

# Helping Babies Breathe in Madagascar: neonatal resuscitation training in the era of sustainable development goals

This article provides current information about neonatal mortality and resuscitation training in low- and middle-income countries. It describes the approach taken by two British paediatricians who benefited from the infrastructure and communication networks built up by a well-established conservation organisation to improve awareness and resuscitation capacity for babies born in remote rural areas of Madagascar.

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## Key points

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1. Neonatal mortality remains disproportionately high in many countries.
2. Helping Babies Breathe is an evidence-based educational programme for teaching neonatal resuscitation in resource-poor settings.
3. Implementing health care improvements in low- and middle-income countries requires local knowledge and sustainable partnerships at local and national levels.

## Global child health in the 21st century

Each year an estimated 2.7 million babies die within the first 28 days of life, and over a million children survive with impairment following neonatal conditions.<sup>1</sup> Despite considerable reduction in mortality of children under five during the era of the Millennium Development Goals (MDGs 1990-2015), neonatal mortality remains unacceptably high in many low- and middle-income countries.<sup>2</sup> In recognition of this the Every Newborn Action Plan was launched in 2014 with the aim of providing evidence-based solutions to prevent deaths from the three most common causes of neonatal mortality:<sup>3,4</sup>

- prematurity (36%)
- infection (23%)
- complications around the time of birth (23%).

## Helping Babies Breathe

Helping Babies Breathe (HBB)<sup>5</sup> is a neonatal resuscitation programme designed and developed for use in resource-limited settings by a number of global partners, including the American Academy of Pediatrics (AAP), Eunice Kennedy Shriver National Institute of Child Health and Human Development, Laerdal Global Health, Save the Children, USAID and Latter-Day Saint Charities. HBB emphasises having a skilled and equipped attendant at every birth, assessment of every baby, temperature support, stimulation to breathe, and assisted ventilation as needed, all within the 'golden

minute' – the first minute after birth.

Approximately 10% of babies require some help with breathing at birth: about half will respond to stimulation and aspiration of secretions, and about half will require positive pressure ventilation. Less than 1% will require advanced resuscitation with cardiac massage. A review of studies found that training in neonatal resuscitation could reduce intrapartum-

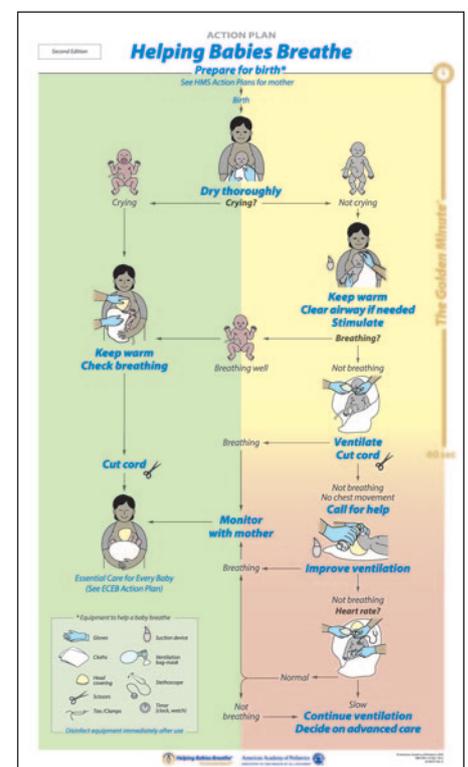


FIGURE 1 The wall action plan (reproduced with permission from *Helping Babies Breathe* ISBN:9781610021005; 20-00372 Rev D, 2016 by American Academy of Pediatrics).

related neonatal mortality by about 30% and showed that neonatal resuscitation can be performed by a broad range of health-care workers including non-physician clinicians, traditional birth attendants and community health workers.<sup>6</sup> Two other large ‘before and after’ studies of HBB within hospital settings in Tanzania and India showed significant reductions in neonatal death and fresh stillbirth.<sup>7,8</sup>

HBB courses can be run at different levels:

- master trainers – will go on to organise and disseminate training
- facilitators – will be able to teach and support colleagues
- providers – will attend births and provide life-saving resuscitation to those in their care.

