Helping Babies Survive Programs as an Impetus for Quality Improvement

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abstract

Achieving the ambitious reduction in global neonatal mortality targeted in the Sustainable Development Goals and Every Newborn Action Plan will require reducing geographic disparities in newborn deaths through targeted implementation of evidence-based practices. Helping Babies Survive, a suite of educational programs targeting the 3 leading causes of neonatal mortality, has been commonly used to educate providers in evidence-based practices in low-resource settings. Quality improvement (QI) can play a pivotal role in translating this education into improved care. Measurement of key process and outcome indicators, derived from the algorithms (“Action Plans”) central to these training programs, can assist health care providers in understanding the baseline quality of their care, identifying gaps, and assessing improvement. Helping Babies Survive has been the focus of QI programs in Kenya, Nepal, Honduras, and Ethiopia, with critical lessons learned regarding the challenge of measurement, necessity of facility-based QI mentorship and multidisciplinary teams, and importance of systemic commitment to improvement in promoting a culture of QI. Complementing education with QI strategies to identify and close remaining gaps in newborn care will be essential to achieving the Sustainable Development Goals and Every Newborn Action Plan targets in the coming decade.

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Seven thousand neonates die each day, amounting to a global burden of 2.5 million newborn deaths annually. Most of these neonatal deaths, defined as mortality in the first month of life, are preventable. The current Sustainable Development Goals (SDGs) include a reduction in neonatal mortality to ≤12 per 1000 live births for all countries by 2030 (Target 3.2). The Every Newborn Action Plan (ENAP) extends this ambitious improvement to a global neonatal mortality rate of ≤10 per 1000 live births by 2035. Although improving, the global neonatal mortality rate of 18 deaths per 1000 live births remains unacceptably high compared to these target goals. Furthermore, marked disparities in neonatal mortality exist across regions and countries, exemplified by rates as high as 28 deaths per 1000 live births in sub-Saharan Africa in 2018. Realizing these bold international targets of mortality reduction will require reducing geographic disparities through targeted implementation of evidence-based practices.

One approach to improving implementation of evidence-based practices is education of health care providers. Helping Babies Survive (HBS), a suite of educational programs for newborn care, has been commonly used to educate providers about evidence-based practices in low-resource settings. These programs instruct providers in basic newborn resuscitation, including bag and mask ventilation (BMV), essential care for infants (such as breastfeeding and vitamin K prophylaxis), and care of the well small infant, including thermoregulation and feeding. The Formula for Survival, one framework for implementation of education programs articulated by the International Liaison Committee on Resuscitation, highlights the synergy among scientific guidelines, educational efficiency, and local implementation for improvement of care. Although education in evidence-based practices is an enabling step in reducing mortality, this formula suggests that education alone is insufficient to sustain changes in quality of care or outcomes. The guidelines taught in the HBS educational programs must be adapted, embraced, and implemented locally to be effective. In this article, we will discuss how quality improvement (QI) can support local implementation to maximize the impact of HBS training.

**IMPACT OF HELPING BABIES BREATHE IMPLEMENTATION STRATEGIES ON MORTALITY**

Implementation of Helping Babies Breathe (HBB) training in low-resource settings has produced mixed results with respect to newborn mortality. In the first evaluation of HBB, training in Tanzania resulted in a marked reduction in early perinatal mortality, defined as fresh stillbirths plus neonatal deaths within 24 hours of birth, from 32.3 to 21.6 per 1000 births (relative risk: 0.67; 95% confidence interval 0.59–0.76). After this landmark study, additional HBB trials were conducted in Tanzania, Nepal, Sudan, India, and Kenya. In a recent systematic review, researchers synthesized the results from these trials with respect to perinatal mortality, intrapartum-related (fresh) stillbirths, neonatal mortality within 1 day after birth, neonatal mortality within 7 days after birth, and neonatal mortality within 28 days after birth. All of the 7 included trials had a pre- and post-implementation study design and were predominantly of moderate quality. In the systematic review, researchers found significant reductions in 1 of 2 trials describing perinatal mortality, 4 of 6 trials reporting intrapartum-related stillbirths, 4 of 5 trials focusing on 1-day neonatal mortality, and 1 of 3 studies describing 7-day neonatal mortality. In neither of the 2 studies in which researchers examined 28-day neonatal mortality did the authors find significant changes after implementing HBB. The authors concluded that there was moderate quality evidence for a decrease in intrapartum-related stillbirth and 1-day neonatal mortality after implementing the HBB training program, reaffirming the results of a previous systematic review and meta-analysis.

