



Simulation and education

Impact of contextualized pediatric resuscitation training on pediatric healthcare providers in Botswana[☆]



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ABSTRACT

Background: Worldwide, 6.6 million children die each year, partly due to a failure to recognize and treat acutely ill children. Programs that improve provider recognition and treatment initiation may improve child survival.

Objectives: Describe provider characteristics and hospital resources during a contextualized pediatric resuscitation training program in Botswana and determine if training impacts provider knowledge retention.

Design/methods: The American Heart Association's Pediatric Emergency Assessment Recognition and Stabilization (PEARS) course was contextualized to Botswana resources and practice guidelines in this observational study. A cohort of facility-based nurses (FBN) was assessed prior to and 1-month following training. Survey tools assessed provider characteristics, cognitive knowledge and confidence and hospital pediatric resources. Data analysis utilized Fisher's exact, Chi-square, Wilcoxon rank-sum and linear regression where appropriate.

Results: 61 healthcare providers (89% FBNs, 11% physicians) successfully completed PEARS training. Referral facilities had more pediatric specific equipment and high-flow oxygen. Median frequency of pediatric resuscitation was higher in referral compared to district level FBN's (5 [3,10] vs. 2 [1,3] $p=0.007$). While 50% of FBN's had previous resuscitation training, none was pediatric specific. Median provider confidence improved significantly after training (3.8/5 vs. 4.7/5, $p<0.001$), as did knowledge of correct management of acute pneumonia and diarrhea (44% vs. 100%, $p<0.001$, 6% vs. 67%, $p<0.001$, respectively).

Conclusion: FBN's in Botswana report frequent resuscitation of ill children but low baseline training. Provider knowledge for recognition and initial treatment of respiratory distress and shock is low. Contextualized training significantly increased FBN provider confidence and knowledge retention 1-month after training.

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1. Background

Globally, 6.6 million children under the age of five died in 2012, largely due to pneumonia and diarrhea.¹ Although survival has improved over the last 20 years, much faster progress is needed to achieve Millennium Development Goal 4 by 2015.¹ Botswana is an upper middle-income country,² and eighty-four percent of the million population resides within 5 km from a medical facility.³ 11.5% of the population is under the age of 5,⁴ diarrhea and

pneumonia represent almost 30% of child morbidity and almost 40% of child mortality.^{3,5} Under-5 mortality (U5M) in Botswana, defined as deaths in children born alive up to 5 years of age, has worsened from 45 to 76/1000 live births over the last 15 years.^{1,4,6}

Provider recognition and initiation of appropriate treatment for diarrhea and pneumonia in Botswana remains poor at the hospital ward, accident and emergency (A + E), and clinic.^{7–9} Between 2011 and 2013, a child mortality audit in Botswana revealed that 33% of in-hospital pediatric deaths occurred within the first 24 h, an indication that referred children arrive at the hospital critically ill.^{9,10} Twenty-six percent of deaths were considered avoidable, with an average of 2.6 modifiable factors contributing to each death.⁹ Inappropriate recognition and treatment of diarrhea and pneumonia in inpatient wards, accident and emergency and clinics were the major modifiable factors contributing to mortality.⁹

The International Liaison Committee on Resuscitation concluded that little evidence exists to indicate that pediatric resuscitation training provides the necessary training for learners to achieve significant improvement in self-efficacy, competence or patient outcomes in developing countries.¹¹ Standard resuscitation training was developed in high resource settings and is not optimally calibrated to health systems of many low- and middle-income countries (LMICs), and a wide gap exists between high resourced and least resourced settings for pediatric resuscitation training.^{12,13}

In 2007, the American Heart Association created the *Pediatric Emergency Assessment, Recognition and Stabilization* (PEARS).¹⁴ PEARS is a 1 day course designed for a broad range of health care providers who are likely to be the first provider to evaluate a sick child, and its goal is to provide knowledge and skills to recognize a life-threatening pediatric emergency and initiate stabilizing treatment early.

In 2013, the Botswana Ministry of Health, the Children's Hospital of Philadelphia and the American Heart Association (AHA) contextualized PEARS to Botswana's Public Health Care System. To our knowledge, this is the first study to describe implementation of PEARS in a resource-limited setting. The purpose of this study was to describe provider characteristics and hospital resources and to determine if training impacted knowledge acquisition and retention of facility-based nurses (FBN). Secondly, we sought to describe the process of contextualization of PEARS training program for Botswana's healthcare system.