All courses are best taught over two days in order to provide adequate time for assimilation of the different aspects of knowledge and skills required. The key educational tools used are:

- facilitator flip chart
- wall action plan (FIGURE 1)
- provider guide handbook
- routine resuscitation equipment
- an inflatable manikin (NeoNatalie) that is able to simulate breathing and heart rate (FIGURE 2).

The course involves abundant role-play and practical participation. The first version of HBB was launched in 2010 with a revised version in 2016. Materials are available in a range of languages and well over 1,000 courses have now been run in around 130 countries.

### The health service in Madagascar

Madagascar is renowned for its rich biological diversity and endemic wildlife. Despite international interest in conservation and wildlife tourism, Madagascar remains one of the world’s poorest countries ranking 158/188 in the Human Development Index. The population is largely rural, with only 35% living in urban areas. The health service in Madagascar is supported by both the public and private sectors; however communication infrastructure is poor, making delivery of even basic health care difficult. Overall service strategy is coordinated at national level through the Ministry of Health.<sup>9</sup> International non-governmental organisations such as Unicef and USAID provide technical and financial assistance to contribute to health system strengthening.



FIGURE 2 The NeoNatalie manikin and HBB training materials (in French).

The most basic health facility is the Centre de Santé de Base (CSB) level 1, staffed by one nurse or midwife and equipped with minimal resources. This is the most widespread facility providing immunisations, family planning and some antenatal care but very little emergency care. CSB2s are additionally staffed by a doctor, but medical equipment is usually similar to CSB1. Ventouse delivery may be available. Larger district hospitals are expected to provide surgical and more comprehensive obstetric services and regional and university hospitals provide higher-level care. Transport to higher facilities is often unavailable and there is virtually no neonatal intensive care. Many rural facilities lack basic amenities such as running water and electricity; private facilities are usually better resourced.<sup>9,10</sup>

National coverage of doctors and paramedical staff is low. International targets for basic emergency obstetric and neonatal care, and comprehensive emergency obstetric and neonatal care, have been set at five and one per 500,000 population, respectively. In Madagascar, the rates are 0.5 and 0.1.<sup>9</sup>

### Perinatal care

The neonatal mortality rate (NMR; deaths within the first 28 days of life, expressed per 1,000 live births) decreased significantly during the MDG span, from 40 to 20.<sup>11</sup> However, the NMR trend has not kept up with overall child mortality reduction

and neonatal deaths now account for an increasing proportion of childhood deaths (25% in Madagascar in 1990; 40% in 2015).<sup>11,12</sup> One quarter of neonatal deaths in Madagascar are attributable to prematurity; one quarter intrapartum-related events; and one quarter sepsis, tetanus, meningitis and neonatal pneumonia.<sup>12</sup>

Despite these challenges in provision and access it is still possible to improve the outcomes for mothers and babies by strengthening the health system using strategies with proven efficacy. This includes ensuring local facilities are welcoming and well-resourced and that staff are adequately trained and motivated. In line with World Health Organization (WHO) advice, the Ministry of Health advocates at least four antenatal consultations, delivery with a skilled birth attendant and a postnatal check-up within 48 hours. The most recent demographic and health survey identified that only 44% of deliveries were attended by a skilled birth attendant. Maternity care, both antenatal and postnatal, falls well short of target. It is evident that improving care during pregnancy, delivery and early neonatal life will have a huge impact on neonatal survival in Madagascar.

### Sustainable development and population health environment

The United Nations Conference on Environment and Development in 1992

emphasised the importance of cross-sectoral working within sustainable development.<sup>13</sup> Conservation organisations typically work with communities in remote areas of high biodiversity, with poor infrastructure and limited access to health services. Isolated communities are subject to the inverse care law, whereby their need for health care is highest yet they face the greatest barriers to access. Integrating health services with community-based natural resource management and livelihood activities can serve to strengthen community participation in conservation, while enabling health services to reach some of the world's most underserved communities.

At the request of partner communities, Blue Ventures (a marine conservation organisation that works with coastal communities to help rebuild tropical fisheries) integrated community health services into its programme of activities in south-west Madagascar. Services initially focused on family planning and have subsequently been broadened to include maternal and child health care and safe water initiatives. This holistic, multi-sector approach to working with communities is sometimes termed population health environment (PHE) because it recognises the links between people, their health and the health of their environment.

