

Adaptation of Essential Care for Every Baby Educational Program to Improve Infant Outcomes in the Context of Zika

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Abstract

Background: The outbreak and ongoing transmission of Zika virus provided an opportunity to strengthen essential newborn care and early childhood development systems through assistance by US Agency for International Development Applying Science to Strengthen and Improve Systems (USAID ASSIST). There is an evidence gap on the impact of Helping Babies Survive educational programs, including Essential Care for Every Baby (ECEB), beyond early mortality. The objective was to create a system of sustainable training dissemination which improves newborn care-related quality indicators in the context of Zika.

Methods: USAID ASSIST supported a series of technical assistance visits by the American Academy of Pediatrics (AAP) in four Caribbean countries to strengthen the clinical capacity in care of children potentially affected by Zika through dissemination of ECEB, teaching QI methodology, coaching visits, and development of clinical care guidelines. ECEB was adapted to emphasize physical exam findings related to Zika. The first series of workshops were facilitated by AAP technical advisors and the second series were facilitated by the newly trained local champions. Quality care was monitored with performance indicators at 134 health facilities.

Results: A repeated measures (pre-post) ANOVA was conducted, revealing significant pre-post knowledge gains [$F(1)=197.9, p<0.001$] on knowledge check scores. Certain performance indicators related to ECEB practices demonstrated significant changes and midline shift on the run chart in four countries.

Conclusion: ECEB can be adapted to incorporate important local practices, causes of neonatal morbidity and mortality, and differing healthcare system structures, leading to improved performance of health systems.

Background

The UN Sustainable Development Goals (SDG) target reductions in neonatal mortality rate and include ending preventable deaths of newborns and children under 5 years of age.(1) A collaborative toolkit has been developed to support the implementation of the *Global Strategy for Women's, Children's and Adolescent's Health* and accelerate the health-related Development Goals. However, there is currently a lack of evidence on successful implementation strategies to improve newborn care across systems of practice.(2, 3) The outbreak and ongoing transmission of Zika virus in Latin America and the Caribbean since 2016 provided an opportunity to strengthen essential newborn care and early childhood development systems in Zika-affected countries through donor assistance. Since July 2018, the US Agency for International Development Applying Science to Strengthen and Improve Systems (USAID ASSIST) Project has been working with Ministries of Health (MOH) to provide short-term technical assistance in four Eastern and Southern Caribbean countries (Antigua and Barbuda, St. Vincent and the Grenadines, St. Kitts and Nevis, and Dominica) to improve early detection, care and support of children and families potentially affected by Zika.(4) Full description of this technical assistance program is described elsewhere.(4)

The total number of suspected cases of Zika in these countries ranged from 508 to 1154 from 2015 to January 2018, and 5-17 confirmed cases in pregnant women per country. At the start of this project (2018 data), the median neonatal mortality rates ranged from 3.4 to 28.3 per 1,000 live births in these countries and the UN SDG is a rate of under 12 deaths per 1,000 neonates by 2030. (5) The MOH of supported countries prioritized technical assistance to focus on strengthening the resiliency of newborn and well-baby care systems to address similar future public health emergencies. However, with limited access to confirmatory testing, and the full spectrum of clinical disease from congenital Zika still evolving, it was unclear what percentage of affected pregnant women and their neonates were receiving a diagnosis of Zika, how Zika was impacting neonatal mortality, and whether surviving neonates were being connected to recommended services.

USAID ASSIST used a combination of different methods to achieve above objectives. Improvement teams were set up and supported in all 134 functional health facilities in the four countries to strengthen quality improvement and clinical capacity in care of newborns potentially affected by Zika through Essential Care for Every Baby (ECEB), neurodevelopmental surveillance, early child stimulation, and psycho-emotional support trainings. Teams were provided with monthly quality improvement (QI) coaching to identify quality gaps and use plan-do-study-act cycles to improve care. There was an additional focus on development and dissemination of Zika clinical care guidelines and provider decision support tools for related processes of care. Existing in-country and regional referral systems were standardized for newborns with developmental needs, including those potentially affected by Zika across the early detection and care continuum, including psychosocial support of affected families. Clinical content-expertise, including ECEB trainings was provided by USAID ASSIST's partner organization, American Academy of Pediatrics (AAP).

