



Basic Neonatal Resuscitation: Global Landscape Analysis

September 2016



Save the Children

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Photo: Sherri Bucher.

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This document is dedicated to the memory of Donna Vivio who played a very active part in its development. It stands for her many years of strong commitment to maternal and newborn health and we will always remember her contributions to resuscitation.

Acronyms

AAP	American Academy of Pediatrics
AIR	Augmented Infant Resuscitator
ASSIST	Applying Science to Strengthen and Improve Systems Project
BASICS	Basic Institutionalization of Child Survival
CIFF	Children's Investment Fund Foundation
CURE	Commission on Urgent Relief and Equipment
DHS/SPA	Demographic Health Survey/Service Provision Assessment
DHIS2	District Health Information System
DHO	district health office
EmONC	Emergency Obstetric and Newborn Care
ENAP	Every Newborn Action Plan
ENC	essential newborn care
FiO2	fraction of inspired oxygen
GDA	Global Developmental Alliance
GNI	gross national income
HBB	Helping Babies Breathe
HCI	Health Care International
HMIS	Health management information system
IAP	Indian Academy of Pediatrics
ILCOR	International Liaison Committee on Resuscitation
IMNCI	Integrated Management of Newborn and Childhood Illnesses
LDSC	The Church of Latter Day Saints Charities
LAC	Latin American and Caribbean
LMIC	low- and middle-income countries

MCHIP	Maternal Child Health Integrated Program
M&E	monitoring and evaluation
MOH	Ministry of Health
MSPS	Colombian Ministry of Health and Social Protection
NRP	National Resuscitation Program
NSSK	Navjat Shishu Suraksha Karyakram (Training program for newborn care and neonatal resuscitation)
PEEP	positive end-expiratory pressure
POPPHI	Prevention of Post-Partum Hemorrhage Initiative
QI	Quality improvement
SARA	Service Availability Readiness Assessment
SBA	Skilled birth attendant
SCUS	Save the Children, US
SPA	Service Provision Assessment
UNICEF	United Nations Children's Fund
URC	University Research Corporation
USAID	United States Agency for International Development
WHO	World Health Organization

Executive summary

Despite global reductions in under-five mortality in the last decade, neonatal mortality rates have not decreased to the same extent, particularly in low- and middle-income countries (LMIC). As governments pursue interventions to improve newborn survival, increased attention on basic neonatal resuscitation is an important component. Resuscitation can help avert newborn death by helping to establish adequate breathing and circulation when newborns struggle to achieve these on their own.

The Helping Babies Breathe (HBB) Global Development Alliance (GDA), with the commitment of national leaders, is achieving progress in reducing neonatal mortality through improved access to resuscitation commodities. Competency-based resuscitation training for health care providers is key to these efforts. Translating quality training and care into infant survival, however, requires a variety of other components, including follow up mentoring and supervision; a reliable supply of essential resuscitation devices; reprocessing (cleaning and disinfection); attention to referral practices and improved data to support monitoring and evaluation (M&E) of activities and outcomes.

Countries face a variety of challenges and opportunities in these arenas. Many LMICs have mechanisms to supervise health care providers, but face gaps in supervisors' capacity and motivation, as well as in the planning and data to support them. Once trained, providers need reliable access to essential commodities. These currently include self-inflating bags and masks, suction devices, and training manikins; in the future, new innovations (such as an “upright” vertically oriented bag and mask) and several products in development may also improve care. Although procurement is seldom hindered by stock-outs, quantification challenges exist in determining the total numbers required in the facilities, availability, consistent quality, and cost-effective importation. There are also gaps in consistent and optimal reprocessing, which can result in an increased risk of infection for the newborn and damage to commodities.

Documentation and review of data on newborn resuscitation is also an area for improvement. Often, data available in LMICs is inadequate for M&E of coverage (i.e., of training and care), quality of care, and patient outcomes, and cannot be used to assess or improve the efficacy of resuscitation programs. In fact, many countries do not include appropriate resuscitation indicators in national- and district-level health management information systems at all. Several groups and organizations, through the Every Newborn Action Plan (ENAP) working group, are collaborating to help define key indicators and promote their validation and incorporation into country monitoring systems.

Key recommendations to address gaps, improve care, and save lives in the future include a continued global focus on:

- Strong country ownership of resuscitation programs.

- Effective policies, standards, and health management information systems.
- Improved procurement and maintenance of cost-effective and high-quality resuscitation commodities.
- Increased focus on coverage with high quality of care
- Improved referral systems.
- Implementation at scale (with a focus on integration of resuscitation with other components of maternal and newborn care and equity issues).
- Development of innovative new tools and approaches to improve care and outcomes.

Introduction

Globally, under-five mortality has significantly decreased over the last decade, from 90 deaths per 1,000 live births in 1990, to 46 per 1,000 in 2013. However, neonatal mortality has not kept pace. Today, newborn deaths account for 44 percent of under-five deaths worldwide. Nearly a quarter of these deaths are caused by adverse intra-partum events; a large proportion of these babies die in their first 24 hours of life (Figure 1).¹

Neonatal resuscitation can help avert newborn death by helping to establish adequate breathing and circulation when newborns are unable to achieve these on their own.² It is estimated that between 5 and 10 percent of newborns at birth require resuscitation.³

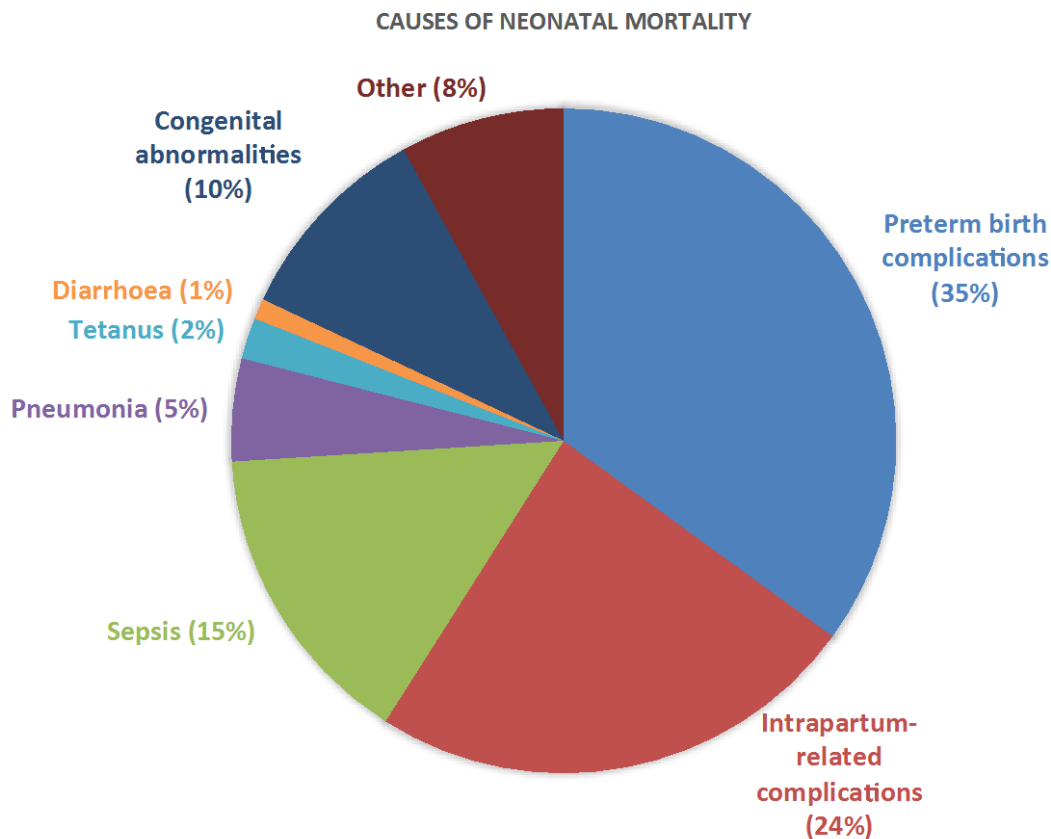


Figure 1. Causes of neonatal mortality.

In addition, an unknown percentage of stillbirths are actually early neonatal deaths. With the right intervention, some of these babies may be revived.⁴ Therefore, guidelines from the World Health Organization (WHO) recommend that resuscitation be applied to all babies who do not breathe properly at birth, including fresh/non-macerated stillbirths immediately after drying.⁵ In this context, an increased focus on neonatal resuscitation is crucial to saving a greater number of newborn lives.

Goals and methodology

In 2010, the American Academy of Pediatrics (AAP) developed the Helping Babies Breathe (HBB) initiative, an evidence-based educational program to teach basic neonatal resuscitation techniques in resource-limited areas. In 2015, the Global Development Alliance, established for the Helping Babies Breathe (HBB) Initiative, released an important document highlighting their key achievements, challenges faced, lessons learned and future goals.⁶

Guided by this document, the Newborn Resuscitation Working Group of the Newborn Technical Reference Team of the United Nations Commission on Life-Saving Commodities determined that it would be useful to look into coverage of basic neonatal resuscitation in LMICs.⁷ However, during review of the existing situation it was clear that due to the challenges, noted below in the M&E section, there is an inadequacy of data to document coverage in a meaningful way. As basic resuscitation activities were undergoing expansion, it was determined that there would be value in reviewing progress made in the various components. Hence, this landscape analysis was commissioned. Findings presented here complement those of the previous 5-year report from the HBB Global Development Alliance, *Helping Babies Breathe: Lessons learned guiding the way forward*.⁶

A global approach to successful wide-scale use of neonatal resuscitation requires a focus on several areas. Health care providers must have the commodities, training, and adequate support to acquire and maintain clinical skills in order to provide safe and effective care. Global, national, and local policies must be in place that support, guide, and fund best practices and prioritize resuscitation. Health systems must be strengthened to facilitate quality of care and support must be provided for the supply chains and systems that make essential commodities, such as resuscitators, suction devices, and training manikins, available to providers. Finally, M&E is key to every effort, from actions taken by health care providers for babies who do not breathe properly at birth, to the quality of care provided, and outcomes.

This landscape analysis focuses on each of these arenas, touching on the origin and evolution of basic neonatal resuscitation to meet global requirements, training and quality of care, M&E, relevant ENAP metrics, indicators, procurement issues, and reprocessing of the devices, which is particularly relevant to LMICs where they need to be re-used between babies. It covers challenges and potential solutions, innovations, and recommendations for the way forward.

The authors used a methodology that combined a desk review, which entailed a review of reports on basic newborn resuscitation developed by organizations working in this area and peer reviewed publications; one-on-one discussions and email exchanges with key stakeholders involved in neonatal resuscitation, policy, training, and other relevant efforts; and added sample case studies of select countries from the three regions, Africa, Asia and Latin American and Caribbean (LAC) region.

The evolution of basic resuscitation

Resuscitation has been used in some form for thousands of years.^{8,9} The first note of basic resuscitation is in the Bible, with additional mentions in the 15th and 16th centuries; writers described successful attempts at air inflation using blacksmith bellows. In the mid-18th century, mouth-to-mouth resuscitation was recognized as effective, but use decreased after an influential obstetrician, Hunter, denounced it as “vulgar practice.” In the early 19th century, another influential physician, Gunn, advised midwives to revive stillbirths through the application of “noxious stimuli to the nostrils,” along with alternating cold and warm water immersion and bleeding.¹⁰ Despite these and other questionable methods, it is notable that resuscitation dates back thousands of years, and that the first efforts to revive stillbirths were initiated centuries ago.

Over time, these changes coincided with a growing understanding of respiration itself. Hippocrates (c.460–c.377) first noted that “there was something in the air” that entered the heart and lungs. The importance of oxygen for preterm babies was documented by Bonnaire in 1891.¹¹ Over the years, the use of oxygen has increased. However, in the 1990s, Saugstед highlighted risks associated with unnecessary and excessive use of oxygen.¹² The current WHO evidence based guidelines for neonatal resuscitation also cautions against the unnecessary use of oxygen, recommending that in babies above 32 weeks of gestation, positive pressure ventilation when required should be initiated with room air.⁵

Devices

As improvements in medical practices led to a reduction in maternal deaths during childbirth, more attention was focused on newborn survival. Initially, adult resuscitation devices were adapted to make them more suitable for infants, leading to attempts to institute rhythmic inflation and deflation for prolonged ventilation. As technologies improved, more appropriate devices became available, including the self-inflating bag and mask in 1958. Additionally, with increased availability of blended air-oxygen sources, flow-inflating bags and T-piece resuscitators became more accessible in advanced care centers.¹³ However, the self-inflating bag and mask has remained the standard for low-resource settings and as an alternative in advanced units because it can function even without a source of a blended oxygen and airflow.

Guidelines

Increased use of tools and practice of resuscitation also necessitated standardized guidelines. Early examples include the 1987 guidelines from the American Academy of Pediatrics National Resuscitation Program (NRP). In 1995, the International Liaison Committee on Resuscitation (ILCOR) also established a neonatal sub-group to focus on the special needs of this vulnerable group. Guidelines to support neonatal resuscitation have been periodically updated.^{14,15,16} In

addition, WHO has published evidence based guidelines for neonatal resuscitation,⁵ and also, more recently, technical specifications for key resuscitation commodities.¹⁷

Training

As neonatal resuscitation advanced, the practice expanded to include clearing of the airways, bag and mask ventilation, cardiac massage, endotracheal intubation, and use of medication. This more complex process has in turn required considerable clinical skills and was primarily performed in hospitals by highly skilled anesthetists, pediatricians, and neonatologists. Fortunately, high-quality guidelines, such as those developed by ILCOR, along with excellent training programs such as NRP, have enabled a greater number of skilled personnel to acquire the necessary competence to perform neonatal resuscitation.