PHE programmes are now being replicated in other parts of Madagascar and have been developed in other countries, by a wide range of organisations.<sup>14</sup> Evidence on the effectiveness of PHE suggests that this multi-sector approach gets better results at lower overall cost than traditional single sector approaches.<sup>15</sup>

### HBB in Madagascar

Drawn by similar interests in global health and sustainable development, in November 2014 co-authors Emily Clark and Alison Leaf met in the remote south-west coastal village of Andavadoaka – the site of Blue Ventures' flagship PHE programme in Madagascar. Increases in the use of contraception had contributed to significant improvements in birth spacing, which no doubt would have been contributing to reductions in child mortality, but a lack of effective neonatal resuscitation facilities in the region meant that neonatal mortality would have remained unacceptably high. Aware that HBB had already been used on a limited scale within Madagascar the authors resolved to investigate whether



**FIGURE 3** Participants with their certificates after the HBB course in Andavadoaka, 2016.

HBB training could be introduced within more remote locations to try and redress the balance of the inverse care law. During 2014 Alison also visited the Duke Lemur Center SAVA Conservation programme. Engaged in critical work to protect and conserve some of Madagascar's iconic, endemic and highly endangered lemur species in the north-eastern rainforests, Duke Lemur Center was also engaged in PHE work and is keen to improve neonatal care within its areas of activity.

Supported by Blue Ventures and Duke Lemur Center, and with engagement from Ministry of Health staff at national and district levels, Emily and Alison have been able to deliver HBB training as part of PHE programmes in two contrasting locations in Madagascar in 2015 and 2016. In 2017, they were able to carry out detailed follow-up of the 2016 training, contribute to large-scale central training (jointly with Latter-Day Saint Charities), and participate in meetings with all the key players involved in training at national level.

### SAVA region, north-east Madagascar

In May 2015, supported by Duke Lemur Center, two HBB courses were delivered by Alison in the towns of Sambava and Andapa, part of the mountainous SAVA region. Each course had 12 participants, including doctors, midwives and nurses from public and private hospitals and urban health centres (CSB2). Annual deliveries ranged from 200 to 650 and most facilities already had some equipment and some knowledge of neonatal

resuscitation. Courses took place over two days: 1.5 days for providers and an extra 0.5 day for three trainers. Training materials were provided in French, with oral delivery in a mixture of French/English with Malagasy translation. Courses were well-received; participants were enthusiastic and all passed, demonstrating an increase in scores between pre- and post-course knowledge tests and satisfactory skill acquisition. All were given a personal set of resuscitation equipment including suction device and bag-valve-mask resuscitator. Five flipcharts and manikins were also left to enable refresher training and further dissemination.

### South-west Madagascar

In August 2016 Alison and Emily returned to Andavadoaka in the Atsimo-Andrefana region of south-west Madagascar, an area characterised by scattered fishing villages lining the coast. Within the area that Blue Ventures works, health care is provided by six CSB1 and one small NGO hospital without a formal obstetric service. Only one CSB has electricity and none of the health workers had the essential resuscitation items of a bag-valve mask or suction. Only one had previously received practical training on neonatal resuscitation, yet all single-handedly managed deliveries.

Supported by Blue Ventures Alison and Emily ran two HBB courses for the seven nurses and midwives who work in the region. All participants successfully passed the written and clinical assessments (**FIGURE 3**), and were issued each a bag-

valve mask, manual suction device, learner workbook, and wall reminder action plan.

### Follow-up, feedback and future challenges

When providing training it is essential to try and assess effectiveness and impact and also to ensure activities are consistent with and complementary to national endeavours.

In the SAVA region a written questionnaire was sent four months after training. For logistical reasons it was only possible to obtain feedback from one centre, Andapa. All trainees reported benefit from the training and ongoing use of equipment, with most attending up to 20 births each month. In 2016 Alison made a further visit with personal follow-up to all available trainers. Two reported dissemination of training to a further 25 staff, but as they had difficulty obtaining equipment this had stopped. In 2017 a further visit was made to deliver resuscitation equipment donated with funding from a small UK charity, the Bateleur Fund. This will be used to increase coverage of CSBs, which are now receiving training as part of the USAID-funded Mother and Child Survival Program.