Essential Care for Every Baby is one component of the *Helping Babies Survive* (HBS) suite of programs: an initiative of a public-private Global Development including partners such as the American Academy of Pediatrics.(6, 7) HBS curricula are evidence-based, hands-on training programs developed to reduce neonatal mortality in resource-limited environments at a relatively low cost.(8) ECEB specifically teaches health care providers essential newborn care practices to keep all newborns healthy from the time of birth until discharge from the facility, and was found to improve newborn care practices in other settings.(7, 9, 10) There is an evidence gap on the impact of HBS program beyond early neonatal outcomes of stillbirth and early mortality.(11) The objective of the ECEB Eastern and Southern Caribbean in-country program was to create a system of sustainable training dissemination that contributes to improving newborn care-related quality indicators in the context of Zika. The aims of this study were to determine if health care providers would have an increase in knowledge about newborn care and signs of congenital Zika after attending an adapted ECEB course which emphasized features of Zika that present in newborns, to determine if skills were retained through the training of trainers cascade, and to monitor relevant clinical processes and outcomes at the facility and regional level. We hypothesized that health care providers would demonstrate an increase in newborn care knowledge after attending the workshop regardless of the type of ECEB facilitator. Our objective was to demonstrate improved newborn care at the health facility, national and regional level after ECEB courses as part of a set of interventions.

Methods

Beginning in July 2018, USAID ASSIST supported a series of technical assistance visits by the AAP to disseminate ECEB training within the larger scope of work focused on strengthening the clinical capacity in care of newborns and children potentially affected by Zika. ECEB, a skills-based program to teach essential newborn care from birth until discharge, was adapted within this context. ECEB utilizes hands-on learning and practice using a newborn simulator and breastfeeding simulator. Additional educational materials include the Action Plan, flip charts, provider guide, parent guide, a multiple-choice knowledge check questionnaire, and two Objective Structured Clinical Evaluations (OSCEs). In preparation for the in-country ECEB workshops, the Action Plan was adapted to emphasize screening for signs and symptoms of Zika at birth (Figure 1). An insert to the provider guide was created and disseminated to all learners at the workshops to focus on facility-level Zika clinical care improvement. These adapted ECEB materials harmonized with other job aids provided as part of this project, including standardized anthropometric growth charts for microcephaly screening, a Clinical Management Decision-Tree for Infants Born During Zika Transmission (Figure 2), and a Signs of Zika at Birth poster.

With use of these adapted materials and during hands-on training, technical advisors from the AAP emphasized physical exam findings indicative of Congenital Zika Syndrome; measurement, plotting and documentation of newborn growth parameters with an emphasis on head circumference; and developmental surveillance after discharge. In each country, in November and December 2018, an AAP technical advisor taught 2-3 ECEB workshops with 6-10 learners each. Three months later, identified in-country ECEB champions (4-7 per workshop) were coached by AAP technical advisors to facilitate additional trainings for naive learners (2-7 per workshop). This train-the-trainer model has been used in other HBS programs.⁽¹²⁾ The in-country ECEB champions were selected by their respective MOHs based on their role within the health care facility and leadership ability.

The ECEB training occurred within the larger context of the USAID project, with improvement team formation at 134 health facilities in the four countries. At each in-country technical assistance visit, health care providers received formal QI training and improvement activities continued through September 2019. Teams received monthly QI coaching throughout the life cycle of the project to identify quality gaps and use plan-do-study-act cycles to test and implement changes, routinely monitor the performance and refine changes based on the monitoring results. Performance data were collected and entered into a web-based improvement indicator database, allowing performance tracking over time at the facility, district, and national levels in run charts that were evaluated by statistical process control for significant improvement.

Performance indicators that directly related to the Essential Care for Every Baby workshops

United States Agency for International Development Applying Science to Strengthen and Improve Systems Project Zika response in Antigua, Dominica, St Kitts and Nevis, and St Vincent and the Grenadines with partnership by the American Academy of Pediatrics, August 2018 to July 2019.

No.	Indicator components
1	Proportion of newborns receiving essential newborn care before discharge
	Percent of newborns breastfed within one hour of birth
	Percent of newborns with immediate skin to skin contact with mothers during the first hour after birth
	Percent of newborns with Vitamin K administration
	Percent of newborns with eye care
2	Proportion of newborns who were appropriately screened for microcephaly
	Percent of newborns whose head circumference was properly measured and documented
	Percent of newborns whose head circumference was properly classified
	Percent of newborns who were appropriately evaluated for other symptoms of Congenital Syndrome Associated with Zika Virus and whose mothers were screened for Zika virus infection during pregnancy
	Percent of newborns with documented presence or absence of any visible congenital brain abnormalities
	Percent of newborns whose mothers were screened for signs and symptoms (rash, red eyes, joint pains, fever) or lab results of Zika virus infection during pregnancy
4	Percent of newborns in postnatal care wards or areas in the health facility with essential assessment practices
	Percent of newborns with documented weight and length
	Percent of newborns with documented respiratory rate
	Percent of newborns with documented feeding assessment
	Percent of newborns with documented body temperature
	Percent of newborns with danger signs assessment and documentation
	Percent of newborns who had hypothermia (Temperature < 36.5 C) within the first 24 hours after birth
5	Percent of newborns with exclusive breastfeeding before discharge