Although neonatal resuscitation has been practiced extensively, only in the last decade has the efficacy of ventilation been evaluated objectively for safety. Recent studies have explored how effectively the current practice delivers appropriate volumes of air, especially during changes in compliance associated with fluid-filled lungs in asphyxiated babies and surfactant deficient preterm infants. Studies documenting lung function have revealed that even among competent experienced staff (such as neonatologists and respiratory therapists), inappropriate ventilation can sometimes occur. While inadequate ventilation is an important issue, more recently, concern has been growing over the delivery of excessive tidal volumes and to a lesser extent, higher peak inspiratory pressure. The risk of the latter may, to some extent, be offset by the presence of safety pop-off valves, which are incorporated into the devices to release excessive pressures.¹⁸

The NRP course used worldwide (with country-level customization as appropriate), has helped improve the skills of qualified hospital staff in LMICs.¹⁹ However, a persistent lack of highly skilled health workers in many LMICs has historically meant that trained staff were often unable to reach infants soon enough to help. In addition, midwives, nurses, and even physicians in general health centers were not included in training sessions, making services unavailable in certain locations.

In the 1990s, as high neonatal mortality rates gained national and global attention, basic newborn care, that included resuscitation at birth, received significant attention from the global health community. Leaders realized that although conventional training courses such as the NRP were effective, they did not prepare skilled birth attendants—such as midwives—who most often attended deliveries in LMICs. In addition, studies from these countries revealed that more than 80 percent of newborn infants who were not breathing properly at birth did not really need all the components covered in the existing courses. Most of the infants could be revived by the stimulation process by drying, keeping warm, and gentle clearing of the airways as required; many of those remaining could be saved through bag and mask ventilation. Less than 2 percent of

infants who did not breathe at birth required advanced resuscitation (i.e., endotracheal intubation, cardiac massage, and medication).^{20,21,22}

In response to these findings, several groups developed training manuals emphasizing basic (rather than advanced) neonatal resuscitation. Some, including the Church of Latter Day Saints Charities (LDSC) focused primarily on resuscitation.²³ Others, including the WHO and Save the Children, US (SCUS), integrated resuscitation with elements of essential newborn care.^{24,25}

Additionally, the USAID BASICS (Basic Institutionalization of Child Survival) and the Prevention of Postpartum Hemorrhage Initiative (POPPHI) course, combined resuscitation with additional components, including basic maternal care at delivery, prevention of post-partum hemorrhage, and postnatal care.²⁶ Despite these variations, most trainings included the same basic components of neonatal resuscitation (Figure 2).

The first multi-partner, coordinated initiative for training in basic neonatal resuscitation took place with the commencement of the HBB initiative in 2010, under the AAP.²⁷ It is currently the most widely applied training program for basic neonatal resuscitation, worldwide. Another foundational milestone was the development of WHO Guidelines on Basic Newborn Resuscitation in 2012, which outlined evidence-based standards and guidelines for the training and practice of neonatal resuscitation.⁵



Figure 2. Helping Babies Breathe Training in Columbia. Credit: PATH-MCSP/Goldy Mazia.

Figure 3. Components of basic resuscitation training

- Immediate drying of the baby at birth and temperature maintenance.
- Assessment of respiration.
- Clearing of the upper airways (mouth and nose) when necessary.
- Additional safe stimulation if required (included by some).
- Manual ventilation using a self-inflating bag and mask to be initiated when necessary within one minute of birth (the “Golden Minute”).

The Apgar score

The Apgar score was developed in 1952 by Virginia Apgar and has since been widely applied.²⁸ The score assesses heart rate, respiration, muscle tone, response to stimulation, and color at one, five, and ten minutes after birth. The score is not considered part of the basic neonatal resuscitation process because in basic resuscitation the emphasis is on early initiation of the process. Ventilation, when required, must take place within the first minute of birth, the golden minute.²⁷ However, the documentation of the Apgar score only commences at 1-minute, which is too late to be an effective guide in the resuscitation process. Additionally, in many of the smaller health centers there are already significant challenges in recording and reviewing key essential indicators reflecting mortality and quality of care. Recording the Apgar score in such facilities would be as equally challenging and may be inaccurate, not only in the assessment of technical components but also in the absence of a clock with a second hand. This however does not detract from the importance of assessing an infant’s well-being and needs soon after birth using the Apgar method.

Current context

The Helping Babies Breathe Global Development Alliance

The HBB GDA was established in 2010 through a memorandum of understanding between five core partners: the AAP, USAID, Laerdal Global Health, SCUS, and the Eunice Kennedy Shriver National Institute of Child Health and Human Development. The goal of the alliance continues to be to work toward achieving a significant reduction in neonatal mortality by increasing the availability of trained health care workers in resuscitation to manage newborn asphyxia during birth. Since 2010, the partnership has expanded to include other interested and relevant organizations including LDSC, Johnson and Johnson, Catholic Medical Missions, Earth Institute/Columbia University, Project CURE (Commission on Urgent Relief and Equipment), and the International Pediatric Association. Facilitated by USAID, HBB has drawn on the unique contributions of each organization. The initiative is supported and implemented by additional

groups, including the United Nations Children’s Fund (UNICEF), PATH, the University Research Corporation, the LAC Neonatal Alliance, and the CORE group. The key objectives and guiding principles of the HBB GDA are provided below in Table 1. In 2012, this alliance was merged with the Survive and Thrive Alliance to address other newborn/early infant causes of death.⁶

Table 1: The HBB Global Development Alliance ⁶

Objectives

1.	Advocate for international, regional, and national commitment including resources to incorporate resuscitation at birth as a part of essential newborn care.
2.	Promote availability of suitable, high-quality, affordable training tools and basic resuscitation devices.
3.	Improve competence of birth attendants with focus on skilled birth attendants.
4.	Strengthen supply chain relevant to basic resuscitation devices.
5.	Evaluate impact of these resuscitation activities at scale.

Guiding principles

1.	Collaboration between partners and promotion of inclusiveness.
2.	Promotion of country ownership and lead.
3.	Integration of HBB components within the broader package of essential newborn care.
4.	Emphasis on shared goals, results and recognition.
5.	Promotion of brand non-exclusivity.

The HBB GDA at work: Government partnerships to develop policies and standards

Initially, HBB activities were implemented by alliance organizations within their own program areas and focus countries. However, it became evident that involving national governments was a key component to influencing national policies and guidelines, as well as furthering activities to achieve wide-scale, sustainable implementation. In order to achieve greater country buy-in, implementers began to work more closely with country leaders. Additionally, alliance organizations undertook advocacy efforts to sensitize ministries of health and key stakeholders,

including professional organizations for pediatricians, obstetricians, and midwives. These efforts have played a significant role in the development of policies and guidelines that promote and support program implementation. Currently, several national governments, including the governments of Uganda, Tanzania, Bangladesh, and Colombia are closely involved in HBB activities. Tanzania, for example, has included HBB, and Uganda's government introduced HBB Plus for integrated newborn care. All of the mentioned country governments have opted to include basic resuscitation in their national standards and guidelines for newborn care.

In Tanzania, the Ministry of Health (MOH) became involved in HBB efforts early on and committed to a countrywide rollout of HBB efforts, as well as quickly prioritizing, supporting, and expediting activities to prevent neonatal deaths. The Tanzanian government had originally planned to include a basic resuscitation program in the national Emergency Obstetric and Neonatal Care (EmONC) program—which was supporting the Helping Babies Breathe Initiative—however, the ministry decided to implement HBB separately to ensure a quicker rollout.²⁹ The acceleration of efforts, demonstrated through the ministry's commitment, is a strong example of the potential of donor-supported programs when embraced, owned, and led by country leaders. Despite this recognized success, many countries continue to face challenges including lack of key indicators in national- and district-level health management information systems (HMIS).

Current training programs

The establishment of the HBB initiative sparked a rapid increase in resuscitation training for health care providers in participating countries.

To date, resuscitation-training programs have been provided primarily as in-service trainings and, to a lesser extent, as pre-service education for nurses, midwives, and other health care providers. Most in-service training has been provided through a cascade approach, focusing on health care providers in facilities that conduct deliveries. Training has mostly reached public-sector providers and to lesser extent the private sector.

A country specific pre-service curriculum is also important. Providing resuscitation training for skilled birth attendants during their basic training has the potential to provide greater sustainability over time, instead of having periodic training programs implemented by different organizations. A pre-service curriculum will be less costly and could prevent health care providers from taking extended periods off work to undergo training. To have the greatest impact, it is necessary not only to provide comprehensive, high-quality training, but also to include basic resuscitation evaluations that students must pass to advance or earn credentials. This change would need to be approved by agencies that determine examination content (e.g., country medical councils). Without this component, even if excellent competency-based training is provided, the commitment of the student population may not be at the desired level.

Beginning in 2010, the AAP facilitated and maintained a training matrix based on data received from the organizations implementing HBB activities. A summary of the training data from various regions is shown below in Table 2. Further information can be accessed from the HBB website.³⁰ In the absence of reliable denominators, however, (i.e., the total number of providers in the region in need of training) available data does not accurately represent on true coverage (the percentage of all providers in need of training who have received training). Figure 3 illustrates the rapid increase in trainings between 2010 and 2014.

Table 2: HBB trainings: Region, support, and number of health care providers trained, June 2010 through December 2014

Region	Number of Countries	Implementing agencies Supporting Organization(s)	Number of trainings coordinated by the government	Number trained
North America	2	AAP, HBB website, Vermont Oxford Network/American Academy of Pediatrics		694
Asia and the Middle East	19	Agha Khan Foundation, HBB, LDSC, National Rural Health Mission/Navjak Shishu Suraksha Karyakram Reproductive and Child Health Alliance, SCUS, USAID, MCHIP, USAID/Maternal and Child Survival Program	11	167,927
Africa	29	AAP, CIFF/PATH, Earth Institute, Every Preemie Scale, HBB, Jhpiego, LDSC, Laerdal Global Health, Project for Women's Health in Tanzania, Millennium Villages Project, USAID/MCHIP, SCUS, UNICEF	22	100,983
Regional Courses, Africa		USAID/MCHIP, USAID/Africa 2010, and WHO/UNICEF		2,118
Europe and Eurasia	8	Laerdal, LDSC, Private Health Care Systems, International Federation of Gynecology and Obstetrics, and USAID/MCHIP	4	8,638
Latin America and	20	AAP, LDSC, URC/HCI Project CURE, USAID/MCHIP and Colombian Neonatal Association	14	13,770

Caribbean (LAC) region				
Regional courses, LAC		AAP, URC/HCI, USAID/MCHIP, LDSC, LAC Neonatal Alliance		453
Oceania	3	AAP, LDSC, Project CURE	1	205
TOTAL	81		52	294,788 *

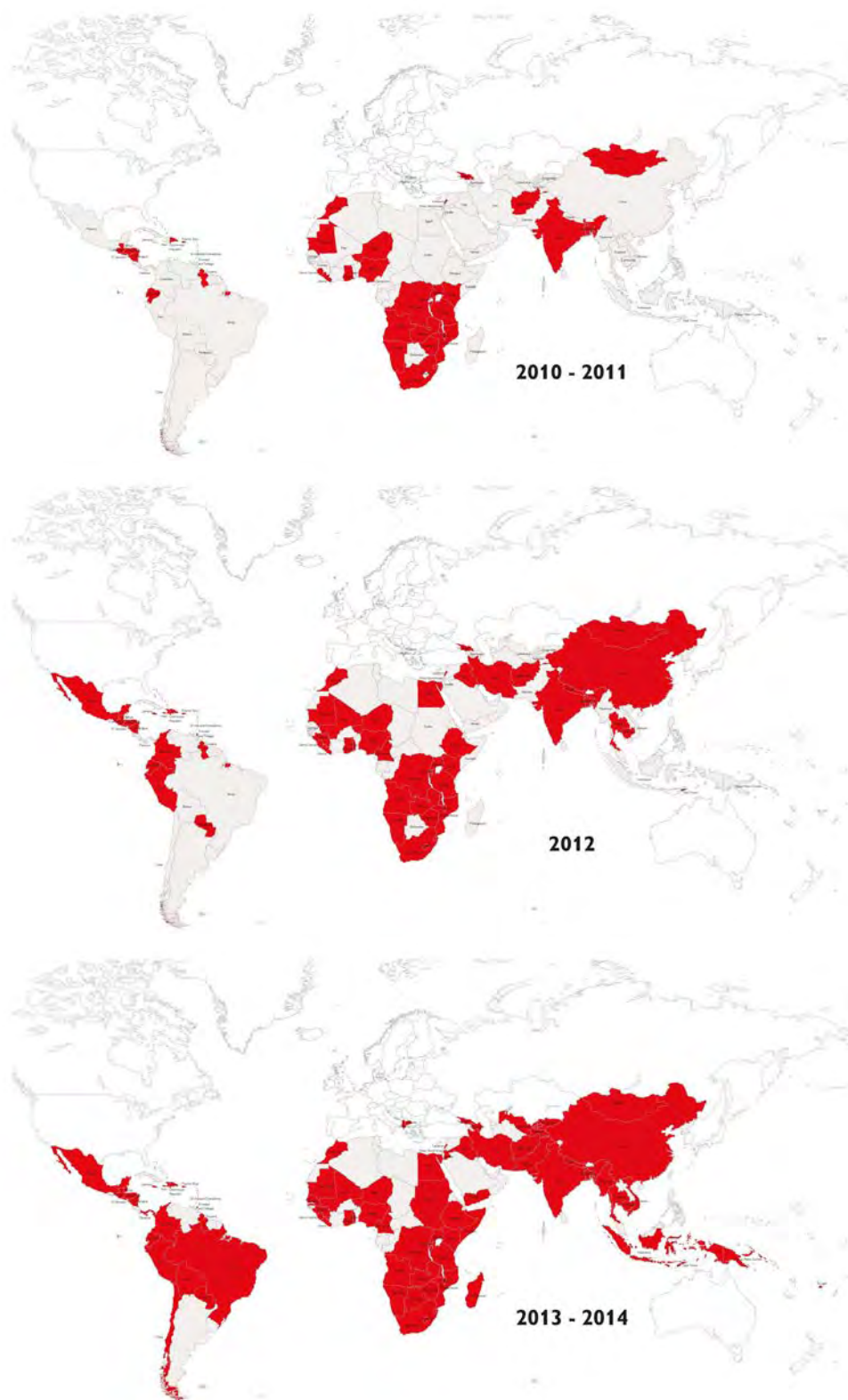


Figure 4. Expansion in HBB implementation between 2010 and 2014. Credit: Laerdal Global Health.

