



Simulation and education

A one-day “Helping Babies Breathe” course improves simulated performance but not clinical management of neonates[☆]H.L. Ersdal^{a,b,*}, C. Vossius^{b,c}, E. Bayo^a, E. Mduma^a, J. Perlman^d, A. Lippert^e, E. Søreide^{b,f}^a Research Institute, Haydom Lutheran Hospital, Tanzania^b SAFER (Stavanger Acute medicine Foundation of Education and Research), Stavanger University Hospital, Norway^c Stavanger Teaching Nursing Home, Stavanger, Norway^d Department of Pediatrics, Weill Cornell Medical College, New York, USA^e Danish Institute for Medical Simulation (DIMS), Herlev Hospital, Denmark^f Department of Anaesthesiology and Intensive Care, Stavanger University Hospital, Norway

ARTICLE INFO

Article history:

Received 4 December 2012

Received in revised form 27 March 2013

Accepted 7 April 2013

Keywords:

Simulation

Helping Babies Breathe

Kirkpatrick model

Neonatal mortality

Neonatal resuscitation

ABSTRACT

Objective: “Helping Babies Breathe” (HBB) is a simulation-based one-day course developed to help reduce neonatal mortality globally. The study objectives were to (1) determine the effect on practical skills and management strategies among providers using simulations seven months after HBB training, and (2) describe neonatal management in the delivery room during the corresponding time period before/after a one-day HBB training in a rural Tanzanian hospital.

Methods: The one-day HBB training was conducted by Tanzanian master instructors in April 2010. Two simulation scenarios; “routine care” and “neonatal resuscitation” were performed by 39 providers before (September 2009) and 27 providers after (November 2010) the HBB training. Two independent raters scored the videotaped scenarios. Overall “pass/fail” performance and different skills were assessed. During the study time period (September 2009–November 2010) no HBB re-trainings were conducted, no local ownership was established, and no HBB action plans were implemented in the labor ward to facilitate transfer and sustainability of performance in the delivery room at birth. Observational data on neonatal management before ($n = 2745$) and after ($n = 3116$) the HBB training was collected in the delivery room by observing all births at the hospital during the same time period.

Results: The proportion of providers who “passed” the simulated “routine care” and “neonatal resuscitation” scenarios increased after HBB training; from 41 to 74% ($p = 0.016$) and from 18 to 74% ($p \leq 0.0001$) respectively. However, the number of babies being suctioned and/or ventilated at birth did not change, and the use of stimulation in the delivery room decreased after HBB training.

Conclusion: Birth attendants in a rural hospital in Tanzania performed significantly better in simulated neonatal care and resuscitation seven months after one day of HBB training. This improvement did not transfer into clinical practice.

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1. Introduction

Neonatal mortality is defined as death before one month of age and recent global estimates range from 2.9 to 3.6 million deaths per year.^{1–4} Of these, 50–70 percent may occur within the first day of life.^{1,5–8} Almost 99% of all deaths take place in resource-poor settings.^{1,9–12} A major factor contributing to the high mortality is

a global lack of trained providers in neonatal stabilization and/or resuscitation which is most acute in Sub-Saharan Africa with the highest neonatal mortality.¹³ “Helping Babies Breathe” (HBB) is an evidence-based curriculum in basic neonatal care and resuscitation, utilizing simulation-based training to educate large numbers of birth attendants in low-resource countries.¹⁴ HBB was developed by the Global Implementation Task Force of the American Academy of Pediatrics, and a formative evaluation of the course has been conducted in Pakistan and Kenya.¹⁵ This evaluation indicates high satisfaction and self-efficacy rating among participants and significantly improved theoretical knowledge after the course, assessed by multiple choice questions. By contrast, post-training mastery of a practical task, i.e. face mask ventilation, as assessed by an objective structured clinical evaluation, did not increase.¹⁵

[☆] A Spanish translated version of the abstract of this article appears as Appendix in the final online version at <http://dx.doi.org/10.1016/j.resuscitation.2013.04.005>.

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The effect of HBB training on management strategies of different simulated scenarios has not been evaluated.

Simulation-based training engages health care workers (HCW) to synthesize and apply knowledge and tasks according to a scenario, thereby combining theoretical, cognitive, technical, and behavioral skills in a dynamic situation.^{16,17} Simulation-based training is a growing method of teaching, learning, and performance evaluation in high-income countries, and several studies demonstrate sustained improvement in management of simulated medical emergencies after this type of education.^{18–21} However, very little is known about the transfer of skills into clinical practice. Further, HCW in low-resource countries, with different socio-cultural background, may not be familiar with simulation-based training, or the training might not be adjusted to the providers' needs and retentiveness. Therefore, performance evaluation of providers in such settings is necessary.