For trainees in south-west Madagascar regular feedback at four-month intervals was obtained during the year following the training. Emily made a personal visit to the health centres in July 2017, which was supported by Blue Ventures. All health workers had delivered babies (range 16–84), yet only two had needed to provide bag-valve mask ventilation. Low caseloads resulted in low numbers of babies requiring resuscitation. Assessment at one year demonstrated good retention of knowledge in a written test, but a simulated scenario highlighted difficulties in providing ventilation using the bag-valve mask, mainly with positioning of the mask.

Refresher training was provided within the CSB wherever possible, enabling health workers to continue their clinical duties. All demonstrated rapid progress in skill acquisition during refresher training, scoring full marks in simulation tests. Subjectively, confidence and fluidity of actions according to the HBB action plan was much better following refresher training than at the end of the initial training in August 2016.

Finding ways to ensure skills are maintained is critically important as the

- Train new health workers as early as possible in post
- Develop sustainable mechanisms for regular refresher training of health workers in remote, resource-poor settings
- Develop formal clinical governance and learning processes
- Ensure that training results in as little disruption of availability of CSB services as possible
- Strengthen supply chains to ensure essential resources are present
- Improve quality of care at CSBs to encourage facility deliveries
- Collaborate with universities to provide practical simulation training during undergraduate degrees, so all health workers graduate with skills in newborn resuscitation
- Encourage facility deliveries to increase caseload with simultaneous endeavours to improve access and quality of care

**TABLE 1** Recommendations for collaborative work with the Ministry of Health and NGOs.

recognition by communities that delivery at a health facility will give access to more advanced care is key to encouraging women in rural villages to choose to deliver with a skilled birth attendant, as advised by the WHO.

### Partnerships and recent developments

With the invaluable help of Blue Ventures, Alison and Emily were able to gain insight to Madagascar and to meet with the key players during their visit in 2017. The current Mother and Child Survival Program, running from 2014–2019, aims to provide comprehensive maternal/child health training to all CSB2s. This includes HBB, is completely delivered by Ministry of Health staff, and includes training of regional and district trainers, so in theory should be sustainable in the longer term. Latter-Day Saint Charities has been working in Madagascar since 2013, and receives infrastructure support from Unicef. It delivers HBB and the related course Helping Mothers Survive in large groups of around 60 participants twice each year. While initially focussing on training master trainers who now work with the charity to disseminate training, largely in Malagasy, it is now aiming to train healthcare staff from CSB1s, and possibly medical and midwifery students – neither of which are included within the scope of the Mother and Child Survival Program and would expand the coverage of HBB training in Madagascar.

### Future challenges

The current activity is encouraging but it remains to be seen whether these ambitious training programmes really can provide universal coverage. In addition the high rate of home deliveries without skilled

birth attendants, particularly in remote areas, still needs to be resolved. Ensuring retention of knowledge and skills of single-handed workers with low caseload is another challenge, but tools being developed for distance learning may be the way forward. HBB is now part of the wider curriculum – Helping Babies Survive – which uses similar, simple educational tools to address the ‘essential care of every baby’ and ‘essential care of small babies’. The authors hope to work with the Ministry of Health and partners to ensure that these updated tools and training methods continue to be used to reduce neonatal mortality in Madagascar.

### Conclusions and recommendations

Neonatal mortality constitutes an increasing proportion of childhood mortality, with the greatest risk on the day of birth. HBB has been shown to reduce neonatal mortality, and is specifically designed for implementation in low-resource settings. The authors have provided HBB courses for local health workers in two remote sites in Madagascar and demonstrated acquisition of essential resuscitation skills. Ongoing partnership with the Ministry of Health and other key organisations is essential in order to provide further training and support to frontline health workers. Recommendations can be seen in **TABLE 1**.

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The first European HBB Master Trainers' Course will take place in Bristol on 5-6 February 2018, for further details and registration visit [www.bmsc.co.uk/course/helping-babies-breathe-master-trainer-course](http://www.bmsc.co.uk/course/helping-babies-breathe-master-trainer-course)

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