Quality of care and services: Challenges and opportunities

Maintaining and improving the quality of neonatal resuscitation is key to saving lives. It is also one of the most challenging components of effective and sustainable programs.

To save lives, neonatal resuscitation must be provided correctly and promptly. To ensure best practice, particularly in LMICs, USAID and partners have created and disseminated a comprehensive framework; *Improving basic newborn resuscitation in low resource settings: A framework for managers and skilled birth attendants*, to guide managers and skilled birth attendants.³¹

Importance of supervision

Readily available and skilled birth attendants who have undergone suitable competency based training is a first step to providing consistent and high-quality care. However, it is also important to ensure that care will continue to be high quality and that health care workers maintain and improve their skills. This requires continuous supportive supervision and mentoring. In addition, health care providers need consistent access to crucial commodities to provide care. These include the self-inflating bag and mask devices, suction devices to carry out resuscitation, as well as manikins, not only for the training but also for subsequent onsite practice to maintain training.

Challenges to supervision

Many LMICs do have mechanisms to supervise health care providers, which is often government provided oversight. However, challenges exist in several areas:

- **Existing supervisory systems.** Challenges include a lack of motivation on the part of supervisors to travel to the health facilities to monitor local activities. This is particularly true in areas where travel is long and arduous (i.e., when roads are poor). Inadequate resources may play a role, such as situations in which vehicles have to be shared between several departments. In addition, although supervisors are frequently health professionals, they may not have the technical expertise in a particular area to evaluate. Additionally, years of working in offices may reduce their competence in clinical practice, further decreasing their capacity to provide support on neonatal resuscitation.
- **Inadequate planning for follow-up activities in training programs.** Although a number of organizations invest a great deal of time and money into planning and implementing trainings, additional support for follow-up supervision and mentoring is often an after-thought, and follow-up activities are inadequate.
- **Variations in the number of childbirths at health centers.** In smaller health centers, fewer deliveries may result in fewer cases of birth asphyxia, making it more difficult for health care

providers to maintain their skills. Frequent simulated practice using training manikins has been shown to play a role in improving competence.²⁹ However, not all health centers have access to manikins, and without consistent supervision and support, workers often lack or lose the motivation to practice. At large facilities, consistent supervision and training, and a greater number of births, can help health care providers maintain their skills and motivation. However, it is important to note that rapid increases in delivery rates at smaller facilities have not always been associated with improvements in infant survival. Often, increases in facility births (for example, as a result of interventions to promote mother and child survival) are seen first in peripherally situated (that is, smaller and more rural) facilities, as compared to larger hospitals. For example, between June 2010 and June 2013, an intervention in Zambia that encouraged mothers to give birth with skilled care resulted in a 1 percent increase in births at large EmONC-qualified facilities. By contrast, births at peripheral (lower-level) facilities increased by 25.2 percent over the same period.³² Although maternal deaths decreased, there was no significant effect on newborn mortality overall. Similarly, research has suggested that even when demand-side community interventions increase facility births, poor quality of care at those facilities resulted in little or no impact in outcome.³³

- **Challenges in observing a “real life” procedure for verification and guidance.** Unlike many other clinical procedures, it is difficult for supervisors and mentors to observe the actual process of resuscitation, because only 5 to 10 percent of infants require it, and the timing cannot always be predicted.
- **Delays in procuring commodities.** Gaps in supply chains in LMICs can prevent crucial tools and devices used for neonatal resuscitation from being available for some time after training. Without tools to practice new skills, health care providers may lose what they have learned.
- **Lack of data or poor motivation to review data.** Data collection and analysis, especially related to health outcomes after resuscitation, can be a powerful tool to measure and monitor quality of care. However, in many countries, indicators for recording such data are not part of the country HMIS and are not routinely recorded. In countries that do record data, workers and leaders may not be motivated to review data, or may not be clear on how to translate findings into action.

Outcomes of training

Early in the initiation process of basic resuscitation activities, implementing agencies realized that maintaining skills after training was challenging, and that follow-up support could help. In the Democratic Republic of the Congo for example, an evaluation six-months after a training for skilled birth attendants in health centers (part of a larger training on a variety of maternal and newborn care topics)* showed a significant decrease in resuscitation skills. Prior to training, participants could carry out a mean of 62 percent of steps outlined in a pre-designed checklist for basic resuscitation. At the end of the training, all participants could carry out at least 80 percent (most of them near 100 percent) of the steps correctly. However, in the first follow-up, about 6 months, health workers’ skills had decreased, now only being able to implement a mean of

* Training programs of USAID/BASICS/POPPHI and USAID/MCH

61percent of the key steps. Notably, refresher-mentoring (visits to the health centers by district supervisors accompanied by a member of the program staff) re-enabled them to implement 78 percent of the tasks.³⁴

Evolution Of Provider Skills In 10 Health Zones (DR Congo)

(At end of training all providers scored at least 80% , most near 100%, when evaluated with checklists)

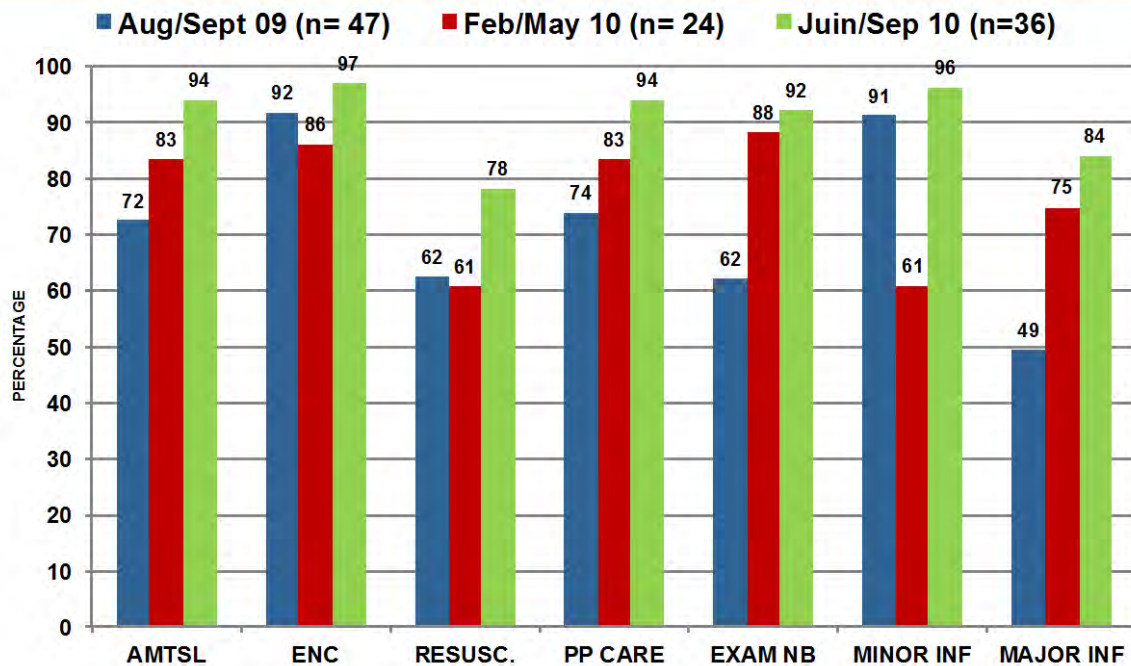


Figure 5: Changes in skills following training and subsequent supportive supervision (Neonatal resuscitation in comparison with select maternal and neonatal components).

Source: Narayanan I. The Need for Quality Improvement: Challenges and Options, presentation at the annual meeting of the Helping Babies Breathe GDA meeting, July, 2012.

As noted above, supervisory visits to health centers can pose challenges. As an alternative, the same program working in the Democratic Republic of Congo provided “group supervision” in Madagascar. Under this model, three months after training, participating providers were called to the local hospital to meet with a supervisor, a staff member from the implementing organization, and hospital staff. Using this model, as many as 13 health care providers could be mentored in one session, rather than having supervisors travel to various facilities where only 1-3 health care providers could be covered at one visit. The model also provided a good opportunity for trainees working in similar situations to share their experiences of what worked and what did not, promoting peer learning.³⁴

Interestingly, follow-up evaluations of trained workers has shown both an increase in use of the steps of drying and suctioning and a decrease in use of ventilation.⁶ Although it is important to institute ventilation, as necessary, promptly it is also important to avoid unnecessary use. This is because ventilation does carry inherent risks, such as introducing excessive tidal volumes that can harm the lungs, especially in preterm babies.³⁵

On the other hand, controlled research studies, particularly in hospitals, have shown substantial improvement in the quality of care and outcome after training. In Tanzania, for example, there was a sustained 47 percent reduction in early neonatal mortality and a 24 percent reduction in stillbirths among normal and low birthweight babies after two years of training program implementation. The study identified several important supportive factors, including the commitment of the Ministry of Health and Social Welfare in implementing the initial training, providing the necessary basic commodities, and the implementation of additional on-the-job and refresher training.²⁹ Further, training manikins were placed in the labor and delivery rooms, and health care providers were instructed to practice ventilation on the manikin whenever they came on duty—which was documented.

Similarly, a 2016 study conducted in a Nepali tertiary hospital through the HBB Initiative, used a “quality improvement cycle” (a method that includes rapid, small-scale changes to achieve a desired goal) to improve the implementation of basic resuscitation.³⁶ It used a multi-pronged approach including local, trained quality improvement teams; clearly defined goals, objectives, and standards of the HBB protocol; daily skills check on a training manikin; self-evaluation checklist; and a refresher training. Evaluation video recordings conducted before and after the cycle documented a fall in an intra-partum stillbirth rate from 9.0 to 3.2 per thousand deliveries and a decrease in first-day mortality from 5.2 to 1.9 per thousand live births. There was also decreased use of inappropriate suctioning and stimulation. After the intervention, almost 84 percent of babies who underwent ventilation received bag and mask ventilation within one minute of birth compared to zero prior to intervention.

It is important to note that outcomes (in terms of quality of care) are influenced not only by the presence or absence of training and follow-up but also by other factors, including sound governance and policies; referral systems, appropriate health information systems, consistent supply and maintenance of suitable and functioning commodities; adequate monitoring and evaluation; and functional health systems.³¹ Challenges and opportunities in some of these additional areas are touched on below.

Referral systems

The importance of an effective referral system, in order to ensure positive care outcomes, is universally recognized and accepted. However, there are unique challenges with neonatal resuscitation referrals, particularly with basic resuscitation (i.e., support only up to bag and mask ventilation), besides the lack of availability of appropriate roads and suitable vehicles.

All newborn brains, particularly those of preterm babies, are still developing and are extremely vulnerable to injuries, including inadequate circulation and oxygenation. Therefore, if basic resuscitation for an infant who is not breathing appropriately is not successful at a peripheral (lower-level) center, sending the infant to a referral center for more advanced care (which can take time) can risk further brain damage. Often, referred infants arrive in a moribund state or die in transit.

Referrals also have other consequences, including cost of transit and a lack of adequate supplies. In instances that require referral to more advanced facilities, families are burdened with the cost of transport. Additionally, in many LMICs, transport systems lack the medical equipment and skills to support the baby during the journey. This is particularly challenging in facilities with only one bag and mask when they need to send the equipment with an infant being transported to an alternate facility, which could deprive another of infant of necessary care.

Even if an extra bag and mask were available, the consistent immediate and long-term efficacy of bag and mask ventilation alone over a prolonged period is unclear. Although there are anecdotal stories of successful outcomes after referral (i.e., subsequent good development and lack of disabilities), such interventions carry major risks and are extremely difficult to handle without additional technology and skills. Therefore, the most competent person available at the site must review potential referral cases. He/she must weigh the risks and potential benefits, have an appropriate discussion with the family, and make a decision with the family.

Notably, in most cases it is safer to transport a mother in labor with danger signs to a referral center before the delivery—ideally in time for the problems to be addressed.