The objectives of this study were to (1) determine the effect on practical skills and management strategies among providers using simulations seven months after HBB training, and (2) describe neonatal management in the delivery room during the corresponding time period before/after the one-day HBB training in a rural Tanzanian hospital. The Kirkpatrick model of evaluation was used to assess the impact of simulation-based training.²¹

2. Methods

2.1. Implementation of HBB

National implementation of HBB in Tanzania began in 2009 and has been led by the Ministry of Health and Social Welfare (MOHSW). Haydom Lutheran Hospital (HLH) in Northern Tanzania is one of eight sites in a multicenter study to evaluate implementation and impact of the program. HLH is a rural referral hospital with an immediate catchment area including about 500,000 people. The greater reference area covers about 2 million people. The hospital provides comprehensive emergency obstetric, and basic emergency newborn care. Midwives largely conduct deliveries and newborn resuscitation if indicated. Occasionally, anesthetic nurses, operating nurses, student nurses, and ward attendants with no formal education have to manage deliveries and non-breathing newborns due to lack of midwives. The equipment is basic, containing two towels, clamps or strings to tie the cord before cutting, scissors, a mechanical suction device, and a neonatal resuscitator. After birth, infants requiring more than routine care are triaged to an adjacent neonatal area. This is a 10-m² room with one long bench, with the capability of providing oxygen, intravenous fluids, and antibiotics. The neonates are intermittently cared for by family members and the labor staff.

The first HBB training at HLH was conducted by Tanzanian Master Instructors in April 2010. The course methodology focuses on hands-on practice using a simulator mannequin, emphasizing the very first basic steps; drying, stimulation, suction, warmth, and initiation of face mask ventilation within the "Golden Minute[®]" after birth. The teaching tools are developed for efficient dissemination, and the educational kit contents a set of flip-over illustrations, an action plan, a neonatal simulator (NeoNatalie, Laerdal Medical), a student handbook, a manual resuscitator (Laerdal Medical), and a suction device (Penguin, Laerdal Medical). The materials and equipment were left behind to facilitate re-training and dissemination.

2.2. Data collection

A time line of the data collection and the HBB training is provided in [Box 2](#) and is as well outlined next. In August 2009, closely linked to the national HBB program, a descriptive observational

open cohort study was initiated in the delivery room at HLH.^{22,23} Sixteen research assistants/observers were trained to observe the birth attendants' performances related to delivery and newborns by measuring time intervals to important key events using a stop watch, and to record the findings on a data collection form following every delivery. The observers work in three shifts over 24 h. Three observers cover each shift; two are always located in the labor ward or in the theater; one in the adjacent neonatal area.

In September 2009, 39 providers from the Maternity Ward (approximately 70% of the entire staff) were invited to perform two simulation scenarios using the HBB equipment. Participants were recruited among available birth attendants and represented five professional categories: midwives, anesthetic, operating, or student nurses, and ward attendants (assistants without any formal medical education). The study was conducted in a separate room where confidentiality was assured. The purpose of the study and the working mode of the mannequin were explained to each participant and written informed consent was obtained before start. Demographic data (gender, age, profession, frequency of attended deliveries, newborn care and resuscitations, and newborn resuscitation trainings) was noted. The participants were asked whether they felt confident caring for and resuscitating a newborn, ranging from "Not confident at all" to "Not very confident", "Confident", "Very confident", and "Always confident". Finally, they were asked to name eight key points of preparing for a delivery, caring for a healthy newborn, and for a newborn not breathing spontaneously. Two simulation scenarios were performed and videotaped; "Routine Care" and "Neonatal Resuscitation".

In November 2010, seven months after the HBB training, the goal was to re-test the same 39 individuals. However, due to high employee turnover, working schedules, and time constraint in the field, only 13 (33%) participants were available for re-testing. Therefore, all accessible birth attendants who had completed HBB training at HLH in April 2010 were traced and an additional 14 participants were recruited to be evaluated, even if they had not been tested before. In total, 27 providers were interviewed and videotaped post HBB, and repeated the same simulated scenarios.

Altogether, there were 66 videos of "routine care" and 66 videos of "neonatal resuscitation". One research assistant (EB) operated all the scenarios and functioned as an interpreter during both pre and post HBB testing. HLE and CV conducted the interviews and introduced the provider to simulation and the scenario before and after HBB, respectively.

2.3. Video assessments of provider performance and inter-rater agreement

The videos were assessed separately by two independent raters with a vast experience in simulation-based education. The raters did not know whether the video performance was pre or post HBB training. Prior to the individual evaluation of the videos, a common observation of two dummy videos for each scenario and agreement about scoring criteria was conducted. Key points of care were scored as "right", "wrong", or "unsure" (e.g. insufficient video quality) by each rater. In the "Neonatal Resuscitation" scenario, time to first ventilation attempt was recorded. In order to assess the overall performance of the participant, summarizing scores were given. A score between 1 and 3 (Very good, Good, Adequate) is indicative of "a performance that would enhance survival of the infant", i.e. equal to a "pass", while a score of 4 or 5 (Inadequate, Incorrect) is indicative of "a performance that places the infant at risk of adverse outcome including death", i.e. equal to "fail". Inter-rater agreement in "pass/fail" was 100% for both scenarios. Overall agreement in the "Routine Care" scenario was 71% with Cohen's kappa 0.64, while the agreement was 86% and Cohen's kappa 0.83 in the "Neona-

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