The variability of these results may be, in part, due to the unique implementation strategies employed. For example, some of the trials paired an initial HBB training with additional educational activities, such as optional or scheduled refresher training, daily skill checks, weekly peer-to-peer resuscitation skills practice, self-evaluations after deliveries, or peer review of resuscitations. Some trials included monitoring plans that fed data back to frontline workers. Although not explicitly stated in the trials’ methodology, there may have also been variability in the procedures for ensuring adequate HBB-trained staffing and availability of essential equipment for performing HBB (eg, functional bags and masks, suction devices, and cloths for drying). These additional factors, differentially employed in these trials, may have modified the effect of HBB training on outcomes.

The variable impact of HBB training demonstrated in published studies has stimulated interest in developing and evaluating strategies to enhance the translation of education into practice. Given the context-specific nature of this challenging translation, the HBS programs have spurred the use of continuous QI strategies to bridge this know-do gap.
FUNDAMENTALS OF QI AS AN IMPLEMENTATION STRATEGY

A basic understanding of QI is necessary to appreciate how QI is a vital complement to education in efforts to reduce neonatal mortality. QI is based on the often cited principle by Batalden and Davidoff\textsuperscript{18} that “everyone in healthcare really has two jobs when they come to work every day: to do their work and to improve it.” Batalden and Davidoff\textsuperscript{18} proposed defining QI as, “the combined and unceasing efforts of everyone—healthcare professionals, patients and their families, researchers, payers, planners and educators—to make the changes that will lead to better patient outcomes (health), better system performance (care) and better professional development (learning)” (Fig 1). QI can be done to support context-specific implementation of education to maximize its impact on newborn mortality.

A QI initiative begins with identification of an opportunity for improvement, often a gap in care with the hypothesis that closing the gap will lead to improved patient or population health outcomes. The fundamentals of a QI initiative are to identify a gap in care, form a multidisciplinary QI team, set a specific and time-bound aim to lessen the gap, develop a measurement strategy so that effects of changes can be identified over time, and conduct iterative tests of changes in the system. The Model for Improvement is a common framework for developing and communicating QI initiatives and is focused on answering 3 key questions: (1) What are we trying to accomplish? (2) How will we know that a change is an improvement? (3) What change can we make that will result in improvement?\textsuperscript{19} (Fig 2). To answer the second key question in the Model for Improvement, different levels of measurement are employed.

While improving within a system of care, 3 levels of measurement are often recommended to support a QI initiative. An outcome measure is a measure of the performance of the system under study, directly related to the aim of the project. Improving an outcome measure is often dependent on improvement in related process measures. A process measure is a measure of whether an activity has been accomplished. A process measure is often used to examine implementation by determining if a guideline or evidence-based practice was executed as planned. While improvement efforts are underway within a system, additional measures, termed “balancing measures,” are recommended to ensure that in making changes to improve the outcome and process measures within a defined aim other related measures are maintained or not worsened as a consequence of the changes.

