International Journal of Gynecology and Obstetrics 130 (2015) S46–S53

Contents lists available at ScienceDirect

International Journal of Gynecology and Obstetrics

journal homepage: www.elsevier.com/locate/ijgo

SUPPLEMENT ARTICLE

Essential basic and emergency obstetric and newborn care: From education and training to service delivery and quality of care

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ARTICLE INFO

Keywords:
Emergency obstetric and newborn care (EmONC)
Emergency obstetric care
Essential newborn care
Signal functions
Skilled birth attendants

ABSTRACT

Approximately 15% of expected births worldwide will result in life-threatening complications during pregnancy, delivery, or the postpartum period. Providers skilled in emergency obstetric and newborn care (EmONC) services are essential, particularly in countries with a high burden of maternal and newborn mortality. Jhpiego and its consortia partners have implemented three global programs to build provider capacity to provide comprehensive EmONC services to women and newborns in these resource-poor settings. Providers have been educated to deliver high-impact maternal and newborn health interventions, such as prevention and treatment of postpartum hemorrhage and pre-eclampsia/eclampsia and management of birth asphyxia, within the broader context of quality health services. This article describes Jhpiego's programming efforts within the framework of the basic and expanded signal functions that serve as indicators of high-quality basic and emergency care services. Lessons learned include the importance of health facility strengthening, competency-based provider education, global leadership, and strong government ownership and coordination as essential precursors to scale-up of high impact evidence-based maternal and newborn interventions in low-resource settings.

1. Introduction

Approximately 15% of expected births worldwide will result in life-threatening complications during pregnancy, delivery, or the postpartum period [1]. The concept of emergency obstetric and newborn care (EmONC) was introduced by WHO, UNICEF, and UNFPA in 1997 as an organizing framework for the delivery of evidence-based clinical services, as a critical component of any program to reduce maternal and newborn mortality [2]. Skilled birth attendants (SBAs) [3] provide EmONC services within the context of community-focused and facility-based health systems, enabling timely prevention of and intervention for these complications and saving the lives of mothers and newborns. Universal access to EmONC is considered essential to reduce maternal mortality and requires that all pregnant women and newborns with complications have rapid access to well-functioning facilities that include a broad range of service delivery types and settings [4].

A set of seven key obstetric services, or "signal functions," has been identified as critical to basic emergency obstetric and newborn care (BEmONC): administration of parenteral antibiotics; administration of parenteral anticonvulsants; administration of parenteral uterotonics; removal of retained products (manual vacuum aspiration); assisted vaginal delivery; manual removal of the placenta; and resuscitation of the newborn [5]. Comprehensive emergency obstetric and newborn care (CEmONC) includes all BEmONC services and adds surgical capacity and blood transfusion. This set of life-saving services defines a health facility with regard to its capacity to treat obstetric and newborn emergencies [4]. The decision to include these functions in a package of emergency obstetric and newborn care services was based on evidence from numerous quasi-experimental or experimental studies and is summarized in various systematic reviews [6–9]. Recent global discussions have centered on expansion of the original seven signal functions to encompass activities related to routine care for mothers and newborns because they enable prediction, prevention, and early intervention to mitigate life-threatening complications [10]. These expanded functions include such services as: infection prevention and management for both mothers and infants; monitoring and management of labor using the partograph; active management of the third stage of labor; and infant thermal protection, feeding, and HIV prevention. Table 1 shows the proposed expanded signal functions for obstetrics and newborn care alongside existing functions.

Over the last 15 years, Jhpiego has led consortia for USAID flagship maternal and newborn health (MNH) programs—Maternal and Neonatal

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http://dx.doi.org/10.1016/j.ijgo.2015.03.007

Table 1
Proposed obstetric and newborn signal functions (existing EmONC functions are in *italics*).[a]

Dimensions of facility care	Obstetric	Newborn
General requirements for health facility	Service availability 24/7 Skilled providers in sufficient numbers Referral service to higher-level care, communications tools Reliable electricity and water supply, heating in cold climates, clean toilets	
A. Routine care (for all mothers and babies)	Monitoring and management of labor using partograph	Thermal protection[b]
	Infection prevention measures (hand-washing, gloves)	Immediate and exclusive breastfeeding
	Active management of the third stage of labor (AMTSL)[c]	Infection prevention including hygenic cord care[d]
B. Basic emergency care (for mothers and babies with complications	*Parenteral magnesium sulfate for (pre-) eclampsia*	Antibiotics for preterm or prolonged PROM to prevent infection
	Assisted vaginal delivery	Corticosteroids in preterm labor
	Parenteral antibiotics for maternal infection	*Resuscitation with bag and mask of non-breathing baby*
	Parenteral oxytocic drugs for hemorrhage	KMC for premature/very small babies
	Manual removal of placenta for retained placenta	Alternative feeding[e] if baby unable to breastfeed
	Removal of retained products of conception	Injectable antibiotics for neonatal sepsis (PMTCT if HIV-positive mother)[f]
C. Comprehensive emergency care (functions in addition to Basic)	*Surgery (e.g. cesarean) including anesthesia*	Intravenous fluids
	Blood transfusion	Safe administration of oxygen

Abbreviations: KMC, kangaroo mother care; PMTCT, prevention of mother-to-child transmission; PROM, premature rupture of membranes; 24/7, 24 hours a day 7 days a week.
[a] Reprinted from Gabrysch et al. [10].
[b] Thermal protection: drying baby immediately after birth, skin-to-skin with mother, wrapping, no bath in first six hours.
[c] AMTSL: oxytocin injection in thigh within 1 minute of delivery of baby, controlled cord traction, uterine massage after delivery of the placenta.
[d] Hygenic cord care: cutting with sterile blade, application of 4% chlorhexidine on tip of cord and stump and no application of harmful substances (or clean and dry care in settings with low neonatal mortality and infection risk).
[e] Breastmilk expression and cup/spoon feeding.
[f] PMTCT: in brackets as not strictly a "newborn" function, but included for continuum of care; situational depending on HIV prevalence.

