia; Neonatal resuscitation protocol; Neonatal sepsis; Traditional birth attendant

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Conflict of interest

The authors have no conflicts of interest.

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1. Introduction

Neonatal mortality accounts for approximately 40% of all childhood mortality in resource-poor countries [1]. Among the major causes of neonatal death, attention has focused on birth asphyxia, hypothermia, and sepsis [2]. Reducing deaths from these causes requires that interventions be readily accessible and, for asphyxia and hypothermia, available in the immediate perinatal period. For remote rural populations, deliveries are often conducted at homes by traditional birth attendants (TBAs) [3]. The Lufwanyama Neonatal Survival Project (LUNESP) tested the effectiveness of a community-based strategy for reducing neonatal mortality due to birth asphyxia, hypothermia, and neonatal sepsis [4]. The intervention had two components: neonatal resuscitation protocol (NRP), which aimed to reduce deaths due to birth asphyxia and neonatal hypothermia; and antibiotics with facilitated referral (AFR), which aimed to reduce deaths caused by neonatal sepsis.

Mortality by day 28 among infants delivered by intervention TBAs was reduced by approximately half [4]. The present companion methods article provides a detailed description of how the interventions were developed and the TBAs trained.

2. Materials and methods

Most of the TBAs had been unofficially delivering infants for years and were later nominated by Village Health Committees to undergo formal training. This generally consisted of attending a 2-week workshop, often sponsored by the Lufwanyama District Health Management Team (DHMT). Notably, 98% of the TBAs considered farming as their primary vocation. Their educational level was low: 17% had never attended school and only 13% had progressed beyond primary school. The TBAs were members of the communities they served, used clean delivery kits for every birth, and were registered, supported, and tracked by the Lufwanyama DHMT. On average, the intervention TBAs delivered 1.3 infants per month, or approximately 33 infants per TBA (interquartile range, 16–44; maximum 112) during the study, which was conducted between September 2006 and November 2008.

Extensive community mobilization activities were conducted: focus groups were held with pregnant women, their husbands, clinic staff, and TBAs; local village headmen and religious leaders were met to raise community awareness about LUNESP; and a variety of activities were sponsored to engage the community. Ethics oversight of LUNESP was provided by the Institutional Review Boards of Boston Medical Center, Boston, USA, and the Tropical Diseases Research Centre, Ndola, Zambia.

Box 1 summarizes the equipment carried by an intervention TBA. Training time was split between working on the intervention skills and mastering the reporting requirements (completion of log books, and delivery and referral forms). In adapting the NRP to local capacity, the intention was to minimize the number of assessments and decision points. Figure 1A summarizes the full NRP [5,6] and Figure 1B shows the simplified NRP of LUNESP. Conservatively, the full NRP algorithm includes 14 assessments (labeled A1–A14) and 5 discrete decision points (labeled D1–D5). By comparison, the simplified NRP of LUNESP includes only 4 assessments and 1 decision point: whether to start positive pressure ventilation (PPV). The full NRP is intended for a highly trained practitioner working at a health facility, with capacity for a wide range of interventions (e.g. chest compressions, intubation, epinephrine, and supplemental oxygen). By contrast, LUNESP focused exclusively on home deliveries conducted by TBAs, so the algorithm had to be adapted to that context and audience. Given the baseline capacity of the TBAs, it was feared

that a more complex and ambitious algorithm would result in confusion, indecision, and error.

Box 2 summarizes the steps of the simplified NRP. Steps 1–5 were performed in all cases and required less than 1 minute to complete. Steps 6–7 were performed only as needed. The TBAs were trained that a stillborn was a fetus delivered after 6 months of gestation lacking movement, spontaneous breathing, or heartbeat at any point during or after delivery.