Essential commodities for resuscitation

The presence of essential, appropriately maintained and readily accessible supplies and equipment to competent skilled health providers, is critical for successful resuscitation. Key considerations include available commodities, the impact of new products and innovations, challenges and opportunities related to procurement, and, in settings where single-use or disposable products are not feasible, challenges associated with properly reprocessing (cleaning and disinfecting) devices.

Standard commodities: Benefits and considerations

In 2012, as a part of the Every Woman, Every Child Initiative, the UN Commission on Life-Saving Commodities was established. The commission's goal was to work with the global community, including major stakeholders and country governments, to advocate for, increase access to, and promote the appropriate use of 13 life-saving commodities that effectively address the leading preventable causes of death during pregnancy, childbirth, and childhood.⁷ Included in this list are the essential commodities for basic neonatal resuscitation, including the self-inflating bag and mask, suction device, and training manikin (Figure 6).

Neonatal Self-inflating bag and mask

The neonatal self-inflating bag and mask typically have a bag size of 220–240 ml. with two masks; size 1 for term and 0 for preterm infants. Based on foundational research the upper limit for bag size was established at 500 ml.³⁷ for many years. In fact, many centers in low-resource areas, including settings in Africa and Asia, still use bags with the 500 ml. capacity. The tidal volume required by even normal-weight full-term babies, however, is only 4–8 ml/kg or approximately 15–30 ml. Therefore, the 220 ml. bag should be enough to provide adequate ventilation. However, because air may leak out under the mask, especially when handled by less experienced users; the larger bag may be useful to offset such leaks. This may be particularly helpful in providing adequate ventilation and achieving the required tidal volumes, especially when lung compliance is low (as in the initial stages of birth asphyxia with fluid filled lungs and in preterm babies). However, among providers with stronger skills with whom mask-leak may be less frequent, all bags—but notably the larger bags—risk delivering higher tidal volumes, especially if the bag is squeezed excessively. This can potentially damage the lungs, especially among preterm babies.

Suction devices

Recently, WHO and ILCOR guidelines have recommended that suctioning be carried out only when absolutely necessary and not as a routine procedure. Although the HBB initiative primarily recommends the use of reusable suction bulbs, WHO also recommends low pressure suction machines used with disposable or single-use suction catheters. A wide variety of suction bulbs are available (Figure 7). While some devices are made of rubber or silicone, others have very hard plastic or glass tips that could potentially injure the mucus membrane during use. In addition, single use suction devices (which cannot be opened) should be discarded after being used. Reusable suction devices (which can be opened) should be properly reprocessed (cleaned and disinfected) before being used on the next.



Figure 6. Examples of Available Suction Bulbs. Photo: PATH. Case Study: Newborn Resuscitation Devices - Prepared for the United Nations Commission on Commodities for Women’s and Children’s Health. 2012

In 2011, Laerdal released the “Penguin,” (Figure 8) a translucent reusable suction device made of silicon material. The upper section of the Penguin can be opened to permit proper cleaning and disinfection.



Figure 7. The Penguin suction device. Photo: Laerdal Global Health.

Manikins

Training manikins (or simulators) are also key to successful resuscitation. During training, follow-up supervision, and mentoring, they permit workers to learn and practice skills before performing resuscitation on babies. Although available simulators include a variety of functions, the single most important requirement is the ability to see chest movements during ventilation. Even with its limitations, this is the only practical and feasible parameter that users have to gauge the effectiveness of simulated ventilation.

As noted above, the WHO has released the technical specification of the key resuscitation commodities.¹⁷ This is likely to prove useful to countries with resuscitation programs.



Figure 8: Resuscitation commodities - Training Manikin supported by the UN Life Saving Commission for Life-Saving Commodities. Photo: PATH/Patrick McKern.

Other commodities

In addition to the commodities noted above, country governments and facilities must also invest in additional items, including tables for resuscitation, sources of warmth such as an overhead warmer, weighing scales, and other items required for essential newborn care including. These should be kept together in a safe, clean manner, and ready for use, in designated spaces, such as a “newborn baby corner.”

New innovations: Benefits and considerations

In 2014, Laerdal released the Laerdal Upright Newborn Bag-Mask (Figure 9), which has CE marking indicating that the product complies with the European “New Approach” product safety directives. The device differs from the conventional horizontal or L-shaped bag and mask in several ways, in addition to orientation of the bag.



Figure 9. Upright (left) and the conventional (right) neonatal bags and masks.
Photo: PATH.

The key issues of the Laerdal resuscitators are highlighted below along with possible implications for ventilation of babies, some as suggested by preliminary studies.^{38,39} The comparison noted below is made between upright and horizontal resuscitators, for use in newborns from the same manufacturer, Laerdal.

- With vertical resuscitators, the orientation keeps the bag over the mask in line with the direction in which the mask is being applied. With the horizontal resuscitators, the bag is aligned at right angles to the mask stem, counter to the direction of application of the mask. The value of this change is likely to be most pronounced during prolonged ventilation, when fatigue may cause a health care provider’s ventilating hand to sag, potentially increasing mask leak in the conventional devices.
- The upright newborn bag-mask can be inverted and be stood up on the other end of the bag, as shown in figure 9. This ensures that the mask is at the top and not in contact with the table surface to avoid contamination during use.
- The mask of the vertical bag has a wider top portion, with a firmer upper rim and a softer lower portion. The former permits a better mask hold while the softer lower portion allows more exact placement over a baby’s face. Both factors could reduce mask leak; which was noted by at least one formal study.³⁹

- The horizontal bag has a smooth stem that slips into the bag stem. This, at times, results in the mask rotating or coming loose. In contrast, the mask stem of the vertical bag has a ridge that slots into a groove on the inside of the bag stem so that the mask fits more firmly into the bag. However, because parts used in the mask of the upright bag comply with international standards, the mask may also be used with the standard conventional horizontal resuscitator.
- The bag size of the new upright Laerdal mask is 320 ml, while the horizontal Laerdal resuscitator for the newborn has a 220 ml. bag size. As noted above, devices with a 500 ml. bag are used in some LMICs, because they are thought to be more effective in producing a better tidal volume in the presence of mask leak. In addition, as noted, above, as skills improve resulting in a successful mask seal, and especially with excessive squeezing of the bag, high tidal volumes may be obtained with bags of all sizes; but they are more likely with larger sized bags. The 320 ml bag option may thus be a better in-between alternative to the 220 and 500 ml bags, in order to help reduce the risk of damaging tidal volumes. Ultimately, it is essential that training focuses on attaining the proper skills for proper mask fixation in order to get a successful mask seal and appropriate squeezing of the bag to deliver tidal volumes in the safe ranges during periods of both low and normal compliance. The size of the bag should also be taken into consideration during squeezing.⁴⁰
- Conventional horizontal resuscitators consist of nine or more parts, along with the mask that need to be disassembled for reprocessing. In contrast, the vertical resuscitator has only six parts and the mask, making disassembly and reassembly during reprocessing easier.³⁸
- Some of the conventional resuscitators can be attached to a source of supplemental oxygen, whereas the vertical resuscitator cannot link with the oxygen supply directly. However, a small separate attachment can be purchased to permit the attachment. It is also important to remember that, as noted earlier, unnecessary use of oxygen should be avoided due to potential risks.

Overall, the new product has raised considerable interest and results of studies on babies are awaited. As interest increases, however, several additional issues are coming to the forefront. If the new vertical resuscitator is to be widely used, it is worth considering whether global training programs should soon include use of both bags, and how training should be adjusted. Although the method of ventilation is the same with both bags, it is likely that most service providers would prefer training and orientation on both, particularly as availability of both products increases.

Recently Laerdal has added a positive end-expiratory pressure (PEEP) functionality to the upright newborn bag-mask that helps retain a volume of air in the lungs between ventilations.⁴¹ This is particularly helpful for ventilating newborn babies with fluid filled or immature lungs. It helps to clear fluid, reduce airway resistance and damage to lung tissue from repeated lung alveolar collapse. In 2015, ILCOR recommended that PEEP could be used with preterm babies and is safe for all newborns.⁴²

Two other innovations in the testing phase include the Augmented Infant Resuscitator (AIR), and NeoBreathe™, a foot-operated resuscitator.

The AIR is an electronic add-on device for existing bag valve mask resuscitators.⁴³ The device monitors and records resuscitation performance by providing real-time, objective feedback on the user's ventilation technique. The goal is to improve the confidence and skill of health care providers.

NeoBreathe™ is a foot-operated, newborn resuscitator, with integrated suction that frees one hand of the health care provider for other use. The manufacturer claims that in addition to protecting against pressure overshoots, the product can provide regulated peak inspiratory pressure (PIP) and enables users to regulate fraction of inspired oxygen (FiO₂) without requiring compressed air or an air-oxygen blender. The device was conceptualized at the Stanford-India Biodesign, operated in collaboration between the All India Institute of Medical Sciences, Delhi. According to a letter with A. Bansal in November 2015, windmill Health is in the process of commercializing the product.

No user reports are available on these two devices.

Procurement

Continuous availability of core essential resuscitation commodities is key to saving infant lives; yet worldwide, supply is inconsistent. There is a strong need to look into appropriate, sustainable procurement strategies to improve availability and care.

Often, commodities are provided to LMICs through donation. Some LMICs do procure commodities, but many lack standardized guidelines for procurement.

In addition, some countries have the capacity to manufacture some commodities. India, for example, manufactures self-inflating bags and masks and suction machines with single-use disposable catheters. In this instance, government agencies, hospitals, and other organizations have the ability to procure items based on tenders; buyers generally choose devices that are more economical. Therefore, a variety of devices are seen in Indian delivery rooms (Figure 10). However, it is important to consider that many LMICs, including India, lack fully integrated quality control regulations for device manufactures, and therefore may be erratic.



Figure 10. Locally manufactured resuscitators of varying sizes in a hospital delivery room in India. Photo: Indira Narayanan.

PATH developed a procurement toolkit to help with the quantification of commodity needs, development of effective procurement plans, and writing specifications for national tenders. It provides information on where and how to procure quality-assured neonatal resuscitation commodities and addresses international shipping considerations.⁴⁴

Markets

Markets are also a key component in improving access and supply. PATH has produced several reports to help leaders understand and shape markets to promote rapid scale-up and increase affordable and effective distribution, particularly in LMICs. This includes, but is not limited to, a global landscape analysis, *Shaping the Market for Neonatal Resuscitation Equipment 2014*, which explored the availability and accessibility of resuscitation devices in several key regions.⁴⁵ Among other findings, the report concluded that in addition to cost, inadequate quality and design

of some devices could present challenges to the development of strong markets, and effective and widespread distribution. It was noted that many countries lacked consistent purchasing standards or distribution channels. A subsequent market assessment by the Southern African Development Community and Economic Community of West Africa States countries also highlighted a strong need for high quality, affordable and reusable resuscitation devices.

Maintenance

Adequate reprocessing (cleaning and disinfection) of reusable medical equipment between use in different babies is essential to preventing unintentional infections. Devices used for resuscitation can be exposed to fluids and blood from a mother and infant; without proper reprocessing between uses, devices can pose a health risk to other babies and possibly to health care providers.

In high-resource settings, both bags and masks, and suction devices are generally disposable or single use items, so reprocessing is not needed. However, procuring single-use devices can be costly, particularly for LMICs. Due to this limitation, it is necessary for devices to be re-usable; therefore, devices require reprocessing.

Reprocessing presents unique challenges in LMICs. Effective reprocessing is a multi-step process, that includes decontamination (pre-cleaning), cleaning, disinfection (that may include high-level disinfection, such as boiling or steaming, or sterilization with the use of an autoclave or a chemical such as glutaraldehyde), and proper storing of reusable medical equipment. Much care has to be taken during this process. For example, once the device is taken apart, it is important to keep track of many small pieces, such as valves, that are crucial to proper function. Lost pieces may present significant challenges, especially if devices are in limited supply or are time-consuming to procure. In addition, the laborious cleaning process can itself pose challenges. In particular, health care providers may lack the motivation to carry out the steps correctly in order to maintain quality procedures. Improper reprocessing can also damage the product.⁴⁶ For example, the bag may develop depressed areas that may prevent it from “bouncing back” (re-inflating) effectively after being squeezed. The translucent suction bulb may become opaque (Figure 11). These issues must be kept in mind when ordering commodities; it is necessary to keep some additional stock on hand to account for damage or wear during reprocessing.