When the Model for Improvement is applied to the health care system, outcome measures refer to patients’ diagnoses or outcomes and population-level outcome metrics, such as mortality rates. These population-level outcome metrics are key outcome measures for public health and are often referred to as impact measures. In public health, an additional category of measures is used to describe access to care and the quality of the care received. The metric used to describe access to care is termed “coverage”: the percent of the intended population that has access to a service or receives an intervention.\textsuperscript{20} Improving access to care and closing coverage gaps may require structural changes in the health care system. By contrast, metrics quantifying the quality of care often refer not just to the receipt of interventions or services but receiving them as intended by guidelines or recommendations. Therefore, process measures, when specifically defined, often serve as quality of care metrics and an effective means to assess implementation of a training program or guideline. A quality gap exists when there is access to care but the care received differs from the intended guidelines or recommendations and, therefore, is less effective.\textsuperscript{21,22} Quality gaps represent missed opportunities to provide evidence-based high-quality care to patients with access to the health care system. The etiology of quality gaps may be multifactorial, including lack of essential equipment and personnel, limitations of the environment, and inadequate knowledge and skills of providers. Quality gaps may be modifiable by using facility-based continuous QI methods.\textsuperscript{23}

MEASURING KEY INDICATORS WITH HBS IMPLEMENTATION

To understand the baseline quality of health care delivery, identify gaps, and assess progress in improving newborn care after the implementation of training packages in health facilities, measurement of processes and outcomes by using metrics, often called indicators, is necessary. The establishment of systems to measure these indicators can guide program managers in resource allocation and areas of necessary clinical improvement by the health care team.

![Diagram](attachment://image.png)

**FIGURE 1**
Linked aims of improvement. (Reprinted with permission from Batalden PB, Davidoff F. What is “quality improvement” and how can it transform healthcare? Qual Saf Health Care. 2007;16(1):2–3.)
Metrics Related to the HBS Programs

All-cause newborn mortality is a key impact measure for understanding the quality of newborn care on a large scale. All-cause newborn mortality can be further broken down into outcome measures, such as death from complications of preterm birth (35% of newborn deaths), intrapartum-related events (24% of newborn deaths), and sepsis (15% of newborn deaths). The HBS programs collectively target each of these outcome measures: HBB targets death from intrapartum-related events; Essential Care for Small Babies (ECSB) targets death from complications of preterm birth; and, although all 3 programs emphasize infection reduction, Essential Care for Every Baby (ECEB) specifically targets death from sepsis. The impact metric central to both the ENAP and SDGs, neonatal mortality, uses the denominator of 1000 live births. Although arguably the most important metric at a national and global level, this outcome may be a relatively rare event at many facilities, depending on the volume of deliveries, and, therefore, not a sufficiently time-sensitive indicator for most facility-based QI initiatives.

Alternatively, process indicators reflecting the evidence-based practices taught in the HBS programs are high frequency events and, therefore, more time-sensitive indicators of HBS implementation. Such indicators can be derived from the action plans accompanying each HBS training program that highlight the key processes of care for mortality reduction. Figure 3 reveals the relationship between impact, outcome, and process measures targeted in HBS programs. In Fig 4A, we use an annotated HBB Action Plan to illustrate the incorporation of metrics, define the coverage indicator “HBB-trained delivery attendant,” and indicate how process measures, such as stimulation and BMV, can be specifically defined as quality indicators. Examples from ECEB and ECSB are shown in Fig 4B and C.

The ENAP Measurement Improvement Roadmap 2015–2020 outlines a plan to establish and measure processes of care at both the hospital and country level. Although impact metrics have been recommended, a number of core ENAP coverage and quality indicators relating to the HBS program still require refining, validation, and testing for feasibility.

Challenges of Establishing Measurement Systems

Given the lack of granularity of most facility registration systems, identifying metrics for HBS implementation using these resources can be challenging. For example, a particular challenge is collecting metrics for determining the quality of resuscitation of newborns. A coverage indicator that is relatively simple to collect might be the attendance of an HBB-trained provider at delivery. However, collecting a corresponding quality indicator to describe ideal care (for example, appropriate use of BMV) might be more challenging. Typically, the number of babies that receive BMV is known. However, without understanding the denominator, the number of babies in which BMV was indicated, or the quality of the resuscitation received, the measure is of little value. Without a denominator to calculate a gap, it is impossible to know if a gap exists or if changes are having the intended consequences. An ideal quality indicator for resuscitation requires capturing the correct population receiving the correct action at the correct time in a pragmatic fashion. One possibility for operationalizing this indicator was evaluated by KC and colleagues in Nepal in a recent observational study. Their study suggests “correct action” as receipt of BMV at a rate of 40 to 60 breaths per minute, “correct time” as within 1 minute of birth, and “correct babies” (ie, the denominator for such an indicator) as noncrying babies at birth.