The simplified NRP introduced several changes to the existing standard of care. First, neonates in Zambia are traditionally swaddled in a thin cotton wrap called a *chitenge*. *Chitenges* are poorly absorbent and are often the only cloth available at home deliveries, meaning that the neonate is left wrapped in the same wet fabric used for drying. Studies have shown that a neonate exposed to 23 °C loses heat at the same rate as a naked adult at 0 °C [7]. In L UNESP, 2 flannel receiving blankets were used, each measuring approximately 2 × 2 feet and made from locally purchased fabric. The blankets were laid one on top of the other, and the neonate was placed on the top blanket and thoroughly rubbed dry. This first, now wet, blanket was set aside and the infant wrapped in the second, dry blanket. Second, a rubber bulb syringe was included to routinely clear the upper airways. Third, the Laerdal (Laerdal Medical, Wappingers Falls, NY, USA) pocket resuscitator mask, which uses a tube/mask design, was included (Figure 2A). To provide PPV, the rescuer leans over the infant to blow directly into the tube—a procedure that can be quite tiring compared with that associated with a bag/mask design [8]. However, bag/mask resuscitators are typically more expensive than pocket resuscitators, which list for approximately US \$15 [9]. Additionally, the pocket resuscitator is easy to clean and has only a single breakable moving part (a 1-way flap valve within the breathing tube). Fourth, by requiring the rescuer to be inches away from the infant, the TBA can easily see the chest wall rise, gaining important feedback of successful ventilation (Figure 2B).

The following observations served as motivation for designing the AFR intervention: transit times to health centers were frequently very long; and neonatal sepsis can be rapidly fatal unless treated.

To minimize time to first dose of antibiotics, this capacity was localized in the community. As with the NRP, the guiding principles were that the algorithm should be simple and the threshold for AFR should be low. Accordingly, only a single decision point was included: does the infant meet any of the specified danger criteria (Figure 3B)? If yes, the TBA was to administer a single 500-mg megadose of oral amoxicillin and immediately facilitate referral to the nearest health center: “first dose and go.” In this way, we erred on the side of over-treating and over-referring, prioritizing sensitivity over specificity. The criteria were based on the WHO Young Infants Study and the Young Infants Clinical Signs Study [10,11]. To enhance the sensitivity of the algorithm further, an additional criterion was included: the TBA could initiate AFR if the mother simply “thought her infant looked sick.”

The TBAs were trained to make an amoxicillin slurry using chlorinated water (or expressed breast milk) and to administer it using an oral syringe. Amoxicillin was selected based on local preferences, its spectrum of activity, its stability, and its safety. Fluoroquinolones, sulfonamides, and injectable gentamicin were considered but rejected.

Intervention TBAs attended a 5-day initiation workshop in June 2006. Thereafter, 2-day refresher trainings for groups of 30 TBAs were convened every 3–4 months for the duration of the study. Box 3 summarizes the requirements for a typical LUNESP training workshop.

The initial and subsequent trainings were performed by a neonatologist from the LUNESP study team (N.G.G.) and a Zambian nurse–midwife, who was herself trained by the

neonatologist to become the “master trainer,” with increasing responsibility and ownership over the trainings as the trial progressed. The TBAs started each training day with a prayer and greeting ceremony accompanied by traditional songs and dances. Because many of the TBAs had difficulty reading or writing, most of the training was carried out orally. The training was highly interactive, relying heavily on demonstrations of key skills, and followed local traditional teaching methods. Working with the full group, the Zambian master trainer used a call-and-response approach. She asked a question and the TBAs offered an answer in unison. This continued for several hours, with frequent repetition and permutations. Periodically, individual TBAs were asked to stand and explain to the group what they understood about a given concept. Throughout, TBAs were identified who appeared particularly influential and who had mastered all skills; they were invited to serve as peer educators. The full group work continued until the master trainer was satisfied that the group fully understood all required concepts.

Refresher trainings also included a peer education activity: each TBA stood in turn and shared with the full group their recent experiences, in addition to providing a summary of deliveries, deaths, resuscitations conducted, antibiotics given, and any interesting or particularly challenging experiences that they had encountered. By so doing, key procedures were reinforced, the master trainer could provide corrective feedback, and community was fostered within the group.

Subsequently, TBAs were divided into groups of 5 or 6 to practice their skills using infant mannequins, bulb syringes, blankets, and masks. One or more members of the LUNESP study team supervised each group. Each TBA had to perform all of the steps in the NRP perfectly before the full group could be passed.

Once all groups had performed satisfactorily, the final step was a 1-on-1 skills assessment with the master trainer or the Boston-based neonatologist, during which the TBA performed a complete simulated NRP according to a scenario presented by the assessor. Any TBA who was deficient received additional training and support; the training continued until all TBAs could pass the skills assessments.

A similar training approach was used for the AFR intervention. The TBAs had to explain each of the trigger conditions on the reference card (Figure 3B), prepare the amoxicillin slurry, and simulate administering the mixture to an infant mannequin. Finally, they had to role-play counseling a reluctant mother to take her infant to a health center.