To alleviate these challenges, user-friendly reprocessing guidelines for health care providers could ensure proper reprocessing of all components. PATH, with support of experts in the Newborn Resuscitation Working Group, led the development of the Reprocessing Guidelines for Basic Neonatal Resuscitation Equipment in Resource-Limited Settings. The guidelines focus on the reprocessing of basic neonatal resuscitation equipment to support Helping Babies Breathe program implementation. The guidelines contain an overview of reprocessing materials and equipment, space planning and workflow, detailed step-by-step

disinfection instructions, training and supervision considerations, and further considerations for health facility administrators and MOH officials.⁴⁷

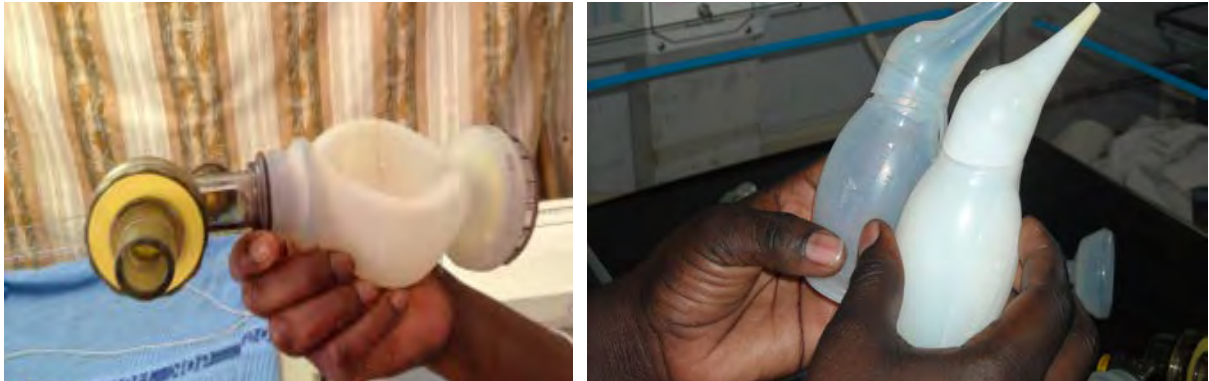


Figure 11. Damage due to improper reprocessing. Photo: Pegeen Eslami, Sherri Bucher.

Monitoring and evaluation

As in all health areas, efforts to improve and scale neonatal resuscitation benefit from, and require, adequate M&E, including high-quality and consistent data collection, compilation, sharing and use for improving program implementation. Particular concerns for neonatal resuscitation include improving effective and safe service coverage, a goal that can only be assessed and reached with proper M&E, and documenting specific indicators so that health leaders, implementers, and health care providers can assess the value and impact of programs, and make adjustments to save the lives of more babies.

Coverage

Coverage of basic resuscitation constitutes an extremely important component of program implementation, but also presents a number of challenges. To have an adequate impact on neonatal mortality, it is essential that correctly implemented basic resuscitation activities reach high coverage in countries where they are implemented, and that available information and data are documented appropriately. Coverage can be defined through a number of indicators that include but are not limited to the proportion of health care providers trained and supervised/mentored, availability of functional equipment, proportion of babies reached, taking into account equity issues, and outcomes.

In several countries, occurrences of birth asphyxia are noted on national-level HMIS reporting forms. However, documentation of the approach health care providers take to manage the condition is lacking. Initial documentation takes place in the delivery room register, yet as noted

above, many babies in need of significant support are referred to another site (often a larger hospital). Further, even when babies are born in the hospital, they are often taken to a special care infant unit. This overlapping care makes it difficult to record or obtain meaningful data on health outcomes, or to make meaningful connections between a baby's initial status, actions taken, and outcomes, without duplicating or missing data.

The Every Newborn Action Plan (ENAP) has recommended neonatal resuscitation coverage indicators that are in the process of being validated by a number of partners. Prior to this, there were some globally recommended, standardized coverage indicators for newborn resuscitation, but without the validated indicators there was a lack of accurate, reliable data on the coverage of basic resuscitation at the national level in LMICs, and comparable data across these countries. What little outcome data are available relate to special, well-controlled field trials and to select programs that have been implemented with established M&E plans to ensure data documentation.²⁹ Further, even among those programs which collect data using survey tools—the Demographic and Health Surveys Service Provision Assessment (DHS/SPA) and the World Health Organization Service Availability and Readiness Assessment (WHO/SARA)—the information collected has focused on facility readiness, rather than on actual implementation of neonatal resuscitation and outcomes.⁶

Ultimately, correct documentation of relevant neonatal resuscitation data is lacking. Equally lacking is the review and use of data to improve quality of services. Many reports provide “numerator” data, that is, just the numbers of health care providers trained or health facilities equipped in a particular program or area. This does not give an accurate depiction of the proportion or extent of coverage of neonatal resuscitation. To obtain that information, it would be necessary to compare the numerator, the number of health workers trained, to the denominator, the total number of health workers in the area (for example). This would provide true coverage data; i.e., proportion of workers trained in relation to overall population of workers needing training.

Indicators

It is important to identify key indicator(s) that are likely to reveal whether or not existing program approaches are having an impact on mortality. For example, data on numbers of skilled birth attendants trained, and even the proportion of all attendants trained, may not actually correlate with decreases in neonatal mortality. That is to say, correctly implemented, competency based training may improve health care provider's skills at the end of the course, but does not necessarily translate into retention, true improvement of skills, or quality of care. Nor do these numbers indicate whether an adequate proportion of targeted clients (babies) are actually receiving services in a timely manner.

To address these challenges, the ENAP Metrics Working Group has been looking into identifying key indicators.⁴⁸ The process has been further strengthened through the WHO consultation on newborn health indicators.⁴⁹ Notably, these efforts have primarily provided recommendations. The indicators need validation and are not yet incorporated into country HMIS's. Key ENAP indicators are noted in Table 3.

In addition, WHO is in the process of developing standards for quality of care for facility-based maternal and newborn care around the time of childbirth based on their quality of care framework.^{48,49}

Table 3: Every Newborn Action Plan Metrics—Key Indicators⁴⁸

Proposed newborn resuscitation coverage indicator
Numerator: Number of newborns that were not breathing spontaneously/crying at birth for whom resuscitation actions (stimulation and/or bag and mask) were initiated.
Possible denominators:
<ul style="list-style-type: none"> • Live births in the facility. • Total births in the facility (including stillbirths). • Estimated births (live or total).
(The indicator on neonatal resuscitation is included in the ENAP set of indicators under the category “ Gaps in coverage definitions and requiring validation and feasibility testing for HMIS use” and “Indicator requiring additional testing to inform consistent measurement”)
Proposed newborn resuscitation process indicator: This indicator relates to documenting facility readiness to deal with a newborn that requires resuscitation
Numerator: The number of facilities with a functional neonatal bag and two masks (sizes 0 and 1) in the labor and delivery service area.
Denominator: The number of facilities with inpatient maternity services that are assessed

Available data

Very limited data are available from countries related to the above indicators. Some data from select individual projects on the percentage of babies successfully resuscitated (an indicator recommended in the 2011 HBB Implementation Guide), is reproduced in Table 4.⁶

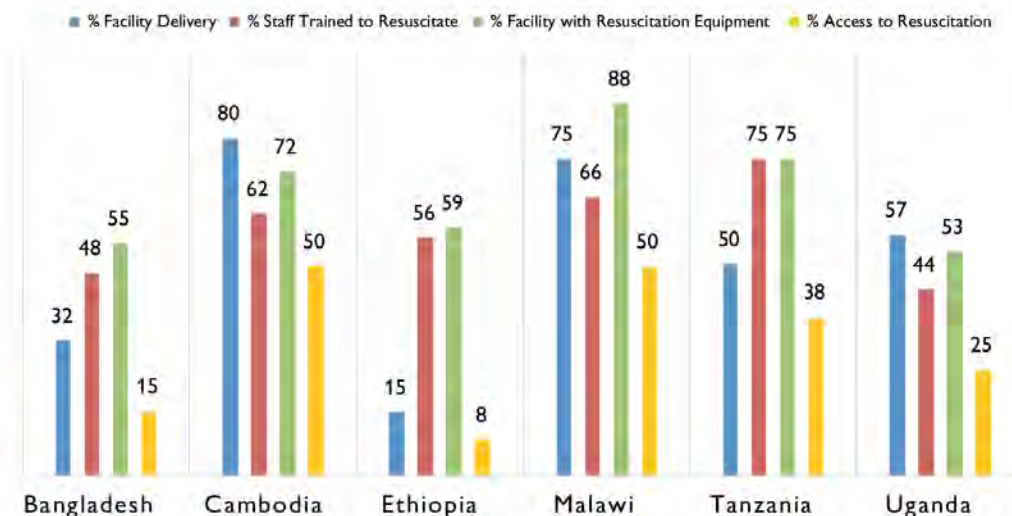
Table 4: Babies successfully resuscitated by country⁶

Bangladesh	79%
Ethiopia	85%
India (MCHIP site)	84%
Malawi	84%
Uganda	84%
Zambia	85%
Zimbabwe	89%

However, there are some challenges to evaluating successful resuscitation appropriately. Although the initial step of drying is very important, there may be an element of over-reporting the occurrence and outcome of birth asphyxia when the recovery takes place just following the initial drying.

Some stakeholders hypothesize that revival with bag and mask ventilation is in fact a more specific indicator, but there are no published data on its validity. Further discussion and evaluation may be required to determine a more objective and correct definition for successful resuscitation.

Because data related to actual “coverage of resuscitation” may be challenging to procure, the evaluation of facility readiness through the DHS/SPA and the WHO/SARA indicators, including the proportions of facility deliveries, staff trained in resuscitation, and facilities with the necessary equipment, along with access to resuscitation, can provide useful information on preparedness.⁵⁰ At the same time, and as noted above, service availability does not equate to coverage. A few examples from selected countries is shown in Figure 12.



Note on Access to Resuscitation: Staff trained adjusted for coverage of babies born in health facilities. Bangladesh Service Provision Assessment Survey 2015. National Institute of Population Research and Training (NIPORT), Mitra and Associates, and ICF International. Malawi Service Provision Assessment Survey 2013-2014. Malawi Ministry of Health and ICF International. Training data is based on MOH HBB program report. Cambodia, Ethiopia, and Tanzania data are based on 2015 HBB program reports from the respective Ministries of Health

Figure 12. Facility readiness and access to resuscitation in selected Countries⁶

Recommendations

Worldwide, there is growing interest in and commitment to expanding basic neonatal resuscitation to decrease neonatal mortality. Despite tremendous progress, focused efforts in several key areas can further accelerate and improve service provision to save more lives. Recommendations for each of these areas are provided below.

- **Advocacy.** While interest in basic resuscitation has increased significantly, it is still necessary to continue advocacy efforts at the global, regional, and country level.
- **Country ownership.** It is important to continue to pursue a country-led, country-coordinated and donor-driven approach. These components have demonstrated strong results in countries that have expanded basic resuscitation activities. Advocacy also needs to be in place to increase a country's own government funds, to the extent feasible. Committing some of their own funds may serve to increase their commitment to ensure that efforts run well. South-to-south collaboration between these countries can also provide additional benefits.
- **Effective policies, standards, and health management information systems.** Although all of these elements are important, there is a need for particular focus on including feasible, useful, and validated indicators in HMIS (including DHIS2). There is a need to improve the collection and transmission of reliable data, and ensuring proper review of the data with suitable feedback and actions for quality improvement. Proper utilization of data trends is one of the most effective approaches to monitor and improve quality at all levels.

- **Procurement and supply.** In addition to the procurement challenges noted above, it is also important to note that in a number of low-resource countries, resuscitation devices and other key tools (such as training manikins) are imported and are often processed through donors. This can cause considerable delays, attracting additional customs duty expenses. Facilitation through donor agencies is often sought to expedite customs clearance.

Ultimately, each country needs to establish a standard method to acquire devices. As these products are lifesaving, it is essential to attempt to procure a waiver for customs duty wherever feasible. Unlike single-use items and medication, as noted above, problems such as stock-outs have not been a major challenge for essential resuscitation commodities. However, as quality of care improves (with additional emphasis on reprocessing of the devices after use), care should be taken to order enough devices to permit effective application of the procedure and replace those damaged through repeated or inappropriate handling and reprocessing. This is particularly relevant in smaller health centers, where there may be only one self-inflating bag available.

- **Pricing and supply security.** Concerns around pricing and supply security have prompted global market shaping efforts to introduce a greater number of low-cost and high-quality resuscitation products into markets. These efforts require a stringent focus on quality and require resuscitation products meet global standards. For example, the Clinton Health Access Initiative has negotiated long-term pricing agreements with resuscitator and manikin manufacturers to increase access to buyers in LMICs.⁵¹
- **Integration of programming.** Most governments prefer an integrated resuscitation program. In fact, while the HBB program was primarily initiated as vertical activity, over the years it has become integrated with additional components, such as Essential Care for Every Baby, Essential Care for the Small Baby, and Helping Mothers Survive (including Bleeding at Birth activities and Integrated Management of Neonatal and Child Illness). However, the integration of too many components can pose a challenge to implement efforts effectively.

In addition, government programs, including Tanzania, (noted above under government partnerships related to HBB GDA) have seen successes with an adaptable HBB integration plan. This success suggests that a flexible approach may work well.

- **Quality of care.** With the introduction of HBB and establishment of the HBB GDA, training courses have expanded to cover large numbers of skilled birth attendants in many countries. It is now even more essential to ensure that the quality of care received by babies is truly adequate and is appropriately documented. Innovative methods are needed to improve supportive supervision and mentoring, and to find ways to replicate outcome results of research studies in programmatic implementation.
- **Prevention of infection.** Prevention of infection applies not just to reprocessing, but also to the steps of resuscitation including, appropriate care of the mother, procuring clean water, and hand washing. Although emphasis is given to the correctness of the resuscitation process, very little stress is placed on these other components during training and in follow-up supervision and mentoring. Preventive care during all phases of resuscitation and in reprocessing must be covered consistently. During the HBB training (including in objective structured clinical examinations), it would be worthwhile to determine the following points:
 - “Was the procedure carried out correctly?”

- “Was the procedure carried out in such a manner that it was less likely to have conveyed infection?”

The risk of nosocomial infection (including with resistant organisms) is a growing threat, particularly as facility deliveries increase.