Strengthening or supplementing existing facility information systems may be required for facility-based QI. There have been several studies investigating the supplementation of existing data systems in documenting processes of care related to HBS. In a multicountry study in Bangladesh, Nepal, and Tanzania, researchers assessed the accuracy of processes of care as recorded in routine health facility registers compared to maternal recall surveys, verified through the use of independent clinical observation. The study revealed that use of health facility registers to measure processes of care, such as neonatal resuscitation, kangaroo care, and management of neonatal infection with antibiotics, is more accurate than data obtained through a maternal recall survey. In the study, the authors also indicated that strengthening of routine information systems is required to use the information for facility-based QI. The investigators noted future areas for improvement, including revising the design of the health facility registers and emphasizing the
value of these data from the health care workers. Day et al reaf
rm the importance of thoughtful, pragmatic design of nonduplicative data collection systems.

Direct observation, an alternative to recall, was used by KC et al to determine the percent of babies requiring resuscitation at delivery and the quality of resuscitation delivered. Kamath-Rayne et al augmented the approach to observation and data collection with video recordings in their study at a community hospital in Honduras. The investigators evaluated an ongoing system of practice after an initial HBB workshop using video recording to collect data on actual delivery room resuscitations to determine adherence to the HBB algorithm, or “Action Plan,” and changes in essential newborn care practices. These alternative approaches can augment data from routine information systems but are labor and resource intensive.

**SUPPORTING FACILITY-BASED QI WITH IMPLEMENTATION OF HBS**

Supporting in-facility leaders with QI resources is key to successful improvement of newborn care after HBS training. A wealth of QI experience in high-income settings has demonstrated the importance of ownership of improvement efforts by frontline workers. Experience with local ownership of QI in low and lower-middle income countries (LMICs) is growing.

Replicating this paradigm successfully in LMICs requires QI support external to the facility. To our knowledge, medical and nursing education programs in most LMICs do not incorporate QI in their student didactics or practicums. On-the-job training in QI at the facility level is similarly rare. Thus, providers in LMICs typically have little knowledge or experience with QI methodology. In this section, we highlight resources to assist program implementers in supporting frontline workers in facility-based improvement efforts after HBS training.

The HBS programs include embedded content on ways to improve care at the facility. Although briefly reviewed in the flipchart at the end of a training course, each program also includes a supplementary provider guide. These guides review the individual steps of an HBS action plan, with an accompanying blue box highlighting how to improve care. This material includes questions for providers to consider regarding how to improve care in their facility. It also offers suggestions for how to decide what to monitor and how to identify problems. HBB training often serves as an impetus for learners to identify gaps in care by comparing current practices at their facilities with what they recently learned are best practices. Facilitated group discussions in HBB training on gaps, barriers, and change ideas often motivate participants to create change at their home facilities. These experiences from the field spurred further inclusion of some basic principles of QI in the second edition of HBB. These included a flipchart page entitled “Commit to making a difference.” Three questions that challenge participants to think about what actions they will take after the workshop is over are introduced on this page: (1) What are you going to do differently? (2) What will you no longer do? (3) How are you going to make these changes happen?