Health (1998–2004), the Access to Clinical and Community Maternal, Neonatal and Women's Health (ACCESS) Program (2004–2009), and the Maternal and Child Health Integrated Program (MCHIP) (2008–2014). These three programs have focused on maternal and newborn survival through the implementation of evidence-based interventions in low-resource countries designed to accelerate the reduction of maternal, newborn, and child mortality [11]. MCHIP has continued to build upon the successes of the Maternal and Neonatal Health and the ACCESS programs while focusing on scale-up and integration into other health areas in the 30 USAID priority countries facing the highest disease burden [11]. These programs have identified and addressed many critical gaps in EmONC service provision by taking research evidence to practice in dozens of low-resource countries. Some of these identified gaps include: (1) poor knowledge and limited coverage of signal functions, especially for the most vulnerable women in hard-to-reach communities; (2) inadequate emphasis on the development of critical clinical skills for EmONC during pre- and in-service education, and poor retention of those skills over time; (3) limited use of birth planning and complication readiness, which aims to reduce or eliminate delays in seeking care and/or reaching care facilities; and (4) poor quality of EmONC services at health facilities in some settings, largely due to weak health systems.

This article aims to share lessons learned from the implementation of the three flagship USAID-funded programs relating to the expansion of coverage and quality of EmONC signal functions. The article also comments on Jhpiego's corollary efforts in advancing the provision of additional high-impact interventions for the provision of high-quality EmONC services, including the expanded signal functions presently under consideration.

2. Methods

The information provided in this article has been extracted from project monitoring documents (service statistics), external evaluation reports, and project publications from the three flagship programs. When necessary, special studies were conducted with approval from the Johns Hopkins University Human Subjects Review Board. Data were extracted from these documents to determine how evidence-based interventions were incorporated at global and national levels into standards of practice, guidelines and protocols, and how healthcare workers were prepared to use these performance standards for quality improvement in the scale-up of access to MNH care. We also looked at how frontline healthcare workers were prepared to become SBAs to provide the most critical evidence-based interventions.

The activities and interventions undertaken by each of these programs are summarized in Table 2. The table looks at the goals and strategic objectives of each program, the major EmONC interventions and notable outcomes related to provider education and training, service delivery, and quality of care in the interest of sharing lessons learned from program experience. We reflect on both achievements from and challenges in the implementation of programs addressing these EmONC services.

As many low-resource countries have worked to increase access to the quality and availability of BEmONC and CEmONC services, Jhpiego has been at the forefront of providing evidence-based technical support to ensure that the health workforce—one of the six "building blocks" of a health system [12,13]—is competent, responsive, and productive in providing these services. Addressing the learning needs of health workers remains a critical component in improving health systems.

The interventions and strategies for improving maternal and neonatal health and survival closely track the household-to-hospital continuum of care (HHCC) approach [14]. The ACCESS program applied the HHCC framework by recognizing the importance of systematically and simultaneously addressing maternal and newborn issues at both the community and facility levels using evidence-based interventions. Supporting community health workers (CHWs) and frontline health workers (physicians, nurses, and midwives) to promote community awareness and care-seeking behaviors in areas with poor utilization of maternal and newborn services increases the potential to reduce the adverse impact of the three delays—(1) delay in the decision to seek care; (2) delay in arrival at a

health facility; and (3) delay in the provision of adequate care—as discussed by Thaddeus and Maine [15]. This manner of community engagement is also known to impact maternal and newborn deaths. Improving the capacity of providers and the health system specifically reduces the "third delay": receiving the appropriate care in a timely fashion. Community involvement is a critical element in helping families understand the benefit of using skilled providers, particularly those who have had prior negative experiences and who are reluctant to engage in care-seeking behaviors for a current pregnancy—a situation often acknowledged as the "Phase Four" delay [16].

3. Implementation experience

The main lesson learned from all of these programs is that a combination of well-coordinated demand creation and service improvement activities is essential to any successful scale-up of evidence-based interventions. Factors that promote such successful scale-up include increased awareness of the availability of global low cost solutions to the major causes of maternal and newborn mortality; strong government ownership of national EmONC efforts that results in the domestication and implementation of global MNH standards; competency-based provider education leading to skilled birth attendance; and respectful maternity care in the context of health systems strengthening. In the sections that follow, information is provided on the settings and process used for dissemination of generic international standards for essential MNH care, provider education, and quality improvement.

3.1. International standards for essential MNH care

Collaborating with WHO, UNFPA, UNICEF, International Federation of Gynecology and Obstetrics (FIGO), International Confederation of Midwives (ICM), and other donors and technical bodies, the Jhpiego-led consortia have helped facilitate the development of a number of guidelines and manuals for provider use. Two manuals were developed in collaboration with WHO as part of The Integrated Management of Pregnancy and Childbirth Series: *Managing Complications of Pregnancy* and *Childbirth (MCPC)* [17] and *Managing Newborn Problems (MNP)* [18]. Both manuals used a symptom-based approach rather than a traditional disease-based approach to clinical decision-making. MCPC was originally published in English and has been translated into several languages including Spanish, French, Dari, Laotian, Bahasa, and Mandarin. MNP is available in English, French, and Arabic. These documents have informed the development and adaptation of maternal and newborn health service delivery guidelines and associated pre- and in-service education and training packages in many low-resource countries including Afghanistan, Bolivia, Burkina Faso, Guatemala, Haiti, Honduras, Indonesia, Nepal, Nigeria, Peru, Tanzania, and Zambia. More recently MCHIP has supported new guidelines from WHO on preventing postpartum hemorrhage (PPH) and pre-eclampsia/eclampsia (PE/E) by making the information more readily available [19].

