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SPECIAL ARTICLE

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

Christopher J. Gill [a,b,*], Nicholas G. Guerina [c], Charity Mulenga [d], Anna B. Knapp [a], Grace Mazala [e], Davidson H. Hamer [a,b,f]

[a] Center for Global Health and Development, Boston, USA
[b] Department of International Health, Boston University School of Public Health, Boston, USA
[c] Department of Pediatrics, Women and Infants Hospital, Providence, USA
[d] Lufwanyama District Health Management Team, Kalulushi, Zambia
[e] Zambian Anglican Council, Lusaka, Zambia
[f] Department of Medicine, Section of Infectious Diseases, Boston University Medical Center, Boston, USA

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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 correctible 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.
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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)

* Corresponding author at: Department of International Health, Boston University School of Public Health, 801 Massachusetts Avenue, Boston, MA 02118, USA. Tel.: +1 617 638 6504; fax: +1 617 414 1261.
E-mail address: cgill@bu.edu (C.J. Gill).

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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. Fig. 1A summarizes the full NRP [5,6] and Fig. 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.

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

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 LUNESP, 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 (Fig. 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 (Fig. 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 (Fig. 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