In addition to the HBS program content on improving care, the American Academy of Pediatrics (AAP) and University Research Company published a QI guide entitled Improving Care for Mothers and Babies (ICMB). ICMB was authored by an international group of medical providers, QI experts, and educators, with representation from the United States Agency for International Development, American College of Nurse-Midwives, Jhpiego, Laerdal Global Health, Save the

FIGURE 3
Relationship of process measures targeted in HBS programming to the 3 main causes of neonatal mortality and the global aim for improvement in neonatal mortality, the impact measure. Process measures reflect “action steps” in the recommended care of the baby, according to the HBS Action Plans.
FIGURE 4
Annotated HBS Action Plans with processes of care (blue) noted as “action steps.” Processes of care can define coverage indicators, which describe access to care, as well as quality indicators, which describe receipt of interventions or services as intended by the Action Plan. A, HBB. B, ECEB. C, ECSB. IM, intramuscular. (Reprinted with permission from the American Academy of Pediatrics.)
Children, and the AAP. ICMB was designed for facility-based improvement teams as a self-study manual for basic QI methodology. The manual outlines 6 steps to improve care for mothers and babies: (1) create an improvement team, (2) decide what to improve, (3) choose barriers to overcome, (4) plan and test change, (5) determine if the change resulted in improvement, and (6) make improvement the norm. Each step begins with the presentation of Key Knowledge, and is accompanied by Practice Exercises that illustrate concepts through case scenarios. Group discussion questions assist teams in considering how to implement this QI step in their facility. Finally, a section on Improvement Team Actions provides practical guidance for QI teams applying this step at their facility.

In Table 1, we highlight a number of additional QI resources that may be paired with the HBS programs to enhance the translation of knowledge into practice. These include resources for training in QI methodology, how-to manuals for teams implementing QI, and guides for effective QI coaching.

**EXAMPLES OF HBS IMPLEMENTATION WITH FACILITY-BASED QI**

A number of recent HBS implementation efforts have included the use of facility-based QI to improve the translation of education into practice. Successful implementation depends on important actions after the HBS workshop that require continued support and mentorship, and, indeed, these ongoing activities are crucial to improving neonatal survival. Administrative leaders are critical members of a multidisciplinary team and essential in effectively overcoming many barriers. Communication and relationships initiated in small-group multidisciplinary HBS training workshops may serve as important precursors to successful QI initiatives. The work of Rule et al. in Kenya demonstrates the importance of a motivated QI team with a common goal, transparency in showcasing progress toward the desired outcome, and including administrators on a QI team. After effective and well-trained labor and delivery staff were reassigned to another ward and replaced with untrained staff, the QI team was able to use their data to correlate the reassignment with an increase in asphyxia-related mortality at their facility. Sharing their data with administrative leaders enabled them to retain well-trained staff in the labor and delivery department.

One strategy for engaging and motivating providers in the improvement process is to provide supportive visual aids to help them understand their progress toward improvement. For example, Kamath-Rayne et al. in Honduras, used run
charts to track essential newborn care indicators that revealed significant improvement in all indicators; however, many fell short of ideal performance (>90%). After the workshop, no further significant improvements were seen over the study period, and, notably, during that time, no further QI initiatives were undertaken. There was, however, a focus on ongoing practice and performance feedback. Individual providers were shown videos of the resuscitations they attended and were able to self-reflect on their performance before they received feedback from a study coordinator who was also an HBB Master Trainer. Subsequent evaluation in both simulation and real-life delivery rooms revealed retention of the majority of basic resuscitation skills. However, there were issues with retaining proficiency in BMV in real-life situations.37

Capacity building for facility-based QI is still needed, although the best method to do so remains unknown. In the Kenya study mentioned above as well as in the work by KC et al30 in Nepal, intensive on-site coaching was incorporated into the study design.36 Using the ICMB QI guide developed by the AAP, Patterson et al39 evaluated 2 methods of intermittent coaching, either virtual (by telephone) or in person. Sixteen hospitals participated and collected continuous data on key newborn processes of care and outcomes. After a 5-month period of coaching, the study investigators rated hospitals using an adapted Institute for Healthcare Improvement scale. Hospitals that received in-person coaching achieved higher QI progress scores and also implemented more complex change packages than those that received virtual coaching. Interestingly, although virtual coaching encounters were more focused on assessing progress, in-person encounters involved coaching on the QI process and team motivation. Pragmatically, incorporating a facility-based QI coach, QI methods, and monitoring and evaluation system into the workflow of a busy facility to incite systemic behavior change remains a challenge. However, the translation of educational training into improved neonatal outcomes requires this investment.