At each workshop, a pre- and post- ECEB Knowledge Check multiple choice questionnaire and two OSCEs were administered. The ECEB knowledge check includes 25 multiple choice questions, and the OSCEs are role-playing, performance-based tests, with a list of skills that need to be demonstrated by the test-taker within a time limit following a verbal prompt. A repeated measures ANOVA was conducted to evaluate factors associated with significant change in knowledge check score. This compared the pre-course knowledge check scores and the post-course knowledge check scores between subjects who attended an AAP advisor-led workshop and those who attended a local champion-led workshop.

Results

Seventy-one health providers were identified to attend an ECEB workshop with Zika emphasis across the four countries (Table 1). Nurse-midwives were the most common type of learner in the AAP led workshop (32/71, 45%), yet fewer learners in the local-champion led workshop were nurse-midwives (4/24, 17%). There was a greater proportion of house officers (physicians-in-training) and physicians in the AAP-led workshops. Local champions were supported in further facilitation of training within the health care facilities.

Table 1
Self-described roles of workshop participants

	Nov-Dec 2018 AAP Advisor-Led Workshop	March 2019 Local Champion-Led Workshop
	n (%)	n (%)
Obstetrical House Officers	4 (5)	0
Pediatric House Officers	3 (4)	2 (8)
Nurse-midwives	32 (45)	4 (17)
Staff Nurses	30 (42)	7 (22)
Ward Managers	1 (1)	1 (3)
Physician	1 (1)	2 (8)
Family Nurse Practitioner	0	5 (21)
Total Learners	71	24

Seventy-one health providers were identified to attend an Essential Care for Every Baby workshop with Zika emphasis across four Caribbean countries. The first series of workshops were led by American Academy of Pediatrics (AAP) technical advisors. The second series of workshops were led by local champions, who were supported in further facilitation of training within the health care facilities.

In the first series of workshops, knowledge check results improved from an average 19.1 correct answers of 25 questions pre-workshop, to 23.4 correct answers post-workshop (n=70). Twenty-four selected local champions led subsequent workshops, with knowledge check improvement from an average of 20.3 correct answers before the workshop to 23.8 correct answers after workshop completion (n=18). A repeated measures (pre-post) ANOVA with between-subjects factor of workshop leader (AAP vs. local) was conducted (Table 2).

Table 2
Repeated measures ANOVA of pre-workshop and post-workshop knowledge check scores

	AAP Advisor-Led Workshop	Local Champion-Led Workshop	
Pre-Workshop Knowledge Check Score (25 Qs)	19.1	20.3	
Post-Workshop Knowledge Check Score (25 Qs)	23.4	23.8	Facilitator effect p < 0.001
		Pre-/post- effect: p < 0.05	

A repeated measures ANOVA was conducted to evaluate factors associated with significant change in knowledge check score after a series of modified Essential Care for Every Baby workshops in the Caribbean. This compared the pre-course knowledge check scores and the post-course knowledge check scores between subjects who attended an American Academy of Pediatrics (AAP) technical advisor-led workshop and those who attended a local champion-led workshop.

This revealed significant pre-post knowledge gains [F(1)=197.9, p<0.001]. There was a significant effect of type of facilitator on knowledge check scores, with a greater improvement when workshops were led by the AAP technical advisor [F(1, 1) = 4.065, p = 0.047]. All participants passed the OSCE. The local champions in two countries also took the knowledge check before and after the workshop that they led. The knowledge check scores prior to their own workshop were lower than the knowledge check scores after their first training.

At each workshop, participants brought feedback that there was a discrepancy between documentation forms at the hospitals and the documentation required per the modified ECEB workshop. The most common inconsistencies were between measuring and documenting temperatures in Fahrenheit versus Celsius, and anthropometric assessment and corresponding documentation with use of a decimal place and standardized growth charts.