The key lesson learned is that the provision of global generic guidance on low-cost effective interventions for the prevention and/or treatment of the common causes of maternal and newborn mortality provides a template for countries who wish to set performance standards or protocols for MNH care and a roadmap for the program design.

3.2. Provider education

The education of providers in EmONC always includes a knowledge domain, either in a classroom setting or using online resources, and a competency update enabling providers to practice decision-making and new clinical skills. Jhpiego uses a "humanistic" approach to education and training, in which providers first practice skills on anatomic models, treating them as though they are actual clients. This approach is consonant with Jhpiego's commitment to the philosophy and practice of respectful maternity care [20]. Once skills are mastered on models, providers then form small groups and move to the clinical setting for supervised practice.

Jhpiego has developed a continuum of activities to ensure that providers: (1) learn the evidence basis for EmONC interventions, including the preventive signal functions presently under consideration; (2) practice critical life-saving skills; and (3) transfer their knowledge and skills to their clinical sites. To prepare for the practical component, at least one clinical site is chosen and prepared as a demonstration site for "best practice." These clinical sites must have a high volume of clients and the providers often require targeted educational updates to enhance their ability to provide essential standardized interventions. A dedicated manual was developed to ensure rapid site strengthening and optimal clinical experience during education and training [21].

Supplemental materials have also been developed to support standardized competency-based education and include a variety of teacher/tutor and participant teaching and learning resources. For example, the knowledge domain has been addressed using interactive presentations; the decision-making tools use case studies; and psychomotor skills and promotion of professional attitudes use demonstrations and practice with checklists, first with anatomic models and then with clients. A specific example of this process is Jhpiego's work with the Averting Maternal Death and Disability (AMDD) program to prepare healthcare workers in obstetric anesthesia for use during EmONC service delivery [22–25].

Because repetitive teaching interventions achieve better learning outcomes than single interventions [26], Jhpiego has structured its educational programming with a "low-dose, high-frequency" educational innovation that iteratively prepares lower-level health providers to improve maternal and newborn outcomes [27]. In order for providers to manage complications, it is essential that they understand and support normal birth and labor management, including use of the partograph and active management of the third stage of labor (AMTSL). A number of resource materials and manuals were developed that address these supportive processes and EmONC skills [27].

Follow-up with providers occurs within three to six months to promote the retention of knowledge and skills. Providers undergo testing for knowledge competencies and are observed performing skills on clients and/or models. Discussions are then held with providers' supervisors and facility administrators to assess any barriers to use of best practices. A guide for this process has been developed that can be used both for ongoing assessments and for supportive supervision (Box 1) [28].

The lessons learned from provider education for MNH are that competency-based clinical skills standardizations with the use of anatomic models help to build confidence of providers to provide quality services while protecting clients from harm (see Table 2 for illustrative notable outcomes). A holistic approach to this transfer of learning that prescribes tasks for the learner, teacher, supervisor, and co-workers before, during, and after the teaching intervention is essential, and program managers must learn to adequately invest resources for this implementation.

3.3. Quality improvement

Paxton et al. [29] reviewed 24 national-level needs assessments conducted in Asia, Africa, and Latin America to determine the availability of BEmONC and CEmONC services. The authors noted that while CEmONC facilities were available in adequate number, BEmONC services were not as well distributed within geographic areas. There were also concerns about the quality of care, equity of service delivery, and financial accessibility of these emergency obstetric care facilities. The authors therefore recommended prioritizing upgrades to infrastructure for BEmONC facilities, in-service education of staff on essential EmONC skills, and providing supportive supervision and improved management systems.

To provide a platform for a root cause analysis of quality issues in BEmONC and CEmONC facilities, Jhpiego introduced its quality improvement (QI) approach, known as Standards Based Management

Table 2
Summary of EmONC and maternal/neonatal care services provided by Jhpiego and partners through USAID flagship programs (1998–2014).

