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Simulation and education

Helping Babies Breathe: Global neonatal resuscitation program development and formative educational evaluation☆

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ABSTRACT

Objectives: To develop an educational program designed to train health care providers in resource limited settings to carry out neonatal resuscitation. We analyzed facilitator and learner perceptions about the course, examined skill performance, and assessed the quality of instruments used for learner evaluation as part of the formative evaluation of the educational program Helping Babies Breathe.
Methods: Multiple stakeholders and a Delphi panel contributed to program development. Training of facilitators and learners occurred in global field test sites. Course evaluations and focus groups provided data on facilitator and learner perceptions. Knowledge and skill assessments included pre/post scores from multiple choice questions (MCQ) and post-training assessment of bag and mask skills, as well as 2 objective structured clinical evaluations (OSCE).
Results: Two sites (Kenya and Pakistan) trained 31 facilitators and 102 learners. Participants expressed high satisfaction with the program and high self-efficacy with respect to neonatal resuscitation. Assessment of participant knowledge and skills pre/post-program demonstrated significant gains; however, the majority of participants could not demonstrate mastery of bag and mask ventilation on the post-training assessment without additional practice.
Conclusions: Participants in a program for neonatal resuscitation in resource-limited settings demonstrated high satisfaction, high self-efficacy and gains in knowledge and skills. Mastery of ventilation skills and integration of skills into case management may not be achievable in the classroom setting without additional practice, continued learning, and active mentoring in the workplace. These findings were used to revise program structure, materials and assessment tools.

1. Background

Of the 7.7 million deaths of children under age 5 years worldwide, 3.1 million are neonatal deaths.[1] Intrapartum-related hypoxic events ("asphyxia") result in an estimated 814,000 neonatal deaths[2] and 1.02 million stillbirths annually.[3] More than 98% of these deaths occur in low- and middle-income countries. If targets for Millennium Development Goal 4 (reducing under-5 child deaths by 2/3 from 1990 levels by the year 2015)[4] are to be met, neonatal deaths from intrapartum-related hypoxic events, prematurity, and infection must be reduced.

Life support programs in developed countries have shown post-course improvement but have demonstrated variable retention of knowledge and skills.[5–9] Helping Babies Breathe® (HBB), developed with the American Academy of Pediatrics, is designed to train birth attendants in developing countries in the essential skills of newborn resuscitation. It is based on the neonatal evidence evaluation of ILCOR (International Liaison Committee on Resuscitation) and recognizes that in many countries only one birth attendant must provide care to both mother and newborn.

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Table 1
Skills taught in Helping Babies Breathe®.

Preparation for birth
Identifying a helper and reviewing the emergency plan
Preparing the area for delivery
Hand washing
Preparing an area for ventilation and checking equipment
Routine care
Drying thoroughly
Keeping warm
Evaluating crying
Checking breathing
Clamping or typing and cutting the cord
The Golden Minute®
Positioning the head
Clearing the airway
Providing stimulation to breathe
Evaluating breathing
Initiating ventilation
Ventilating with bag and mask
Continued ventilation with normal or slow heart rate
Improving ventilation
Evaluating heart rate
Activating the emergency plan
Supporting the family

Formative evaluation of HBB focused on the first steps of a 7-stage hierarchy proposed for comprehensive assessment of educational outcomes: participant numbers, satisfaction, learning, competence and performance; patient health; and community health.[10]

The evaluation, conducted independently at two international field testing sites, addressed: (1) How do facilitators and learners perceive the course structure, learning materials, and assessment tools? (2) Do learners achieve acceptable levels of knowledge and/or performance of skills? (3) What is the quality of the assessment tools used to evaluate learner knowledge and skills performance? The information from these analyses was used to guide the refinement of course materials and participant assessment.

2. Methods

2.1. The educational program

2.1.1. General description

The HBB educational program is described at (http://www.helpingbabiesbreathe.org/about.html) and (http://www.helpingbabiesbreathe.org/docs/HBB%20Brochure.pdf). The course structure reflects contemporary educational theory and research and includes evidence-informed content, active learning, skill practice with feedback, case scenarios, self-reflection, group discussion, and structured assessment of knowledge, skills and performance.[11–14] HBB emphasizes assessment at birth, stimulation to breathe, and assisted ventilation for all newborns who are not breathing well by 1 min after birth (The Golden Minute®). Of all the skills taught (Table 1), the central life-saving skill is ventilation with a bag and mask.

The program was developed by the Global Implementation Task Force of the American Academy of Pediatrics (AAP). Prior to field testing, complete course materials underwent two rounds of review by a Delphi panel of experts in global child health and neonatal resuscitation and a regional technical expert review conducted at the World Health Organization.

2.1.2. Learning materials

The following tools were developed to facilitate learning:

- Action plan – a pictorial representation of the resuscitation algorithm (see: http://www.helpingbabiesbreathe.org/docs/HBBBrochure.pdf).
- Learner workbook – pocket-sized booklet to prepare learners with knowledge, guide practice during the course, and support continued learning after training.
- Facilitator flip chart – table-top sized pictorial flip chart to guide facilitator presentations.
- Neonatal simulator – an optional purpose-built, low-cost neonatal simulator which can be filled with 2 l of water or air. The simulator's features include crying, spontaneous breathing, chest wall movement with bag-and-mask ventilation, and umbilical cord pulse.
- Equipment – reusable ventilation bag masks, and bulb suction device.

2.2. Training

HBB utilizes a train-the-trainer model[7–9] in which potential facilitators are selected, trained to deliver a standardized educational program, and then assume responsibility for training facilitators and health care professionals within their medical facility or community. The program trains master trainers, facilitators, and learners and uses one simulator for each pair of trainees so that each participant takes turns being the learner (performing resuscitation actions/assessments of the baby) and teacher (providing responses with the simulator and verbal feedback on technique).

2.3. Selection of test sites

Two test sites were selected on the basis of responses to a competitive Request for Applications from AAP, their experience in delivery of educational programs, ability to collect data and willingness to train facilitators and learners. The principal investigator at each site was responsible for selecting and training facilitators and learners; planning, directing and executing the project; overseeing central data collection, data quality assurance, data management, and submission of data for analysis.

Facilitators were selected on the basis of their experience in labor and delivery or neonatology as well as for their experience as teachers of other courses. Each facilitator agreed to offer the program on 1–2 occasions. Members of the HBB editorial board oriented the principal investigators to the course design, content, curriculum and teaching design, and evaluation procedures.

2.4. Program evaluation and learner assessment tools

Satisfaction or a level 2 outcome[10] was measured by:

- Facilitators and learners recorded their perceptions of the course and its teachers on a course evaluation form (1–5 Likert scale, strongly disagree–strongly agree) as shown in Tables 2–4. Participants were invited to provide written suggestions for improvement in a comments section. Facilitators completed evaluation forms immediately after they were trained and also after leading the course at least once.
- Separate focus groups with facilitators and learners registered perceptions of program acceptability and ease of teaching. A semi-structured interview guide asked participants to discuss the learning and assessment tools. Focus groups were audio taped (with the participants' consent) and transcribed verbatim.

The assessment of declarative and procedural learning or knowing (level 3 outcome)[10] utilized a 16 item set of written/verbal