- **Access to resuscitation.** To have a strong impact on mortality, it is important to ensure that the caregiver and facility management can provide high-quality services, as well as ensuring appropriate coverage. Addressing equity issues will constitute an important component of ensuring adequate access. Access to newborn resuscitation is a major problem where there are still a significant number of home deliveries. For example, in Bangladesh, around 70 percent of births take place in the home or in the community. For this reason, community-based skilled birth attendants were included in the HBB training (see Appendix 5, case study on Bangladesh).

Interestingly, an evaluation by the International Centre for Diarrheal Disease Research, Bangladesh showed that there was no improvement in skills among community health skilled birth attendants, as compared those in health facilities. In fact, the report concluded that training such workers would not have an impact on the outcome of cases of birth asphyxia among the large number of home births. This finding was surprising because based on the same evaluation, initial drying and clearing of airways seemed to have been used more frequently and there was an actual decrease in bag and mask ventilation.⁶ These findings require further evaluation in order to determine efficacy but also to further understand home deliveries. It is possible that other factors may play a role in negative outcomes, such as the community worker not reaching the home in time to assist in the delivery and post-delivery process. At present, the primary focus of newborn resuscitation activities has been at the facility level. Expansion to home deliveries has taken place to a limited extent through special studies; more evidence is required on effectiveness and safety in programmatic activities at the home/community level.

- **Implementation at scale.** To have an adequate impact on neonatal mortality, it is essential that interventions such as basic neonatal resuscitation and health system strengthening within the reproductive, maternal, newborn and child health framework, is implemented at scale. Although vertical implementation may achieve more extensive coverage of service provision of basic resuscitation, it also requires a balanced approach. Many governments are, in general, more interested in integrated programs. Although controlled field trials often have a significant impact on neonatal mortality, introduction into regular large-scale country programs may be influenced greatly by existing system-wide challenges.
- **Quality of life, follow-up of survivors, and prevention and management of disabilities.** In LMICs where neonatal mortality is high and where significant challenges exist in reducing the number of deaths, addressing disabilities may seem ambitious. However, every child deserves the chance to realize his/her full potential.

Prevention may at times be more feasible than management of disabilities. It is necessary for health care providers and stakeholders to review current procedures to identify potentially harmful steps or actions. One example noted above, is the decision to transport an infant who is not breathing properly to a referral center with non-optimal support during transport. In

addition, research studies on resuscitation should, where feasible, include follow-up evaluation to assess infants' development into the future.

- **Research.** Continued research in the area of basic resuscitation, including evaluation of the newer devices, validation of key indicators, and innovative methods for supportive supervision and mentoring can help to improve quality of care and outcome. Priorities will need to be determined in countries based on individual needs.
- **Innovations.** Challenges exist in making resuscitation safe and effective, especially among preterm babies, continued interest and investment in more innovations is essential to bring simple, efficient, safe, and cost-effective products to markets.

Select country experiences

Case histories from several countries are presented in the 2015 HBB report *Helping Babies Breathe: Lessons learned guiding the way forward*.⁶ Tables with salient features of selected case histories are provided in the appendix. Regions covered include Africa (Kenya, Malawi, Tanzania, and Uganda), Asia (Bangladesh and India), and the LAC region (Colombia and the Dominican Republic).

Appendix

Appendix 1: Africa—Kenya. Select Information on Basic Neonatal Resuscitation (HBB)⁶

1.	Country Statistics
	<ul style="list-style-type: none"> Gross national income (GNI) per capita: US\$1,290.⁵² Deliveries by skilled birth attendants (SBAs): 61%. Neonatal mortality rate: 22 per 1,000 live births. Proportion of neonatal deaths due to birth asphyxia: 33%.
2.	Policy/Strategy Planning
	<ul style="list-style-type: none"> The United States Agency for International Development's (USAID) Maternal and Child Health Integrated Program (MCHIP) facilitated stakeholder meetings to coordinate activities across multiple resuscitation programs in Kenya. Through consensus, Helping Babies Breathe (HBB) was selected as the main program for basic neonatal resuscitation and was incorporated into the updated essential newborn care (ENC) guidelines. An additional meeting in July 2013 brought together a large number of global and national partners to support appropriate planning for the rollout of HBB and the ENC guidelines. HBB tools were translated into Swahili.
3.	Implementation
3a.	Training
	<ul style="list-style-type: none"> In 2006 training was initially focused on physicians with the more advanced resuscitation course, Neonatal Resuscitation Program. Basic resuscitation was initiated between 2007 and 2009 following the World Health Organization (WHO) guidelines on ENC. HBB training, after field-testing, was commenced in 2010 and included nurse midwives along with physicians. Training has been implemented by a large number of partners and stakeholders working with the government, including the American Academy of Pediatrics (AAP), Amref Health Africa, Kenya Medical Research Institute, Kenya Pediatric Society, Moi University School of Medicine, Indiana University School of Medicine, National Resuscitation Council of Kenya, and University of Nairobi and USAID/ASSIST, to name a few.
3b.	Quality
	<ul style="list-style-type: none"> A quality improvement and continuous monitoring initiative was commenced to support HBB by the Global Network for Women's and Children's Health Research. Improvement of basic newborn resuscitation as part of a comprehensive maternal and newborn care package was also supported by USAID/ASSIST through improving institutional partners' QI capacity (five US Government partners) and direct improvement interventions in five counties of Kenya (46 sites total). As the result of direct improvement support at seven sites, successful resuscitation improved from 86% in January 2015 to 89% in November 2015.
3c.	Commodities for Resuscitation
	<ul style="list-style-type: none"> While commodities for resuscitation have been procured, there is still a significant shortage in the supply to facilities, even in areas where the HBB training has already been carried out. USAID-implementing partners, including ASSIST, have been helping to provide commodities.
3d.	Recording and Reporting System
	<ul style="list-style-type: none"> Collaborative partners at Indiana University School of Medicine and Moi University School of Medicine, with funding by a grant from the Laerdal Foundation for Acute Medicine, have developed a mobile-phone-based data-collection system, called mHBB.⁵³ Key indicators related to neonatal resuscitation are not included in the country's health management information system (HMIS).
3e.	Evaluation

	<ul style="list-style-type: none"> While individual organizations maintain their records, there are no consolidated data available on newborn resuscitation.
4.	Institutionalization
	<ul style="list-style-type: none"> Involvement of the government and inclusion of HBB in a number of national policy documents is a step in the right direction, but additional work is required to strengthen these components. Key indicators are not a part of the HMIS and data-collecting tools, too, have yet to be developed and disseminated adequately.
5.	What Worked Well
	<ul style="list-style-type: none"> With facilitation from the HBB Global Development Alliance and other partners, HBB has been well received by the government. A strong research program has been established in this area. HBB activities have promoted further interest into other components of ENC.
6.	Challenges
	<ul style="list-style-type: none"> Inadequate budget for the HBB training courses. High rates of staff turnover. Shortage of trainers and mentors. In-service training and follow-up have faced problems due to health system issues and health worker strikes. Slow integration with pre-service education. HBB is implemented only at the facility level and does not reach areas where there are very few health centers.
7.	Lessons Learned
	<ul style="list-style-type: none"> An inclusive approach with and coordination between the various stakeholders is more conducive to developing consensus and a wider, better implementation of HBB activities. Addressing preservice education effectively is also important. Currently, with funding from Johnson & Johnson and technical assistance from the AAP, Amref Health Africa is implementing HBB in Nairobi County, and employing deliberate strategies to link and integrate the HBB program with the preservice training curricula of local universities, and medical and other teaching colleges for health workers. Documenting service delivery with appropriate indicators related to newborn care, including HBB, is important and should be a part of the HMIS/District Health Information System (DHIS2). More consistent and creative approaches are needed to promote adequate, supportive supervision and mentoring.

Appendix 2: Africa—Malawi. Select Information on Basic Neonatal Resuscitation (HBB)⁶

1.	Country Statistics
	<ul style="list-style-type: none"> • GNI per capita (2012): US\$250⁵² • Deliveries by SBAs: 71.4% • Neonatal mortality rate: 29 per 1,000 live births • Proportion of neonatal deaths due to birth asphyxia: 28%
2.	Policy/Strategy Planning
	The Ministry of Health (MOH) has incorporated HBB into national policy and strategy documents, such as the Reproductive Health Strategy 2011–2016, Road Map for Accelerating the Reduction of Maternal and Neonatal Morbidity and Mortality Rates 2012, Integrated Maternal and Newborn Health Training Manual, and the obstetric protocols.
3.	Implementation
3a.	Training
	<ul style="list-style-type: none"> • A plan for implementation at scale was developed in March 2011. It was initiated as a vertical activity but the MOH has agreed to include it in ENC integrated with maternal and newborn health care. Major implementing partners include the MOH, MCHIP/Maternal and Child Survival Program SCUS, AAP, and Jhpiego. • Cascade training design is used for both in-service and pre-service training. Midwives constitute the main target. The aim is to train three district trainers in each of the 28 districts and 30% of the health workers in each district, covering at least one midwife in each health center conducting deliveries. • Large numbers of students have resulted in changes in the trainer-student ratio from the AAP recommended 1:4 or 1:6 to 1:10.
3b.	Quality
	<ul style="list-style-type: none"> • HBB has been incorporated into the Performance and Quality Improvement Model and also into the Integrated Maternal and Newborn Health Supervision Checklist with the aim of improving the quality of care. • The supervisory structures are based at district, zonal, and national levels, with the district health office (DHO) focused on provider skills and maintenance. DHO members and safe motherhood coordinators are expected to visit health centers on a quarterly basis to provide supportive supervision. • Trained providers are expected to pass on their knowledge and skills to other health workers in the centers (low-dose, high-frequency practice). • The efficacy of the supervision system and the quality of service has been variable across different districts and centers.
3c.	Commodities for Resuscitation
	<ul style="list-style-type: none"> • Goals: Two sets of resuscitation devices for every health facility, five per community hospital, and 10 per district/central hospital. • Initially, challenges delayed procurement by the MOH. HBB commodities were then added to the Central Medical Stores Trust to facilitate the processes. Additional support from a large number of partners (Clinton Health Access Foundation, SCUS, LDSC, AAP through Laerdal, and the United Nations Children's Fund [UNICEF]) has enabled the MOH to obtain the commodities required. However, a number arrived <i>after</i> the HBB training took place at the facilities. Further actions are needed to ensure proper distribution to the various sites.
3d.	Recording and Reporting System
	<ul style="list-style-type: none"> • Relevant data are not maintained in conventional delivery room registers.

	<ul style="list-style-type: none"> • HBB registers have been introduced to capture required data. • Indicators on management of asphyxia have been introduced into the HMIS. • Supervision is needed to strengthen this activity due to its many challenges.
3e.	Roll Out
	<ul style="list-style-type: none"> • HBB is being implemented at each facility in all the districts. Sixty percent of the 1,763 health workers have been trained. Due to staff attrition, the number of trained staff may now be lower.
3f.	Evaluation
	<ul style="list-style-type: none"> • An overall improvement was observed in provider knowledge, presence of equipment, and general management of births and ENC. • Districts were divided into three dose groups (low, medium, and high) based on a scoring of 16 items related to training, practice, supervision, and availability of equipment and supplies for newborn care. There were no differences between intervention and control groups in each of the three dose groups. This was probably due to the rapid rollout; challenges with appropriately trained staff; and logistics, management, and delayed supply of equipment. • Eighty-eight percent of the facilities are now provided with resuscitation commodities and 33% of SBAs are trained in basic neonatal resuscitation. As 75% of births take place in facilities, an estimated 35% of the newborns have access to resuscitation (2013–14 DHS/SPA survey). More recent data suggest that 66% of SBAs are trained and around 50% of the babies have access to resuscitation.
4.	Institutionalization
	<ul style="list-style-type: none"> • HBB has been incorporated into relevant national-level policy documents and training manuals. • A focal person has been appointed at the DHO to oversee the HBB activities in collaboration with the Safe Motherhood Coordinator. HBB is also part of the District Implementation Plan and the preservice training curriculum.
5.	What Worked Well
	<ul style="list-style-type: none"> • Country ownership, a positive relationship between the MOH and the donor, active involvement of the local implementers and stakeholders, high-profile advocacy events, active local champions, and coordination between partners.
6.	Challenges
	<ul style="list-style-type: none"> • Rapid implementation that was not phased resulted in inadequate resources at the district level which affected quality of services. • Delay in procurement of equipment resulted in staff who were trained in resuscitation but did not have the commodities to implement the activities. • Monitoring and evaluation (M&E) tools such as HBB registers were not available when HBB was rolled out.
7.	Lessons Learned
	<ul style="list-style-type: none"> • Besides training, good coordination in planning and implementation is essential for supply of equipment, along with availability of M&E tools, and feasibility of plans for the roll out of supervisory/mentoring activities. • An inclusive approach in managing key partners/stakeholders is necessary for a more effective program implementation.