**FUTURE DIRECTIONS**

HBB has brought about significant progress in the field of maternal newborn child health since its release in 2010. As we celebrate the 10th anniversary of this landmark training program, we must look forward to building on this success while...
adapting, advocating, and innovating to meet current and future challenges. The international community has confirmed its commitment to improving neonatal care and reducing newborn mortality. However, despite allocation of resources and political will, we will not achieve the ambitious SDG and ENAP targets unless critical unmet needs are addressed. The unmet needs on the horizon include the augmentation of newborn health programs like HBS to include integration with tools and technology, incorporation of HBS QI metrics into data systems, and innovations in education for the development of local QI expertise.

The dynamic technological landscape promises new opportunities on the horizon to reduce the human resource burden inherent in many current methods of data collection for QI. In this supplement, Patterson et al.40 and Bucher et al.41 describe innovations that may enhance the efficiency and effectiveness of QI data collection, allowing increased attention to the unmet needs of the health care system in which it is being implemented.

As the HBS program suite becomes further integrated into the global landscape, as reviewed by Patterson et al.,42 opportunities remain for HBS-related metrics to be incorporated within large maternal newborn child health QI programs and data systems. Several examples of integration include the electronic clinical event recording system and QI dashboard used in Nepal in the scale up of the Safer Birth Bundle,43 common data platform used in select Kenyan hospitals for QI of sick newborns through an audit and feedback system,44 or continued integration into the Vermont Oxford Network Global Neonatal Database45 used, in partnership with the Ethiopian Pediatrics Society and with support from the Ethiopian Federal Ministry of Health, in the Ethiopian Neonatal Network for QI activities. Whereas the first decade of HBS has been focused on neonatal mortality, data collection and QI in the second decade of HBS must be reflective of the dynamic and advancing field of neonatal care in LMIC and be expanded to incorporate neonatal morbidities, including neurodevelopmental outcomes.

As data on quality care become more readily available, continued efforts at educating providers in evidence-based practices must be paired with practical education in QI methodology at facilities. In the current and post–COVID-19 era, we must explore new opportunities to further grow and enrich the global neonatal improvement community using less international travel and in-person contact. One such opportunity is the Extension for Community Healthcare Outcomes (ECHO) model, a web-based telementoring approach used for outreach and the creation of virtual communities globally.56 The AAP has embraced Project ECHO for community engagement and education, with the expertise to train partner organizations and provide technical assistance as new content-focused collaborative learning communities are formed. Building on the success of partnering with the Midwives Association of Zambia to support intrapartum care efforts, an exciting next step is to pilot the Project ECHO model to deliver QI education and telementoring focused on HBS QI activities, as a follow-on to previous HBB and HBS initiatives.

CONCLUSIONS

The HBB training program has had a significant impact on perinatal mortality in the last 10 years. More recent efforts to implement HBS, paired with facility-based QI, have underscored a number of important lessons, including the challenge of measurement, necessity of facility-based QI mentorship and multidisciplinary teams, and importance of systemic commitment to improvement in promoting a culture of QI. In the next 10 years, as we approach the time line for SDG and ENAP targets with the goal of ending preventable neonatal deaths, QI will be an essential implementation strategy as we identify, target, and close remaining gaps in newborn care.

ABBREVIATIONS

AAP: American Academy of Pediatrics
BMV: bag and mask ventilation
ECEB: Essential Care for Every Baby
ECHO: Extension for Community Healthcare Outcomes
ECSB: Essential Care for Small Babies
ENAP: Every Newborn Action Plan
HBB: Helping Babies Breathe
HBS: Helping Babies Survive
ICMB: Improving Care for Mothers and Babies
LMIC: low and lower-middle income countries
QI: quality improvement
SDG: Sustainable Development Goal

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