Program/date/partners	Countries	Goals and strategic objectives	Major EmONC activities and interventions	Notable EmONC outcomes (education and training, service delivery, quality of care)
Program: Maternal and Neonatal Health Date: 1998–2004 Partners: Jhpiego, CEDPA, JHU-CCP and PATH	Afghanistan Bangladesh Bhutan Bolivia Burkina Faso Egypt Guatemala Honduras India Indonesia Nepal Pakistan Peru Tanzania Yemen Zambia	To promote maternal and newborn survival in low-resource countries by increasing the use of appropriate MNH and nutrition interventions	• Increased collaboration among organizations promoting maternal and newborn care, e.g. with White Ribbon Alliance. • Establishment and promotion of international evidence-based standards for maternal and newborn health, e.g. MCPC and MNP manuals, and incorporation into national guidelines and protocols. • Facility assessments and strengthening. • Competency-based provider education and training in EmOC/EmONC, e.g. AMTSL, use of magnesium sulfate for eclampsia treatment, use of the partograph to monitor labor etc. • Promotion of birth planning and complication readiness. • Performance and quality improvement programs in Guatemala, Burkina Faso, Indonesia, and Honduras.	• International evidence-based standards for MNH were incorporated into national guidelines in more than 15 countries. • Through competency-based education and training, the program increased skilled attendance at birth in Burkina Faso, Guatemala, Indonesia, and Nepal. • **Burkina Faso**: ANC coverage increased from 21% to 58% while births attended by skilled providers increased from 39% in 2001 to 58% in 2004. • **Nepal**: Skilled attendance at birth increased from 15% at baseline to 33% at endline. • **Afghanistan**: Over 50 health providers trained in EmOC expanded services to all 32 provincial hospitals. Healthcare workers were also trained in spinal anesthesia for cesarean delivery. • **Guatemala**: Promoted development of Emergency Plans with better emergency funding and planning mechanisms for EmOC. • **India**: Established emergency response teams and education and training in EmOC. • **Indonesia**: Included PAC services and management of PPH as part of EmOC. • **Nepal**: Expanded EmOC through skilled midwifery and education and training activities and established 15-year plan aiming to provide BEmOC and CEmOC. • **Pakistan**: Practiced AMTSL for all deliveries and strengthened existing BEmONC sites (e.g. educating and training providers; improving infection prevention practices, donating basic obstetric equipment). • **Yemen**: Improved district hospitals' capacity to provide EmOC.
Program: ACCESS Date; 2004–2009 Partners: Jhpiego, Save the Children, Constella-Futures, AED, ACNM, IMA World Health	Afghanistan Cameroon Ethiopia Ghana Guinea Haiti India Malawi Mauritania Nepal Niger Nigeria Rwanda Tanzania Togo	To improve the health and survival of mothers and their newborns through expansion of coverage, access and use of MNH services and through improving household health behaviors and practices	• Increased international and national attention and commitment to improve MNH through global and local alliances including the WHO, Roll Back Malaria's Malaria in Pregnancy Working Group, UNICEF, UNFPA, Partnership Maternal, Newborn and Child Health, White Ribbon Alliance, International Confederation of Midwives, International Federation of Gynecology and Obstetrics, Healthy Newborn Partnerships, etc. • Introduced and/or expanded focused antenatal care services in 15 countries. • Introduced and/or expanded PPH and PE/E prevention programs in 14 countries. • Introduced and/or expanded skilled attendance at birth in 15 countries. • Introduced and or expanded newborn care in 16 countries.	• **Afghanistan, Ethiopia, Ghana, India, Malawi, Nigeria, Tanzania**: Education and training in BEmONC was implemented coupled with work to improve skills of midwifery tutors and preceptors in 126 pre-service education institutions. • **Afghanistan**: 96% of women in project intervention areas received uterotonics for AMTSL compared with only 26% in the comparison area. 96% of women reached in the community by CHWs accepted to use misoprostol to prevent PPH. • **Nepal**: Misoprostol was dispensed to 18 761 pregnant women by female CHWs, thereby increasing the proportion of deliveries protected by uterotonics to 72.5% from 10.4% at baseline. Skilled attendance at birth increased from 9.9% to16%. • **Ethiopia, Ghana, Malawi, Tanzania**: 132 pre--service tutors/preceptors participated in technical and clinical skills standardization courses in BEmONC. • **Malawi, Nigeria**: National performance standards for EmONC were finalized and implemented.

(continued on next page)

Table 2 (*continued*)

Program/date/partners	Countries	Goals and strategic objectives	Major EmONC activities and interventions	Notable EmONC outcomes (education and training, service delivery, quality of care)
Program: MCHIP Date: 2008–2014 Partners: Jhpiego, Save the Children, John Snow, Inc., Program for Appropriate Technology in Health, ICF International, Population Services International, Broad Branch Associates, Johns Hopkins University's Institute for International Programs	**SBA**: DRC, Ethiopia, Ghana, India, Indonesia, Kenya, Malawi, Mozambique, Nigeria **PPH prevention and treatment**: DRC, Ghana, Guinea, India, Indonesia, Kenya, Liberia, Madagascar, Malawi, Mozambique, Nigeria, Rwanda, South Sudan, Zimbabwe **PE/E prevention and treatment**: Ghana, India, Indonesia, Kenya, Malawi, Mozambique, Nigeria	To accelerate the reduction of maternal, newborn, and child mortality in 30 priority countries through the introduction, development, and scale-up of high-impact maternal, newborn, and child health interventions	• Conducted QoC assessments/introduced PQI/SBM-R. • Updated national standards of care. • Built capacity and competency of midwives and SBAs in prevention and treatment of PPH and PE/E. • Undertook multicountry assessments of PPH and PE/E programming in 2011 and 2012. • Operationalized updated WHO Guidelines on PPH and PE/E.	• **Rwanda**: Over 150 healthcare providers and CHWs were trained in BEmONC, leading to 100% of births in targeted facilities occurring with SBAs using a partograph and AMTSL. • **Bangladesh**: Through the MaMoni Program, CHWs were trained to provide counseling on prevention of PPH and distribution of misoprostol. • **Bolivia**: Finalized 7 areas of SBM-R performance standards while training 9 local consultants on AMTSL; advanced implementation of SBM-R for QI in maternal health. • **DRC**: expanded AMTSL activities, including conducting assessment of combined AMTSL/essential newborn care education and training packages; improved performance of SBAs and supported update of national standards. • **Ethiopia**: The project is increasing the capacity of local nongovernmental organizations to provide BEmONC education and training, e.g. Ethiopian Midwifery Association. • **Ethiopia, Kenya, Madagascar, Mozambique, Rwanda, Tanzania**: Implemented the maternal and newborn QoC assessments with focus on management of PE/E, PPH, and birth asphyxia. • **Ghana**: Supported midwifery pre-service education. • **India**: Initiated SBM-R approach; increased capacity to provide anesthesia for EmONC. • **Indonesia**: Completed health facility survey; introduced SBM-R process with QI efforts; improved competency of midwives in AMTSL. • **Madagascar**: Adoption of national PPH prevention strategy through uterotonic coverage with emphasis on education and training on AMTSL using oxytocin and misoprostol; implemented QoC facility survey; developed capacity in BEmONC. • **Malawi**: Trained health providers on BEmONC; introduced PQI. • **Mozambique**: Institutionalized standardized QI approach in all 34 Model Maternity facilities (country's largest EmONC facilities), including use of AMTSL and partograph. • **Nepal**: Conducted cross-over trial study about PE/E detection; provided in-service education. • **Nigeria**: Scaled up EmONC services to 57 health facilities; supported strengthening of Essential and EmONC with pre-service midwifery education. • **Paraguay**: Strengthened capacity for emergency care, especially capacity of SBAs. • **Rwanda**: Implemented maternal and newborn care QoC study. • **Sierra Leone**: Supported capacity building of SBAs. • **Zimbabwe**: Supported oxytocin potency testing.