Over the year, some outcome and process measures improved in all four countries. Certain indicators related to ECEB practices demonstrated significant changes and midline shift on the run chart. This included proportion of newborns receiving essential newborn care practices in the hospital (Figure 3), appropriate screening and classification of microcephaly, documentation of essential assessment practices in the hospital, and exclusively breastfeeding at hospital discharge. The ECEB training was part of the larger clinical capacity building that also emphasized team-based problem solving and health system strengthening activities.

Discussion

This project demonstrated that ECEB workshops improved objective knowledge of health care providers, as evidenced by a significant difference in pre- to post-knowledge check scores. Although there was a

statistically significant difference in the pre- to post- knowledge check scores dependent on the type of facilitator leading the workshop, the magnitude of the difference was small, and the post-workshop scores with both types of facilitators were very similar. It is not surprising that experienced ECEB facilitators may be slightly more effective than novice facilitators. However, our results indicate that hands-on, in-the-moment training of trainers can effectively coach facilitators and ensure fidelity to the training methods and content, so that the same final results are achieved.

In one country, the local champions also took the knowledge check before and after the workshop they led. The knowledge check scores prior to leading their own workshop were lower than their knowledge check scores following their initial training. While this was not done at each site, precluding firm conclusions, these results do fit with what is commonly known about knowledge and skills after an initial workshop—they decline if not practiced regularly. There is evidence to support the use of low dose, high frequency practice to improve skills retention.(13–15) Ideas generated by participants on how to implement such practice included using the “review key knowledge” section of each page of the provider guide to frequently test skills with a partner, and incorporating ECEB into pre-service education of nursing trainees and house staff officers by dividing the course into hour-long sessions. Finally, teaching new providers both disseminates the information and reinforces the knowledge of the local champion leading the educational session. ECEB clinical practices were continuously measured by the QI teams and reinforced during coaching visits and learning sessions to support knowledge retention and translation into clinical practice.

Logistical planning was crucial for the successful dissemination of training. One common theme of discussion at all sites and at sequential workshops included the importance of keeping the materials easily accessible in a designated location. It is universally acknowledged that health care workers have busy clinical schedules, and so it is important to improve accessibility to the written materials and simulators to facilitate their frequent use as job aids and training tools. A simple intervention would be to identify a place to store the materials. In some settings, teams created a protocol of “checking out” the materials to borrow and return. In most settings, the Action Plan poster (Figure 1) and Signs of Zika at birth poster were strategically hung near the maternity area so that health care providers could easily, and frequently, reference them.

Ongoing monitoring of performance indicators demonstrated improvement in all four countries, with the ECEB workshop as just one piece of the wide scale training and implementation of novel tools. Thus, improvement of performance indicators most likely resulted from a combination of interventions. The uptake of the skills reinforced by ECEB are best demonstrated in the run charts for indicators specific to the Zika-specific ECEB workshop.

It is encouraging that naïve facilitators can be coached to become local experts to continue dissemination of training. ECEB is a model for cascade training that incorporates essential newborn practices with the opportunity to adapt to the context of local practices and respond to public health emergencies. We found that key components of successful cascade training included multilevel support,

appropriate identification of local champions, inclusion of health care providers who served diverse roles in the same system, strategic planning for training dissemination, and adaptation of the program materials to the local context.

Conclusion

ECEB can be adapted to local settings and to specifically address concerns, such as ongoing Zika transmission. These changes can incorporate important local practices, causes of neonatal morbidity and mortality, and differing healthcare system structures. Pre-post workshop knowledge check scores improved with facilitation by both AAP technical advisors and local providers. Continued mentorship and skills building by trained facilitators is important to solidify their knowledge and sustainably strengthen capacity of newborn care providers in these countries.

Abbreviations

American Academy of Pediatrics (AAP), Essential Care for Every Baby (ECEB), Helping Babies Survive (HBS), Ministry of Health (MOH), Objective Structured Clinical Exam (OSCE), Quality Improvement (QI), Sustainable Development Goals (SDG), United States Agency for International Development Applying Science to Strengthen and Improve Systems (USAID ASSIST)

Declarations

Ethical approval: The American Academy of Pediatrics Institutional Review Board (AAP IRB) approved this study and waived the requirement for informed consent from participants. The human subjects research was conducted according to the AAP IRB's and each country's guidelines and regulations.