Appendix 3: Africa—Tanzania. Select Information on Basic Neonatal Resuscitation (HBB)⁶

1.	Country Statistics
	<ul style="list-style-type: none"> • GNI per capita: US\$930⁵² • Deliveries by SBAs: 51% • Neonatal mortality rate (2013): 21 per 1,000 live births • Proportion of neonatal deaths due to birth asphyxia: 31%
2.	Policy/Strategy Planning
	<ul style="list-style-type: none"> • HBB was the first basic resuscitation program in the country and was part of a government-led national plan. • Pre-implementation consensus was achieved between key stakeholders/partners. • After the results of a pilot program and eight research implementation sites, CIFF supported rollout through the MOHSW. • Initially, HBB was intended to be implemented as a part of the EmONC activities. However, it was rolled out separately to facilitate a quicker implementation. • The program received strong support from development partners (UNICEF, WHO, the Laerdal Foundation, LDSC, CIFF, and Jhpiego) to achieve a donor-driven, government-led, country-wide rollout, region by region, in all 16 regions and 108 districts of the mainland. • Funding/budget was decentralized in the councils where newborn health was a priority. • The HBB curriculum was adapted with translation into the local language (Swahili) and pictures were changed to resemble Africans and then it was linked with ENC.
3.	Implementation
3a.	Training
	<ul style="list-style-type: none"> • In-service cascade training targeted all cadres of care providers in labor and delivery rooms in hospitals and health centers in both public and private sectors. • Implementation was supported by CIFF, Jhpiego, Laerdal, LDSC, UNICEF, , USAID, and WHO • Preservice training focused on nursing tutors from both public and private sectors.
3b.	Quality Improvement
	<ul style="list-style-type: none"> • High-dose, high-frequency refresher on-the-job training and supportive supervision were provided four to six weeks after initial training. In the follow-up, practice on manikins with trained providers was carried out before each shift and documented.
3c.	Commodities for Resuscitation
	<ul style="list-style-type: none"> • Commodities for resuscitation were procured through the government, CIFF, Jhpiego UNICEF and WHO. • Distribution was facilitated by the government Medical Stores Department and private companies. • More than 3,300 public and faith-based facilities have been supplied.
3d.	Recording and Reporting System
	<ul style="list-style-type: none"> • Facilities have been supplied with registers, tally sheets, and monthly summary templates. • Data from health centers is sent to the district level (DHIS2).
3e.	Evaluation
	<ul style="list-style-type: none"> • HBB rollout was commenced in 2013. DHS/SPA results indicate that while the facility deliveries have remained at 50% in 2012 and 2015, staff trained in resuscitation increased from 20% in 2012 to 75% in 2015, facilities equipped with resuscitation commodities increased from 21% to 75%, and access to resuscitation increased from 10% to 38%.
4.	Institutionalization/Sustainability

	<ul style="list-style-type: none"> • HBB is a national program with oversight by a team in the MOHSW sponsored by Jhpiego. • After full roll out of HBB activities, HBB will be integrated with ENC and EmONC • HBB indicators have been included in the country HMIS.
5.	What Worked Well
	<ul style="list-style-type: none"> • Full country ownership and high-level commitment were key supportive factors. • The resuscitation equipment is procured from the government Medical Stores Department. • QI for HBB through clinical mentoring is a priority for the government. • Nurse tutors involved in preservice education have been trained. • Newborn resuscitation is included in the pediatric treatment guidelines, currently being updated by the Pediatric Association of Tanzania.
6.	Challenges
	<ul style="list-style-type: none"> • Resuscitation commodities have not yet been supplied to all the facilities. • Changes in the preservice curriculum have not yet been completed and need additional resources. • HMIS data have challenges related to data quality/accuracy and completeness.
7.	Lessons Learned
	<ul style="list-style-type: none"> • Ownership of the program needs to extend from national to regional and district levels. • Coaching and mentoring of health care providers need to increase further through existing supervisory systems. • A short training program such as HBB is readily accepted by health workers.

Appendix 4: Africa—Uganda. Select Information on Basic Neonatal Resuscitation (HBB)⁶

1.	Country Statistics
	<ul style="list-style-type: none"> • GNI per capita: US\$680⁵² • Deliveries by SBAs: 57%⁵⁴ • Neonatal mortality rate: 27 deaths per 1,000 live births • Proportion of neonatal deaths due to birth asphyxia and birth trauma: 28%
2	Policy/Strategy Planning
	<ul style="list-style-type: none"> • HBB was the first basic resuscitation program initiated in Uganda. • It has been integrated with ENC, Essential Care for the Small Baby, and Care of the Sick Baby (HBB plus). • Commodities have been included into in the Essential Medicine/Equipment List. • Equipment is transferred to National Medical Stores for distribution to sites. • HBB plus is included in major policy planning documents (Health Sector Strategic Plan, Child Survival Strategy, the Reproductive Maternal Newborn and Child Health Plan, A Promise Renewed), QI guidelines (newborn service standards and IMNCI supervision guidelines), community health worker guidelines, M&E tools (HMIS, Indicator Manual for Newborn Quality of Care, and Mother Child Passport), and Commodity Quantification Guidelines—developed by PATH for the UN Commission for Life Saving Commodities. HBB Plus is facilitated by the Newborn Steering Committee and other key development partners (World Bank, UNICEF, WHO, AAP, SCUS, MSH/Strides for Family Health, URC/Saving Mothers Giving Life). • Budget for HBB plus is included in the MOH budget tool, but currently most of the funding is through the development partners.
3.	Implementation
3a.	Training/Capacity Building
	<ul style="list-style-type: none"> • HBB plus has been implemented in two districts (Luwero and Masaka) through USAID/HCI and has been expanded further through additional partners. • It is primarily a workshop-based training but attempts are being made to change the mentoring approach. Project staff provide some mentorship after training. Trained district health workers can provide this support once in three months. • Organizations that trained health workers include SCUS (114), World Vision (31), and Healthy Child Uganda (92). Public and private sectors have been included in the program. • HBB plus has been included in the Saving Mothers Giving Life program and is supported by the USAID/ASSIST program in 118 facilities in six districts in North Uganda. • PATH in collaboration with Uganda MOH conducted a pilot introduction of the reprocessing guidelines through a training workshop in August 2016
3b.	Quality
	<ul style="list-style-type: none"> • Training in QI is being planned for HBB plus mentors and selected members of professional bodies and partners. • A QI tool with indicators has been developed along with one for supportive supervision. • Emphasis is being placed on supportive supervision/mentoring commencing two weeks after the initial training to improve quality of care.
3c.	Commodities for Resuscitation
	<ul style="list-style-type: none"> • PATH developed a quantification tool and tested the tool in two countries, Tanzania and Uganda, before finalization in 2016. • Resuscitation commodities will be procured through the World Bank Systems Project in collaboration with the MOH.

3d.	Recording and Reporting System
	<ul style="list-style-type: none"> A manual of M&E and quality indicators and associated tools are being developed for application at all levels of the health care system.
3e.	Evaluation
	<ul style="list-style-type: none"> Mapping of areas covered by 18 partners has been carried out showing initiation of HBB plus in 62 of the 112 districts (55%) including 350 out of the total 2,671 facilities in the 62 districts (35% health-facility coverage). Twenty-seven percent of these facilities have designated functional resuscitation areas. The 2013 Service Availability and Readiness Assessment (SARA) indicates that 44% of the health workers are trained, 53% of the facilities have the resuscitation commodities, and 25% of the newborns have access to resuscitation. In two districts (Luwero and Masaka) in which the collaborative method of QI has been implemented by HCI, health workers attended more than 1,000 births, among which 8% of the babies did not breathe at birth. Out of these, 84% were noted to have been successfully resuscitated. USAID/ASSIST has reported improved neonatal resuscitation practices in Northern Uganda with successful outcomes increasing from 63% in February 2015 (19 sites) to 90% in November 2015 (20 sites).
4.	Institutionalization
	<ul style="list-style-type: none"> The commitment of the MOH to include HBB plus in all the relevant policy documents and guidelines/standards and in both in-service and preservice education, and to lead and coordinate the various development and implementing partners has laid a good foundation for sustainability. Further expansion of quality services is being planned along with improving the preservice curriculum.
5.	What Worked Well
	<ul style="list-style-type: none"> Early involvement of and ownership by the country government has helped to promote activities. A number of partners are interested and involved in these activities. Initiation of QI in several districts relatively early in the program has highlighted the country's interest in improving services.
6.	Challenges
	<ul style="list-style-type: none"> Activities are government-led and coordinated, but still primarily donor-driven. There have been delays in distribution of the resuscitation commodities. QI processes are not always implemented to the extent required. Documentation and review of results with feedback are inadequate.
5.	Lessons Learned
	<ul style="list-style-type: none"> Involvement and coordination of the government, private sector, and professional bodies are essential. Collaborative meetings of teams in facilities help support quality, ownership, and sharing of experiences and information. A functional Newborn Steering Committee and a national-level newborn health coordinator facilitate and support HBB plus. Commodities must be supplied along with or soon after the training.

Appendix 5. Asia—Bangladesh. Select Information on Basic Neonatal Resuscitation (HBB)⁶

1.	Country Statistics
	<ul style="list-style-type: none"> • GNI per capita: US\$1,080⁵² • Deliveries by SBAs: 32% • Neonatal mortality rate: 32 per 1,000 live births • Proportion of neonatal deaths due to birth asphyxia: 23%⁵⁵
2.	Policy/Strategy Planning
	<ul style="list-style-type: none"> • After a pilot evaluation in 2010 facilitated by USAID/MCHIP, a national scale-up was planned through multiple stakeholder meetings and the HBB rollout was included in the national work plan in 2011. • HBB has been incorporated into national policy, strategy, and planning documents. It has also been incorporated into program implementation plans such as the Health Population Nutrition Sector Development Program and the Standard Operating Procedures of Newborn Care Services at Primary and Secondary Level Facilities. HBB is in the process of being included in Maternal Health Strategy. • A HBB scale-up plan has also been developed with the support of MOHSW, USAID/MCHIP, SCUS, UNICEF, Bangabandhu Sheikh Mujib Medical University (BSMMU) and International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B).providing funds and in-kind assistance for training, commodities, and follow-up supervision.
3.	Implementation
3a.	Training
	<ul style="list-style-type: none"> • HBB was the first basic resuscitation program introduced into the country. • It has been adapted for the local context, including translation into Bengali and integration into Essential Care for Every Baby. • A cascade approach was employed, covering SBAs initially in the public sector, but subsequently including the private sector to potentially increase impact.
3b.	Quality
	<ul style="list-style-type: none"> • Supervision targets district and sub-district levels and has been linked fully with monitoring and evaluation including development of checklists. Two versions of the checklists are available, a simpler one for the supervisors and a more detailed one for the trainers.
3c.	Commodities for Resuscitation
	<ul style="list-style-type: none"> • All public-sector facilities have been supplied with resuscitation commodities estimated to be sufficient for programs until 2016.
3d.	Recording and Reporting System
	<ul style="list-style-type: none"> • Monitoring is closely linked with and is an integral part of QI and supportive supervision. • HBB has been implemented in 64 districts with 100% coverage that primarily includes training of 24,460 SBAs, an estimated 95% of the government SBAs (February, 2014).
3e.	Evaluation
	<ul style="list-style-type: none"> • No HBB indicators have as yet been incorporated into the country HMIS. • Any data currently reported are part of the programs implemented by the various organizations. • An independent International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B) evaluation of 7,138 births and follow-up of 221 trained health workers showed an increase in the practice of drying and suctioning, a decrease in bag and mask ventilation, and improved performance in high-volume facilities and in HBB-trained providers compared to other health workers. There was no improvement related with the community-based SBAs. • USAID/MCHIP tracked 17,316 births in 91 facilities. Six percent of the babies did not breathe properly and among these, 79% were successfully resuscitated, 63% with only the stimulation of

	<p>drying and clearing of the airways. Only 37% required ventilation, 1% died, and 20% were referred for advanced care.</p> <ul style="list-style-type: none"> • The 2015 DHS/SPA revealed that 48% of the health workers had received training in 55% of health facilities that did not include community clinics. Based on facility births, it was estimated that only 15% of the newborns had access to newborn resuscitation.
4.	Institutionalization <ul style="list-style-type: none"> • HBB is government-led and has been or will be included in all the national policy, strategy, planning, and implementation documents and has been linked with ENC. • It is included in the preservice curriculum. • Refresher trainings are being promoted. • Tools such as the improved maternity registers are being field tested to ensure that key resuscitation indicators are ultimately included in the HMIS.
5.	What Worked Well <ul style="list-style-type: none"> • Political commitment has been strengthened by the pilot and subsequent evaluation studies. • HBB is incorporated in national guidelines and preservice curriculum • The country HBB director was appointed as chair of the National Technical Working Committee on Newborn Health that was supportive of inclusion of HBB in key newborn health programs.
6.	Challenges <ul style="list-style-type: none"> • Implementation of refresher trainings and maintenance/improvement of skills are not proceeding as well as required. • Inadequate reprocessing of equipment. • Inadequate impact at the community level in a country that has a large number of home births. • Poor coverage of the private sector. • Non-availability of equipment in the market for the private sector.
7.	Lessons Learned <ul style="list-style-type: none"> • The HBB approach was useful in improving the knowledge and skills of the health workers in conjunction with the supply of the essential commodities. • Involvement of multiple partners was beneficial in the rollout of the program. • Impact of program-dependent training is limited with inadequate follow-up, QI, refresher training, supportive supervision/mentoring, and M&E.