Abbreviations: AMTSL, active management of the third stage of labor; ANC, antenatal care; BEmOC, basic emergency obstetric care; BEmONC, basic emergency obstetric and newborn care; CEmOC, comprehensive emergency obstetric care; CHWs, community health workers; EmOC, emergency obstetric care; EmONC, emergency obstetric and newborn care; MNH, maternal and newborn health; PAC, postabortion care; PE/E, pre-eclampsia/eclampsia; PPH, postpartum hemorrhage; PQI, performance and quality improvement; QoC, quality of care; QI, quality improvement; SBAs, skilled birth attendants; SBM-R, Standards-Based Management and Recognition (Jhpiego, Baltimore, USA).

Box 1
Improving AMTSL service provision in Tanzania.

In Tanzania, Jhpiego implemented the Mothers and Infants, Safe, Healthy and Alive program to improve the quality of basic emergency obstetric and newborn care (BEmONC). Programmatic approaches included: competency-based education of healthcare providers on BEmONC; the development and implementation of complementary national BEmONC standards as a tool for supportive follow-up of course participants in their workplace; procurement and distribution of equipment and supplies to fill identified gaps; and promotion of a supportive policy and advocacy environment. These interventions have led to notable improvements in care. For example, 60% of women received active management of the third stage of labor (AMTSL) according to the current guidelines and standards in 2012—an increase of 19% from 2010. There was increased use of oxytocin at all health facilities, and the overall use of 99% oxytocin in the performance of AMTSL reflected excellent availability. In 2012, only four cases of postpartum hemorrhage (PPH) (0.8% of 500 births) were observed compared with 10 cases in 2010, which is a testament to the impact of preventing PPH through AMTSL. All PPH cases were managed successfully.

and Recognition (SBM-R) (Jhpiego, Baltimore, USA) [30], in many of its EmONC projects as a complement to its education and training efforts. Assessment of facilities and providers according to EmONC performance standards helped draw attention to gaps in the quality of care at health facilities and implementation of solutions that could lead to quality improvement. The use of the SBM-R approach has been documented as a strategy that can help to improve the quality of maternal and newborn care in many countries and under a variety of thematic areas, as a key lesson learned. A full discussion of SBM-R is offered in another paper in this supplement [31].

4. Translating research to practice

4.1. Use of the partograph

The partograph, a tool used to provide a continuous pictorial overview of labor on a preprinted single sheet of paper, is an obstetric care practice that has been proposed as a "routine care" signal function. WHO has cited the partograph as one of its essential interventions [32] because it helps identify obstructed labor [33] and thus helps to prevent uterine rupture, one of the five main causes of maternal death, and birth asphyxia, one of the three main causes of newborn mortality. The partograph can prompt a healthcare provider to take action, especially in low-resource settings where prolonged labor and delay in decision-making are significant causes of adverse obstetric outcomes [34]. ICM includes use of the partograph as a basic competency for midwives because of its value as a clinical management tool in low-resource settings [35]. Jhpiego and other global implementing organizations emphasize its use even though adoption is often slow. In Nigeria, for example, despite repeated educational sessions and supportive follow-up visits, use of the partograph at endline was only documented in 44.4% of 81 437 deliveries. Reasons frequently given for the suboptimal use of the partograph include late presentation of the women in labor (often in second stage) and staff shortage in very busy labor wards [36]. Based on lessons learned from program experience, Jhpiego has adapted the text and pictures used in its educational materials to reflect the specific context in which the partograph will be used, to make it as simple as possible for providers to learn and integrate into their daily practice. Jhpiego has also recently introduced "E-Partograms"—electronic handheld devices—based on WHO's paper partograph, designed to increase accessibility to patient data between different levels of healthcare providers and facilities [37,38]. However, current opinion is that further trial evidence is required to establish the efficacy of partogram use [34].