Consent for publication: Not applicable

Availability of data and materials: There are two datasets used in the development of this manuscript. One dataset is included in the Supplemental File, which includes the test performance of participants in the Essential Care for Every Baby program. The other datasets, including performance of the countries and region on Essential Newborn Care in Figure 3, are intellectual property of the United States Agency for International Development Applying Science to Strengthen and Improve Systems Project. Upon reasonable request, the authors will help an interested inquirer access this data.

Competing Interests: All authors have indicated that they have no conflicts of interest to disclose. All authors have indicated that they have no financial relationships relevant to this article to disclose.

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Authors' contribution: Disambiguation: Terrell Carter is abbreviated as TCJ and Tamar Chitashvili is abbreviated as TC. All authors made substantial contributions to the design of the work. KM, NP, SMH, BKR, SBJ, TC, and SH were responsible for acquisition of data. JP, TCJ, and HFM supervised the study. KM, NP, SMH, and BKR were responsible for analysis and interpretation of data. All authors substantially revised the manuscript. All authors approve the submitted version and have agreed to be personally accountable for the work.

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Figures

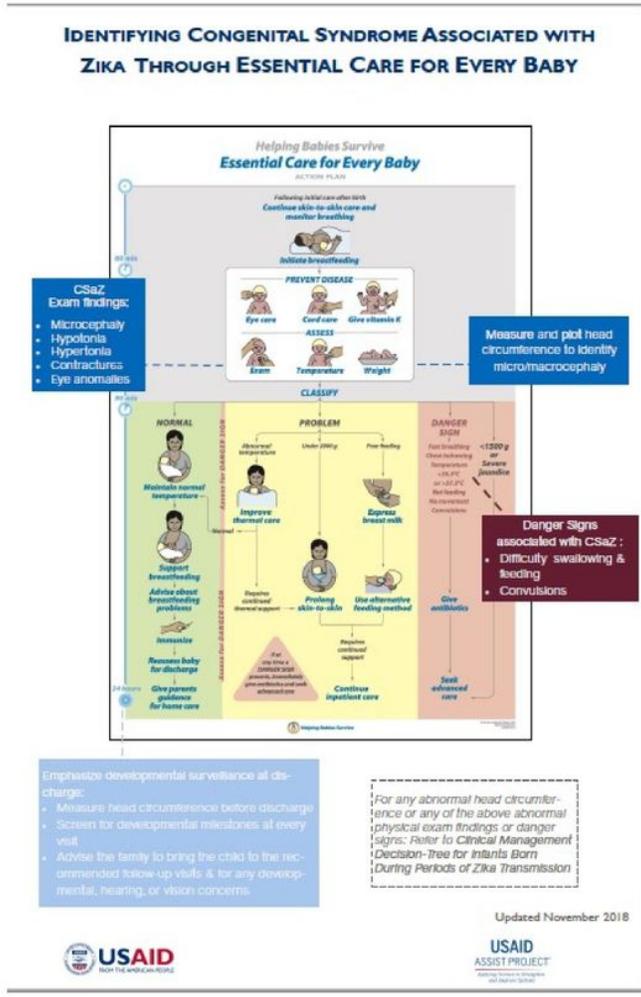


Figure 1

Modified Action Plan The Essential Care for Every Baby Action Plan was modified to incorporate screening for signs and symptoms of Congenital Syndrome associated with Zika at birth. United States Agency for International Development Applying Science to Strengthen and Improve Systems Project Zika response in Antigua, Dominica, St Kitts and Nevis, and St Vincent and the Grenadines with partnership by the American Academy of Pediatrics, August 2018 to July 2019.

Figure 2

Clinical management decision-tree for infants born during periods of Zika transmission After formal approval from the Ministry of Health, this management tool was distributed to health care facilities. This was adapted from the Center for Disease Control recommendations within the constraints of the local resource availability. This decision-tree harmonized with Essential Care for Every Baby, so that the tree

begins with the Standard Zika Evaluation which was taught in the workshop. United States Agency for International Development Applying Science to Strengthen and Improve Systems Project Zika response in Antigua, Dominica, St Kitts and Nevis, and St Vincent and the Grenadines with partnership by the American Academy of Pediatrics, August 2018 to July 2019.



Figure 3

Proportion of newborns receiving essential newborn care interventions^[1] in all functional hospitals of Antigua and Barbuda, St Kitts and Nevis, St Vincent and Grenadines and Dominica. United States Agency for International Development Applying Science to Strengthen and Improve Systems Project Zika response in Antigua, Dominica, St Kitts and Nevis, and St Vincent and the Grenadines with partnership by the American Academy of Pediatrics, August 2018 to July 2019.

Supplementary Files

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