2. Methods

2.1. Course contextualization

Contextualization, defined as “local adaptation of training, utilizing existing and sustainable resources for both care and training,” was based on a collaborative effort between local experts and international faculty to maintain overarching themes while adapting to cultural norms and clinical settings.¹¹ As part of instructor orientation, comparisons of local practice to high-resource setting practice were minimized. To allow for lower baseline knowledge, cultural differences in workday scheduling (e.g. 8 a.m. start, break for teas and lunches, completion of workday at 4:30 p.m.) as well as to allow time for sequential translation if needed, the course was increased from 1 to 2 full days. While the PEARS course curriculum, including the optional skill stations and patient scenarios, was maintained and standard-passing criteria were used for certification, increased emphasis was placed on specific treatment terminology local to the environment (e.g. use of ‘lactated ringers’ instead of “isotonic fluid”, ‘penicillin G’ instead of ‘antibiotics for pneumonia’). Further, local terminology was incorporated to refer to the chain of survival (e.g. “Bleep the on-call doctor” or “call for an ambulance” was

substituted for “Call 911”). English is one of the two official languages of Botswana, and nursing and medical education is conducted in English. As such, training materials and lectures were given in English, and the standard PEARS provider manual and accompanying CD were distributed 1 week prior to training, excepting for last minute roster additions, which were given on the first day.

Didactics and skill stations were designed to emphasize established available hospital protocols Princess Marina Hospital (PMH) for moderate and severe pneumonia, severe dehydration (hypovolemic shock) and septic shock (distributive shock) with and without severe malnutrition. Specific antibiotics and treatments were determined in accordance with the Botswana National Drug Formulary, PMH protocols and Botswana's Integrated Management of Childhood Illness. The Facilities Readiness Assessment (FRA) is a 17-item assessment tool of the pediatric ward clinical staffing and available medications, fluid and resuscitation equipment. The FRA was used to design to tailor scenario stems and skills stations to local settings and resources (e.g. use of electronic nebulizer instead of flow driven nebulizer, use of spinal and 18 gauge needles for Intra-Osseous, Darrow's solution, etc.). Additions and changes were reviewed and approved by the Chair of Department of Pediatrics at PMH (LM) and an AHA ECC committee member (PAM). An audience-response system (Turning Point®) was added to didactic lectures to facilitate structured discussion as well as allow for group remediation during the final examination while still preserving anonymity. The standard 30-question AHA video based exam was used, without modification. Questions were administered in English, and there was no time limit for responses. Successful course completion was defined as achieving a passing score on the final exam or successful remediation, demonstration of minimal competency of CPR and active participation in rescue breathing skills station, respiratory skills station, circulatory skills station and simulated patient scenarios. Skill station and team training was performed in-situ in a pediatric ward at the district level, using low-fidelity manikins (Laerdal® BLS Baby, CPR infant manikin, the Simply NRP kit, AED trainer 2) and locally available consumables (IV tubing, cannula, face masks, etc.) acquired from an in-country medical supplier.

2.2. Participants and training

All in-hospital health care providers engaged in clinical care at a tertiary referral hospital in Gaborone, Botswana (PMH), a district hospital in Mochudi, Botswana (Deborah Retief Memorial Hospital (DRMH) or clinics that refer to DRMH were eligible for training. Participants were selected by hospital administration with preference given to providers currently on pediatric wards or in pediatric clinics. Instructors were international AHA training faculty.

2.3. Assessment

There were three sources of data: Provider Readiness Assessment (PRA), Facility Readiness Assessment (FRA), and Audience Response System (ARS). The PRA is a 20-item semi-structured interview assessing demographic information, a 5-point likert scale to assess self-reported resuscitation confidence and multiple-choice questions on general resuscitation knowledge, including appropriate antibiotics for moderate-severe pneumonia (according to PMH guidelines), appropriate fluid bolus (type, volume and rate) for severe dehydration and clinical indicators of oxygen therapy for hypoxia. A cohort of nurses on the pediatric medical wards at PMH and DRMH undergoing training were assessed with the PRA prior to PEARS training and 1-month after training completion by the same investigator (SWW). All active duty nurses were eligible for assessment. The FRA is a 17-item assessment tool of the pediatric

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