4.2. Scaling up use of magnesium sulfate for severe pre-eclampsia/eclampsia

Hypertensive disorders related to pregnancy affect about 10% of all pregnant women around the world [39–41]. WHO has identified magnesium sulfate as the most effective and low-cost anticonvulsant for women with severe pre-eclampsia/eclampsia [42]. In compliance with WHO guidelines, Jhpiego supported the use of magnesium sulfate in each of the countries in which it worked with mixed success. In Nepal, for instance, the ACCESS Program worked in collaboration with the Nepal Society for Obstetricians and Gynaecologists (NESOG) and the Family Health Division of the Department of Health Services to strengthen the use of magnesium sulfate for the treatment of severe pre-eclampsia/eclampsia in 22 health facilities across Nepal, where pre-eclampsia/eclampsia accounts for 21% of all maternal deaths, using the SBM-R approach [43]. The drug was incorporated into pre- and in-service education for Nepali SBAs starting in 2006 and was included in the national medical standards and essential medicines list. Evaluations of Nepali providers, following continuing professional education activities that were focused on appropriate use of the drug, indicated that the average facility score increased from 26% to 60% [43]. Eight out of 22 sites scored 80% or higher and another 12 sites showed substantial improvements [43]. By the end of the ACCESS program in 2009, 11 of the 22 facilities were performing at 80% or higher in achieving evidence-based standards [43]. During site visits, staff identified gaps and created an action plan to address them. NESOG members conducted clinical updates, disseminated job aids, and supported staff with on-site coaching. This (and similar) experience(s) generated the lesson learned that national professional organizations can be engaged in capacity building of healthcare workers to champion the scale-up of critical evidence-based interventions for MNH.

4.3. Essential newborn care

Based on the evidence that outcomes for the mother and the newborn are intimately linked, ACCESS worked in 16 countries to improve outcomes for newborns with a particular focus on promotion of thermal protection, early and exclusive breastfeeding, newborn resuscitation, and infection prevention and treatment. Following the global introduction of the Helping Babies Breathe (HBB) program [44], MCHIP prepared hundreds of healthcare workers in essential newborn care and specifically in HBB. HBB has been integrated into BEmONC education and training in many countries such as Tanzania and Zimbabwe and is discussed further in this Supplement [45]. In Nepal, for example, under the ACCESS program, community health volunteers were trained in kangaroo mother care, resulting in a 60% adoption of the practice. The fact that low-cost, evidence-based, essential newborn interventions can be rapidly scaled-up in low-resource settings provided there is strong government ownership and coordination of relevant stakeholders, was the important lesson learned.

5. Opportunities and challenges

While remarkable progress has been made toward the reduction of maternal and child mortality in many low-resource countries, critical challenges remain in provision of high-quality EmONC services, particularly in Sub-Saharan Africa and Southeast Asia. The global community must focus on reaching the poorest and most vulnerable populations to address persistent inequities [46]. These inequities include, among other things, a shortage of SBAs in the most vulnerable communities that is driven by lack of targeted workforce planning strategies, for example matching deployment with the competencies of providers and addressing well-known factors that discourage workforce retention.

At the very least, we can ensure that the SBAs, who are available, have the knowledge and skills needed to provide the EmONC services that save maternal and newborn lives. Jhpiego has worked to achieve this objective in many low-resource countries over the past decade by influencing international standards for EmONC; developing uniform, evidence-based, educational approaches tailored for low-resource settings; and continually updating practices based on new research findings.

Jhpiego's programming has been cross-cutting along the continuum of care. Responsive to identified country needs, Jhpiego has attempted to address not only elements of the proposed expansion of EmONC signal functions but also complementary health services that strengthen the quality of MNH service delivery.

Issues still persist, however, that adversely affect the delivery of high-quality maternal, newborn, and EmONC services in health facilities. These include stock-outs of essential maternal, newborn, and child health commodities due to poor logistic management systems; limited opportunities for providers to access supportive supervision and engage in continuing professional development activities; difficulties in keeping up-to-date clinical guidelines based on emerging scientific evidence; weak record-keeping and monitoring and evaluation systems that limit opportunities to document both successes and challenges to service delivery; and inadequate financing of country programs, or conversely, excessive donor dependency that stalls sustained progress.

Jhpiego and MCHIP have worked in alliance with other existing global programs, such as the Global Fund for AIDS, Tuberculosis and Malaria, the President's Emergency Plan for AIDS Relief, the Partnership for Maternal, Newborn and Child Health, and the Child Survival Call to Action, to provide opportunities for addressing issues that overarch the provision of quality health systems, such as the need for health systems strengthening and strategies for management of communicable diseases that affect women and their families. Jhpiego and MCHIP have also worked with initiatives to address community- and facility-level challenges, such as the United Nations Commission for Life-Saving Commodities for Women and Children's Health, which aims to address the problem of stock-outs of key commodities at the community level, and HBB, which focuses on having at least one qualified provider in each delivery setting ready to provide newborn transition services. New opportunities are emerging in the post Millennium Development Goal era, such as: the Every Woman, Every Child; Every Newborn Action Plan; the Commission on Information and Accountability for Women's and Children's Health; A Promise Renewed-Call to Action; Ending Preventable Maternal and Child Deaths and Ending Preventable Maternal Mortality. Countries need to take advantage of these global initiatives to leverage resources for their efforts to achieve reductions in maternal and neonatal morality.

These challenges and potential opportunities need to be addressed in order to achieve a rights-based approach to healthcare delivery [47]. Innovative approaches need to be implemented at scale to extend universal coverage of high-impact interventions and reduce or eliminate inequity while fostering efficiency of the services delivered. Countries should prioritize workforce planning to increase the number of SBAs who will provide these high-impact interventions at the health facility or at home in countries with high homebirth rates. In the interim, provision should be made for task-shifting or task-sharing policies that will allow for low-dose high-frequency capacity building of lower level cadres of staff to provide selected basic EmONC services. For example, such staff could be trained in community distribution of misoprostol for AMTSL or chlorhexidine for prevention of umbilical cord sepsis. They can also be trained to administer the loading dose of magnesium sulfate before referral of eclamptic patients to higher level facilities. In addition to health workforce interventions, countries need to identify and mobilize existing community structures to educate pregnant women and their families on danger signs in pregnancy, during and after childbirth, and to advocate for institutional deliveries. Countries and development partners should also invest in health systems strengthening to improve basic infrastructure in maternity units including electricity and water supply, blood transfusion services, logistic management of life-saving commodities and consumable supplies, record-keeping and use of data for decision-making. Countries, in collaboration with their relevant professional organizations, should be supported to initiate and own vital registrations of births and deaths and institutional or community maternal and perinatal death reviews. Such confidential enquiries should embrace a "no name, no blame" policy to encourage honest and productive dialogue that will lead to quality improvement of MNH services.