Appendix 6: Asia—India. Select Information on Basic Neonatal Resuscitation (HBB)⁶

1.	Country Statistics
	<ul style="list-style-type: none"> • GNI per capita: US\$1,570⁵² • Deliveries by SBAs: 46% • Neonatal mortality rate: 25 per 1,000 live births • Proportion of neonatal deaths due to birth asphyxia: 20%
2.	Policy/Strategy Planning
	<ul style="list-style-type: none"> • With the establishment of the cash incentive program encouraging facility births in 2005 (Janani Swasthya Yojana), there has been a considerable increase in facility births. • Several meetings took place involving key stakeholders including the MOH & FW, Federation of Obstetric and Gynecological Society of India (FOGSI), <u>Indian Society of Perinatology and Reproductive Biology</u> (ISOPARB), National Neonatology Forum of India (NNFi), (Society of Midwives of India (SOMI) and Trained Nurses Association of India (TNAI), to develop algorithms for neonatal resuscitation. Additionally, a training manual for newborn care including neonatal resuscitation, (<u>Navjaat shishu suraksha karyakram</u> - NSSK training manual) was adapted from the NRP manual for use in both the public and private sector. • Neonatal resuscitation has been closely linked with essential newborn care • The resuscitation program was rolled out under the aegis of the MOHFW planning to cover 10 priority states. • The government funded the public sector. For the private sector, funds were provided by agencies such as Johnson & Johnson, India.
3.	Implementation
3a.	Training
	<ul style="list-style-type: none"> • The HBB initiative was introduced through the national NSSK training program by the MOHFW, Indian Academy of Pediatrics (IAP), All India Institute of Medical Sciences (AIIMS), LDSC, and USAID/MCHIP. • Since health programs in India are primarily implemented by the states, programs were rolled out in the various states at district and sub-district levels. • The cascade method was employed and the IAP trained 1,500 district instructors in the public sector through 40 two-day courses, resulting in 65% improvement in provider skills after the training. • Health workers trained included medical officers; SBAs in labor/delivery rooms in facilities; and female health workers and auxiliary nurse midwives working in community health centers, first referral centers, and 24/7 primary health centers. • The training has been in the public sector from 2009 to 2014 and 125,691 health workers have been trained. • In the private sector, Indian Academy of Pediatrics (IAP) and National Neonatology Forum of India (NNFi) are continuing training, aiming to cover 200,000 SBAs, of which, around 50% have already been covered. Currently, the training is being implemented in 27 states. • International research projects on neonatal resuscitation, including addressing pre-service training, have been set up in selected areas, as in Belgaum, in collaboration with The Eunice Kennedy Shriver National Institute of Child Health and Human Development (NIHCD), Norwegian Agency for Development Cooperation (NORAD), the Laerdal Global Foundation, and Jawaharlal Nehru Medical College, Belgaum.
3b.	Quality

	<ul style="list-style-type: none"> Poor performance of trained health workers led to implementation of remedial measures by the government through the National Rural Health Mission (NRHM), commencing with assessment of facility readiness. Based on the findings, a three-day skills-based training was carried out followed by two days of supportive supervision, on-the-job mentoring, peer learning, use of job aids, and establishment of skills labs at facilities. Strengthening of HMIS was also initiated, including recording and reporting of key data. Follow-up, low-dose, high-frequency training/practice is being planned. USAID/ASSIST, with its expertise in QI, has provided support to a local nongovernmental organization, IPE Global, to assist in capacity building of All India Institute of Medical Sciences (AIIMS), the apex medical college in India, and the Indian Academy of Pediatrics (IAP) on QI.
3c.	Commodities for Resuscitation
	<ul style="list-style-type: none"> Resuscitation commodities are produced by local manufacturers as well as international ones such as Laerdal and Ambu. Local institutions, organizations, and donors procure these commodities according to their mandates related to obtaining tenders with decisions often based on cost.
3d.	Recording and Reporting System
	<ul style="list-style-type: none"> There are no specific indicators on basic resuscitation within the country HMIS.
3e.	Evaluation
	<ul style="list-style-type: none"> Most reports are parts of specific programs as noted above, with no large national-level data. USAID/ASSIST has been working in India since 2013 in the six USAID-supported states with a focus on improving quality across the Reproductive Maternal Newborn Child and Adolescent Health continuum in 417 facilities in all 27 USAID-supported districts. Newborn resuscitation was integrated with other components of MNH care. It led to improved documentation, care practices, and outcomes. For example, the facility-based perinatal death rate (per 1,000 births) was reduced from 24.2 in July through November 2013 to 20.7 in July through November 2015 in ASSIST-supported facilities, with a 10% reduction in stillbirths and a 30.4% reduction in neonatal deaths.
4.	What Worked Well
	<ul style="list-style-type: none"> IAP, the key large implementing organization, has access to 23,000 members. Linking a number of key partners in the rollout of the program was helpful. The Indian Neonatal Resuscitation Program- Federation of Obstetrics and Gynecology (NRP-FGM) program has a separate warehouse in Meerut, Uttar Pradesh that takes care of program logistics and supply chain management. Committed state academic coordinators and trainers are available at all levels.
5.	Challenges
	<ul style="list-style-type: none"> Low performance of health workers after the NSSK training is attributed to poor facility readiness, and overall performance in delivering newborn care. Initial difficulties existed in procuring commodities. These were resolved with the help of manufacturers such as Laerdal. The current NSSK model focuses on training that is more traditional with a “frontal repetitive style” and not on a mentoring approach. The NSSK model does not track or ensure availability of the health care provider when the baby requires aid. Nor does it monitor the quality of care. Follow-up supportive supervision is not implemented in an adequate manner.
6.	Lessons Learned
	<ul style="list-style-type: none"> Collaboration between international and national organizations and the private and public sectors was productive. The “hands-on” learning approach produced better acquisition skills as documented by post-training evaluation.

- Areas functioned better where there was maximum coordination between the partners.

Appendix 7: Latin America and Caribbean—Colombia. Select Information on Basic Neonatal Resuscitation (HBB)⁶

1.	Country Statistics
	<ul style="list-style-type: none"> GNI per capita: US\$7,970⁵²⁵² Deliveries by SBAs: 96% Neonatal mortality rate: 11.2 deaths per 1,000 live births. This is slightly higher than in the other Latin America and Caribbean (LAC) countries and with significant in-country regional variations. Proportion of neonatal deaths due to birth asphyxia: about 11%
2.	Policy/Strategy Planning
	<ul style="list-style-type: none"> HBB curriculum was introduced in 2011. The Colombian Ministry of Health and Social Protection (MSPS) and Colombian Neonatology Association (ASCON) have been instrumental in the scale-up of HBB in 26 of the country's 32 departments (81%), with special focus on needy areas made vulnerable by armed conflict or having poor geographical access to care. Additional support for facilitation and for implementation was provided by Pan American Health Organization (PAHO), USAID/MCHIP, LDSC, and the URC/HCI project. HBB was translated into Spanish and incorporated into the IMNCI guidelines and preservice curriculum in 2013. The government has sanctioned training of TBAs in regions where they are the only available birth attendants.
3.	Implementation
3a.	Training
	<ul style="list-style-type: none"> The first training of trainers took place at a regional meeting of pediatrics of the Latin American Pediatric Association (ALAPE) followed by training in 2012 of a total of 283 health care providers. This increased to 1,859 trainers and health workers by the end of 2014. There are now a total of nine master trainers, one of whom attends the HBB training sessions where the trainer-trainee ratio is 1:10. Trainees sign an agreement to carry out a minimum of two replicated trainings at the health centers. This not only expands coverage of health workers, but also enhances the skills of the original trainees as they prepare for and implement the training activity.
3b.	Quality
	<ul style="list-style-type: none"> Following initial training, health workers are provided with in-person and virtual support by Colombian Neonatology Association (Asociación Colombiana de Neonatología (ASCON).
3c.	Commodities for Resuscitation
	<ul style="list-style-type: none"> The commodities are purchased with the national budget of the MSPS supported by additional donations from organizations such as LDSC.
3d.	Recording and Reporting System
	<ul style="list-style-type: none"> Data collection tools pilot tested by USAID/MCHIP in the Dominican Republic have been introduced into Colombia but have not yet been accepted or applied.
3e.	Evaluation
	<ul style="list-style-type: none"> Indicators have not been included in the delivery room registers and in the national HMIS.
4.	Institutionalization
	<ul style="list-style-type: none"> The strong partnership between the government Ministry of Health and Social Protection (Ministerio de Salud y Protección Social) (MSPS) and Colombian Neonatology Association (Asociación Colombiana de Neonatología) ASCON and the closely-knit links with the LAC Neonatal Alliance is a good foundation for expansion and sustainability.

	<ul style="list-style-type: none"> Existence of HBB champions, Ministry of Health and Social Protection (Ministerio de Salud y Protección Social) (MSPS) and Colombian Neonatology Association (Asociación Colombiana de Neonatología (ASCON),Pan American Health Organization (PAHO), and Integrated Management of Neonatal and Childhood Illnesses (IMNCI) national trainers bodes well for continued advocacy and their active involvement offers additional support.
5.	What Worked Well
	<ul style="list-style-type: none"> The coordination and strong integration between the two main stakeholders Ministry of Health and Social Protection (Ministerio de Salud y Protección Social) (MSPS) and Colombian Neonatology Association (Asociación Colombiana de Neonatología) ASCON and their relationship with the other partners worked well to support the programs.
6.	Challenges
	<ul style="list-style-type: none"> Focus on the post-training QI and follow-up supervision/mentoring needs further strengthening. The M&E component, including suitable indicators and tools, needs to be more clearly defined and incorporated in the country HMIS.
7.	Lessons Learned
	<ul style="list-style-type: none"> Strong links with committed working partners brings strong support to implementing programs at scale.

Appendix 8: LAC—Dominican Republic. Select Information on Basic Neonatal Resuscitation (HBB)⁶

1.	Country Statistics
	<ul style="list-style-type: none"> • GNI per capita: US\$6,030⁵² • Deliveries by SBAs: 99% • Neonatal mortality rate: 21 per 1,000 live births (third highest in the LAC region, after Haiti and Bolivia). • Proportion of neonatal deaths due to birth asphyxia: 13%
2.	Policy/Strategy Planning
	<ul style="list-style-type: none"> • HBB was introduced to the USAID Mission in 2010 by MCHIP. A basic resuscitation module had been integrated with the national IMNCI guidelines. In addition, the AAP advanced NRP course was part of the national training program for hospitals with the support of AAP and LDSC between 2005 and 2012. • HBB training tools have been translated into Spanish and pictures adapted for LAC ethnicities. • Initial training of master trainers took place in Washington, DC during the launch of HBB in 2010. • The Dominican Republic Mission, LDSC, MCHIP, and AbT Associates (bilateral) supported HBB scale-up in the Dominican Republic. Additional sub-regional expansion has taken place since 2013.
3.	Implementation
3a.	Training
	<ul style="list-style-type: none"> • HBB training was included in in-service training (cascade method involving national master trainers) and pre-service education. • Since 2005, LDSC has facilitated annual newborn resuscitation workshops where more than 800 trainers have been trained who, in turn, have trained more than 5,700 providers in the various regions of the country. • In two years, MCHIP facilitated 23 training courses, including one for regional trainers, covering 52 facilitators and 573 providers from 10 hospitals, and donated 70 sets of equipment. • Additional trainings are being carried out by the LDSC. Twenty-eight hospitals have been covered since January 2014.
3b.	Quality
	<ul style="list-style-type: none"> • In 2012, technical assistance was provided by MCHIP for supportive supervision, but follow-up was not possible due to closure of the project. • The Maternal and Child Health Centers of Excellence project (Abt Associates) provided technical support to selected centers where refresher trainings were carried out.
3c.	Commodities for Resuscitation
	<ul style="list-style-type: none"> • Since 2005, LDSC has donated more than 370 training sets, including manikins and teaching aids (102 HBB flip charts, 1,560 HBB workbooks, and more than 800 NRP textbooks), and 650 resuscitation kits (each with a self-inflating bag and mask, suction device, and stethoscope). MCHIP donated 70 sets of equipment. • The country does not have a national regulatory committee for medical equipment and supplies. The MOH is responsible for procuring equipment not manufactured in the country. It usually takes two months for the shipment and to obtain custom clearance.
3d.	Recording and Reporting System
	<ul style="list-style-type: none"> • MCHIP and the Maternal and Child Health Centers of Excellence have prepared basic newborn resuscitation indicators. In addition, a delivery room register was prepared to collect the results. In 2013, data collection was initiated in three regional hospitals and recommendations were made to include the indicators in the country HMIS.

3e.	Evaluation
	<ul style="list-style-type: none"> M&E of basic resuscitation has faced challenges in incorporating the required indicators in the HMIS system and procuring quality data.
4.	Institutionalization
	<ul style="list-style-type: none"> It has taken time for HBB to be accepted by the MOH, but linking it with the hospital NRP program has improved the acceptability in the country.
5.	What Worked Well
	<ul style="list-style-type: none"> Trained staff have continued their commitment by training other staff from their referral facilities. Even following the closure of the USAID/MCHIP project, the training has continued, partly funded by the MOH, indicating ownership.
6.	Challenges
	<ul style="list-style-type: none"> Incorporation of HBB in IMNCI was not successful. HBB is as yet not incorporated into the national guidelines. With the closure of USAID programs there has been limited funding leading to challenges in procuring training tools and equipment.
7.	Lessons Learned
	<ul style="list-style-type: none"> Empowering the nurses and nursing professionals to teach HBB is critical. Discontinuing international programs that bring in funding as well as technical support can present considerable challenges in continuing existing programs. The MOH stepping forward to provide at least partial funding has helped to continue some of the activities and has highlighted a degree of country ownership.

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