3. Results

The LUNESP study showed that trained TBAs can be highly effective at reducing neonatal mortality in remote rural settings. Given how successful this strategy proved to be, it seems puzzling that TBAs are so rarely included in national health programs. Notably, in 2004, the WHO—which had earlier embraced TBAs—removed them from the category of “skilled birth attendants” [3]. Many African nations subsequently responded by eliminating TBA training programs or enacting policies prohibiting TBAs from performing home deliveries. It should be noted that LUNESP was approved at the local and national levels as a research study with the expectation that it could be useful for informing policy. One likely explanation for this shift in attitude is that training TBAs to perform home deliveries appears to conflict with the goal of encouraging mothers to deliver at health facilities. However, this position overlooks a sad reality: TBAs exist because they fill an unmet public health need. In Lufwanyama, women frequently walk for hours to reach the nearest health center, and expecting that women could do this while in active labor is unrealistic. For many women, the choice is to deliver with a trained TBA, to deliver with an untrained birth attendant, or to deliver alone. Because eliminating training programs for TBAs does nothing to improve

access to health facilities, such policies may serve only to force mothers into the hands of unskilled attendants.

It is also true that previous research has generally failed to demonstrate a beneficial impact on maternal mortality from training TBAs [12-14]. However, this result seems confounded by the limited range of interventions that TBAs were asked to provide (e.g. to encourage breastfeeding and health-seeking behaviors, to provide prenatal care, or to serve as family-planning counselors) [12]. By contrast, in Bangladesh, training community-based nurse-midwives to manage common obstetric complications yielded impressive reductions in maternal mortality [15]. As shown in LUNESP, by asking a different question, one can get a very different answer.

Given how effective TBAs proved to be at reducing neonatal mortality, could they serve a more direct role in reducing maternal mortality? For example, oral misoprostol is highly effective at controlling postpartum hemorrhage [16]; TBAs could be trained to provide this medication as part of routine care, reducing maternal morbidity and buying precious time in which to transfer critically ill mothers to higher levels of care [17]. Similarly, TBAs could be trained to manage puerperal sepsis, either as a “first dose and go” strategy or administering a full therapeutic course in the community. Lastly, Jokhio et al. [18] observed a trend toward improved maternal outcome when TBAs were trained in a package of perinatal and postnatal interventions, including the use of clean delivery kits.

To promote this paradigm, common concerns about TBAs must be reconsidered. First, although TBAs are often poorly educated, one cannot assume that they are unintelligent and incapable of learning. To de-emphasize the “traditional” nature of TBAs, the solution to having them deliver unproven or unorthodox interventions should be to educate them about which practices are effective and why some traditional practices, such as rubbing cow dung into the umbilical stump, could be harmful [19].

Second, TBAs should be “mainstreamed.” In other words, they should be embraced within the larger corps of community health workers. They should be registered; receive standardized training; be supported with supplies, refresher training, and supervision; and, in return, consent to have their activities tracked.

Third, as with other cadres of community health workers, TBAs should be compensated for their work. Whether this would be in the form of a fixed government salary or, as in the case of LUNESP, by fees negotiated between TBAs and their patients, incentives are essential for maintaining quality and motivation.

Fourth, the apparent conflict between community-based interventions that primarily benefit infants should be reconciled from facilities-based interventions that benefit mothers. In LUNESP, only 2 maternal deaths occurred in approximately 3500 deliveries (approximately 57 per 100 000 births). Because this ratio is far lower than expected (Zambia averages between 591 and 729 deaths per 100 000 deliveries) [20], it is likely that the TBAs had referred high-risk mothers and those with complications to health centers. This is a crucial observation, given that neonatal mortality rates exceed maternal mortality rates by approximately 10-fold: by empowering TBAs to save infants in the community, no evidence was observed that mothers were put at greater risk. In LUNESP, the goal was not to dissuade women from delivering at facilities. Rather, we were guided by the reality that some deliveries will inevitably occur at the community level; for these women and their infants, having a skilled attendant is far better than having an unskilled attendant or no attendant at all. Conversely, marginalizing TBAs ignores the pivotal services they provide in rural communities and wastes a potentially valuable resource.