Conflict of interest

The authors have no conflicts of interest.

References

[1] WHO, UNICEF, UNFPA, World Bank. Trends in maternal mortality: 1990 to 2010. Geneva: WHO; 2012. http://www.unfpa.org/public/home/publications/pid/10728. Accessed April 3, 2014.

[2] Paxton A, Maine D, Freedman L, Fry D, Lobis S. The evidence for emergency obstetric care. Int J Gynecol Obstet 2005;88(2):181–93.

[3] World Health Organization, International Confederation of Midwives, International federation of Gynecology and Obstetrics. Making pregnancy safer: the critical role of the skilled attendant. A joint statement by WHO, ICM and FIGO. Geneva: WHO; 2004. http://www.who.int/maternal_child_adolescent/documents/9241591692/en/. Accessed April 3, 2014.

[4] Campbell OM, Graham WJ, Lancet Maternal Survival Series steering group. Strategies for reducing maternal mortality: getting on with what works. Lancet 2006; 368(9543):1284–99.

[5] World Health Organization, UNFPA, UNICEF, AMDD. Monitoring emergency obstetric care: a handbook. Geneva: WHO; 2009. http://whqlibdoc.who.int/publications/2009/9789241547734_eng.pdf?ua=1. Accessed April 3, 2014.

[6] Hofmeyr GJ, Haws RA, Bergström S, Lee A, Okong P, Darmstadt G, et al. Obstetric care in low-resource settings: what, who, and how to overcome challenges to scale up? Int J Gynecol Obstet 2009;107(Suppl. 1):S21–45.

[7] Hussein J, Kanguru L, Astin M, Munjanja S. The effectiveness of emergency obstetric referral interventions in developing country settings: a systematic review. PLoS Med 2012;9(7):e1001264.

[8] van Lonkhuijzen L, Dijkman A, van Roosmalen J, Zeeman G, Scherpbier A. A systematic review of the effectiveness of training in emergency obstetric care in low-resource environments. BJOG 2010;117(7):777–87.

[9] Dogba M, Fournier P. Human resources and the quality of emergency obstetric care in developing countries: a systematic review of the literature. Hum Resour Health 2009;7:7.

[10] Gabrysch S, Civitelli G, Edmond KM, Mathai M, Ali M, Bhutta ZA, et al. New signal functions to measure the ability of health facilities to provide routine and emergency newborn care. PLoS Med 2012;9(11):e1001340.

[11] Jhpiego. Jhpiego: a history. http://www.jhpiego.org/content/jhpiego-history. Accessed June 18, 2014.

[12] World Health Organization. Monitoring the building blocks of health systems: a handbook of indicators and their measurement strategies. Geneva: WHO; 2010. www.who.int/healthinfo/systems/monitoring/en/index.html. Accessed April 3, 2014.

[13] World Health Organization. Everybody's Business: Strengthening health systems to improve health outcomes. WHO's framework for action. Geneva: WHO; 2007. http://www.who.int/healthsystems/strategy/everybodys_business.pdf. Accessed April 3, 2014.

[14] Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. Lancet 2007;370(9595):1358–69.

[15] Thaddeus S, Maine D. Too far to walk: maternal mortality in context. Soc Sci Med 1994;38(8):1091–110.

[16] Pacagnella RC, Cecatti JG, Osis MJ, Souza JP. The role of delays in severe maternal morbidity and mortality: expanding the conceptual framework. Reprod Health Matters 2012;20(39):155–63.

[17] World Health Organization, UNFPA, UNICEF, World Bank. Managing complications in pregnancy and childbirth: a guide for midwives and doctors. http://whqlibdoc.who.int/publications/2007/9241545879_eng.pdf?ua=1 Geneva: WHO; 2000 (reprint 2007)Accessed April 3, 2014.

[18] World Health Organization, UNFPA, UNICEF, World Bank. Managing newborn problems: a guide for doctors, nurses, and midwives. http://whqlibdoc.who.int/publications/2003/9241546220.pdf Geneva: WHO; 2003Accessed April 3, 2014.

[19] USAID, MCHIP, PRE-EMPT, World Health Organization. WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia: implications and actions. http://www.mchip.net/sites/default/files/PEE%20Briefer.pdf. Accessed April 3, 2014.

[20] Bowser D, Hill K. Exploring evidence for disrespect and abuse in facility-based childbirth: report of a landscape analysis. http://www.mhtf.org/wp-content/uploads/sites/17/2013/02/Respectful_Care_at_Birth_9-20-101_Final.pdf. Published 2010. Accessed April 3, 2014.

[21] Jhpiego. Site assessment and strengthening for maternal and newborn health programs. http://www.jhpiego.org/files/SiteAssessMNH.pdf Baltimore, USA: JHPIEGO; 2004Accessed April 3, 2014.