4. Conclusion

In summary, program-relevant information about the design and implementation of a successful community-based intervention to reduce neonatal mortality has been provided. The key elements that facilitated this result were: focusing on common and correctible causes of mortality; selecting a study population with a high unmet public health need; early community mobilization to build awareness and support; emphasizing simplicity in the intervention technology and algorithms; using a traditional training approach appropriate to students with low literacy rates; requiring TBAs to demonstrate their competence before completing each workshop; and minimizing attrition of skills by retraining and reassessing the TBAs regularly throughout the study. The skills and approaches adopted in LUNESP should be highly generalizable to other remote populations with limited access to health facilities.

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Box 1**Equipment carried by a LUNESP TBA****Standard equipment**

One clean delivery kit (1 kit per delivery)

- 1 plastic delivery sheet
- 1 cord cutter
- 4 cotton ties
- 1 pair of latex gloves
- 1 bar of soap
- 1 candle (for night deliveries)
- 1 box of matches

Equipment related to NRP intervention

One laminated pictorial reference card depicting the NRP and AFR interventions

One Laerdal pocket infant resuscitator mask

Two flannel towels (2 per delivery)

One bulb syringe (1 per delivery)

Equipment related to AFR intervention

One polypropylene bottle for chlorinated water (diluent for amoxicillin slurry)

One plastic mixing cup

One plastic mixing spoon

Two 250-mg amoxicillin tablets

One 3-mL oral syringe

Abbreviations:

AFR, antibiotics with facilitated referral

NRP, neonatal resuscitation protocol

Box 2**Steps in the LUNESP simplified neonatal resuscitation protocol algorithm**

1. Dry infant.
2. Wrap infant in fresh blanket.
3. Suction infant's nose and mouth with rubber bulb syringe.
4. Optimally position infant's head for breathing.
5. Assess infants' breathing.
6. (Where indicated) provide gentle stimulation by rubbing infant's back or feet (never slapping infant).
7. (Where indicated) provide PPV using a Laerdal pocket infant resuscitator mask.

Box 3**Elements of a LUNESP training workshop****Prior to workshop**

- Mobilization activities (notifying TBAs of time and location of workshop) – typically at least 1 week in advance
- Training venue rental

During workshop**Logistics**

- Accommodations (staff and TBAs)
- Food for meals (breakfast, lunch, dinner for 2–3 days)
- Tea and snacks (twice a day for 2–3 days)
- Photocopies of training materials
- Flipchart paper/markers
- Driver's allowance to convey study team members to training site
- Projector (therefore, electricity needed at site) – not used for most workshops

Trainers

- Master trainer
- 3–4 assistant trainers (Zambian and Boston-based study members, others). At least 5 would be used at any given workshop.

Supplies *

- Baby blankets
- Clean delivery kits
- Bulb syringes
- Water bottles and chlorine tablets
- Medicine spoons/syringes
- Mixing cups
- Amoxicillin tablets
- Laminated reference cards
- Resuscitation baby mannequins
- Pediatric pocket masks
- Bag/case for pocket masks

End of workshop

- Transportation refunds for TBAs

*After the first workshop, the TBAs used the materials provided by the project for these trainings, with the obvious exception of the infant mannequins.

Figure 1.

Comparison of full neonatal resuscitation protocol (NRP) and LUNESP simplified NRP. (A) Full NRP, with annotations, per the American Academy of Pediatrics/American Heart Association algorithm. (B) LUNESP simplified NRP, with annotations. Annotations starting with “A” refer to assessments; annotations starting with “D” refer to decision points.

Figure 2.

The Laerdal pocket infant resuscitator mask. (A) The mask is constructed from soft silicone rubber and is sized for an infant. It uses a tube/mask design. The offset breathing tube includes a 1-way flap valve to prevent aspiration of secretions by the rescuer. (B) A LUNESP traditional birth attendant demonstrating the use of the mask on an infant mannequin. The attendant provides rescue breaths positioned from in front of the infant's head. This enables the rescuer to observe chest wall rise as visual feedback that ventilation is being achieved (photo by Anna Knapp).

Figure 3. Front and back of laminated reference cards used by LUNESP traditional birth attendants. Instructions are written in Lamba. Cards measured approximately 4 × 5 inches. (A) Pictorial and written instructions for the steps of the LUNESP simplified neonatal resuscitation protocol. (B) Pictorial and written descriptions (in Lamba) of the signs/symptoms of possible sepsis, which served as the trigger conditions for initiating the antibiotics with facilitated referral intervention. Red text annotations in square brackets were not present on the actual cards, but are provided here to explain what each picture represented.