[22] Islam MT, Haque YA, Waxman R, Bhuiyan A. Implementation of emergency obstetric care training in Bangladesh: lessons learned. Reprod Health Matters 2006;14(27):61–72.
[23] Mavalankar D, Sriram V. Provision of anaesthesia services for emergency obstetric care through task shifting in South Asia. Reprod Health Matters 2009;17(33):21–31.
[24] Jhpiego. Emergency Obstetric Care for Doctors and Midwives. http://reprolineplus.org/resources/emergency-obstetric-care-doctors-and-midwives-learning-resource-package. Published in 2003.
[25] Jhpiego. Anesthesia for Emergency Obstetric Care for Doctors and Midwives. http://reprolineplus.org/resources/anesthesia-emergency-obstetric-care-doctors-and-midwives-learning-resource-package. Published 2003. Accessed April 7, 2014.
[26] Bluestone J, Johnson P, Fullerton J, Carr C, Alderman J, BonTempo J. Effective in-service training design and delivery: evidence from an integrative literature review. Hum Resour Health 2013;11:51.
[27] Jhpiego. Guidelines for assessment of skilled providers after training in maternal and newborn healthcare. http://www.jhpiego.org/files/GdlnsSkillProvEN.pdf Baltimore, USA: JHPIEGO; 2004Accessed April 3, 2014.
[28] Jhpiego. Maternal and newborn health. http://reprolineplus.org/resources/technical/maternal-newborn-health. Accessed April 3, 2014.
[29] Paxton A, Bailey P, Lobis S, Fry D. Global patterns in availability of emergency obstetric care. Int J Gynecol Obstet 2006;93(3):300–7.
[30] Necochea E, Bossemeyer D. Field guide: Standards-based management and recognition learning resource package. http://reprolineplus.org/resources/field-guide-standards-based-management-and-recognition-learning-resource-package. Published 2005. Accessed April 3, 2014.
[31] Necochea E, Tripathi V, Kim Y-M, Akram N, Hyjazi Y, Rashidi T, et al. Implementation of the Standards-Based Management and Recognition approach to quality improvement in maternal, newborn, and child health programs in low-resource countries. Int J Gynecol Obstet 2015;130(Suppl. 2):S17-S24.
[32] The Partnership for Maternal, Newborn and Child Health. Essential interventions, commodities and guidelines for reproductive health, maternal, newborn and child health: a global review of the key interventions related to reproductive, maternal, newborn and child health (RMNCH). http://www.who.int/pmnch/knowldeges/publications/201112_essential_interventions/en/ Geneva: PMNCH; 2011Accessed April 7, 2014.
[33] Javed I, Bhutta S, Shoaib T. Role of partogram in preventing prolonged labour. J Pak Med Assoc 2007;57(8):408–11.
[34] Lavender T, Hart A, Smyth RM. Effect of partogram use on outcomes for women in spontaneous labour at term. Cochrane Database Syst Rev 2013;7:CD005461.
[35] Fullerton J, Thompson J. 2013 Amendments to international conference of midwives' essential competencies and education standards core documents: clarification and rationale. Int J Childbirth 2013;3(4):184–94.
[36] Airede LR, Ishola G, Segun T, Isiugo-Abanine U, Rwalins B, Otolorin E. Strengthening Emergency Obstetric and Newborn Care and Family Planning Services in Northwest Nigeria (poster). http://www.mchip.net/sites/default/files/mchipfiles/FPService_GHC.pdf. Published 2011. Accessed April 7, 2014.
[37] Jhpiego. Jhpiego Innovations Program: development, delivery and impact at scale. http://www.jhpiego.org/en/content/innovations. Accessed July 1, 2014.
[38] USAID. The Catalog: version 1.0. http://www.jhpiego.org/files/innovations/USAID_The_Catalog_Version_1.pdf. Published 2013. Accessed July 1, 2014.
[39] Duley L. The global impact of pre-eclampsia and eclampsia. Semin Perinatol 2009;33(3):130–7.
[40] Steegers EA, von Dadelszen P, Duvekot JJ, Pijnenborg R. Pre-eclampsia. Lancet 2010;376(9741):631–44.
[41] Roberts CL, Ford JB, Algert CS, Antonsen S, Chalmers J, Cnattingius S, et al. Population-based trends in pregnancy hypertension and pre-eclampsia: an international comparative study. BMJ Open 2011;1(1):e000101.
[42] World Health Organization. WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia: evidence base. http://whqlibdoc.who.int/hq/2011/WHO_RHR_11.25_eng.pdf. Accessed April 3, 2014.
[43] USAID, ACCESS. Strengthening the use of magnesium sulphate for management of severe pre-eclampsia and eclampsia. http://reprolineplus.org/resources/strengthening-use-magnesium-sulphate-management-severe-pre-eclampsia-and-eclampsia. Published 2010. Accessed April 9, 2014.
[44] Van Heerden C, Cur B, Cur M. An introduction to Helping Babies Breathe: the "Golden Minute" is here for South African newborn babies. Prof Nurs Today 2012;16(3):1–2.
[45] Smith J, de Graft-Johnson, Azfar P, Ricca J, Fullerton J. Scaling up high-impact interventions: how is it done? Int J Gynecol Obstet 2015;130(Supp. 2):S4–S10.
[46] Souza J, Gulmezoqlu AM, Vogel J, Carroli G, Lumbiganon, Qureshi Z, et al. Moving beyond essential interventions for reduction of maternal mortality (the WHO multicountry survey on maternal and newborn health): a cross-sectional study. Lancet 2013;381(9879):1747–55.
[47] Hammonds R, Ooms G. The emergence of a global right to health norm – the unresolved case of universal access to quality emergency obstetric care. BMC Int Health Hum Rights 2014;14:4.