



RESEARCH ARTICLE

Simulation Education to Advance Emergency Medicine and Pediatric Critical Care in Nepal

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Abstract

Background: Internationally emergency medicine is a relatively young specialty that is increasingly recognized for its potential for growth. In low middle-income countries (LMICs) like Nepal resources are quite limited and the development of new specialties such as emergency medicine can be slow to evolve. Specific areas of emergency care, including pediatric critical care have significant challenges due to clinical and educational limitations in countries like Nepal. Countries with robust healthcare systems like the United States can play a significant role in bridging this education and clinical divide in LMICs. In 2018 and 2019 the University of Toledo Medical Center in collaboration with Dhulikhel Hospital-Kathmandu University Hospital School of Medicine developed adult and pediatric critical emergency care workshops and educational sessions in an effort to improve the development of emergency medicine in Nepal. These sessions included hands-on workshops, educational lectures, and simulation participation environments in critical care procedures and decision making for both adult and pediatric emergencies. In these two workshops a total of 71 participants, including Nepalese emergency care providers ranging from pre-hospital personnel to faculty, engaged in these sessions.

Results: Pre and post-workshop surveys were provided and this subjective data showed significant improvement in confidence levels along with procedural skills technique and knowledge as a result of the educational sessions provided.

Conclusion: Multidisciplinary education and workshops to LMIC are necessary for development of emergency medicine and pediatric critical care. Simulation education and workshop training are highly valuable "hands on" methods

to educate these healthcare providers. Highly developed healthcare systems in emergency and critical care must assist in the world wide development acute care management in these poorly resourced countries.

Introduction

Internationally, emergency medicine is a relatively young specialty that is increasingly recognized for its potential for growth. Almost uniformly it is under-resourced and underdeveloped. This is especially true in low middle-income countries (LMICs), like Nepal [1]. Even in established centers, emergency care in both adult and pediatric patients is delivered by providers that may have little or no additional training in emergency medicine. In recent years the concept of quality emergency care is flourishing in Nepal and various pathways to emergency medicine specialization have been accredited [2]. However, no specialized training programs for pediatric emergencies and procedures exist yet to date.

In most well-resourced countries there has been a move toward providing seamless, efficient critical care that has been established specifically for pediatric patients [3]. For the most part, however, pediatric critical care remains in its infancy in most hospitals across most LMICs. The majority of hospitals lack pediatric emergency care units dedicated to the pediatric age group,

healthcare staff trained to care for critically ill children and rapid access to necessary medications, supplies and equipment. Perhaps one of the most important stumbling blocks in most LMICs is the lack of established training programs for healthcare providers working in clinical environments with a high volume of pediatric patients like emergency departments [4].

The formalization of emergency care education is an important first step, as skill specialization may enhance the blossoming specialty of emergency medicine in Nepal. As a way to provide emergency care education from a system with established emergency care protocols, several workshops were organized in collaboration with the University of Toledo Medical Center at Dhulikhel Hospital-Kathmandu University Hospital (DH-KUH). These emergency care conferences were focused on the teaching of knowledge, skills and approaches to common adult and pediatric emergencies and critical care situations. These conferences utilized didactic lectures, hands-on skills sessions and simulation-based scenarios as educational tools to fortify knowledge and enhance the confidence of participating health care providers.

Furthermore, they focused on multidisciplinary participation of healthcare providers. These providers included attendings, residents, medical officers, nurses and paramedics who would work as a team. The workshops also utilized “simulation-based” learning models rather than the antiquated “see one, do one, teach one” which has previously been shown to put patients at risk [5]. Experiential learning, deliberate practice and the ability to provide immediate feedback are the primary advantages of simulation-based medical education. It is an effective way to develop new skills, identify knowledge gaps, reduce medical errors, practice teamwork communication and maintain infrequently used clinical skills with the overall goal of improving patient care [6]. Although simulation cannot replace clinical exposure as a form of experiential learning, it replicates real life situation and promotes learning without compromising patient safety. In essence, “simulation-based” education allows providers to practice case management and procedures many times, improving their competency before they actually manage a real patient. Therefore, our objective of the workshops was to promote experiential learning, practice procedural skills, review common errors via debriefing and practice multidisciplinary teamwork dynamics.

Methods

We had two workshops performed across 2018 and 2019 focused on adult and pediatric critical emergency care situations organized in DH-KUH in collaboration with the University of Toledo Medical Center, USA. The session in December of 2018 was focused on introducing a base of knowledge to participants through several lectures and focused on adult and pediatric behavioral and procedural skills including intraosseous infusion,

airway management, vascular access and pediatric resuscitation with a follow up session in August 2019. The August simulation based session was divided into three consecutive sessions of two and a half hours each:

- Session I (interactive lectures): Topics-fundamental knowledge about critical pediatric evaluation and management, sepsis in pediatric patients, trauma in pediatric patients, vascular access.
- Session II (workshop on skills): Demonstration and hands on practice of intraosseous access, pediatric basic and advanced airway, pediatric resuscitation and arrhythmias.
- Session III (practice with real life simulation scenarios in low fidelity manikins with debriefing sessions).

Multidisciplinary healthcare providers, including paramedics, nurses, medical officers (resident equivalent), residents (fellow equivalent) and physicians working at different departments of DH-KUH and MD General Practice (MDGP) doctors from other urban and rural health care centers were invited to participate in the workshops. Four Emergency Medicine faculty members from the University of Toledo, a pediatric critical care trained nurse practitioner, and local facilitators conducted the workshops.

At registration, the attendees filled out an online pre-workshop survey (Supplementary file 1) documenting their demographic details, specialty, location and duration of work experience, experience in managing critical cases and previous participation in simulation-based learning. Their perceived confidence level in eight domains (recognition of a sick child, pediatric resuscitation, airway management, trauma, sepsis, arrhythmia, intraosseous access and pediatric drug calculation) was evaluated using a 5-point Likert scale, with 1 being the least confident and 5 being the most confident. Following the workshop the self-reported confidence level of the participants was reassessed. Suggestions for future collaboration and education were also collected after the workshops.

Results

A total of 30 healthcare providers participated in December 2018 and 41 participants in the August 2019 session. The practice details of the healthcare providers who participated in the August workshop are illustrated in [Table 1](#) and [Table 2](#). Based on our demographic information for this workshop, clearly there was a wide spectrum of emergency providers ranging from paramedics to physicians. All physicians were essentially in training programs ranging from intern to resident physicians. Twenty-six (63.4%) participants were from Emergency department, and most of these providers were actively participating in the management of pediatric emergencies. Most of the partici-

pants have only been involved in post medical school practice and training for 0 to 4 years (82.9%). Furthermore, 78% noted that they are managing emergency or critical pediatric patients on a limited basis. 24.4% had never participated and 31.3% had participated only occasionally in the simulation based learning sessions.

Table 3 demonstrates subjective data improvement in self-reported confidence of the participants in various domains. The most significant improvement was noted in the management of sepsis and intraosseous access. The participants still felt least confident regarding pediatric drug calculation.

Discussion

Table 1: Details of the participants (N = 41).

Characteristics	N (%)
Designation	
Resident Doctors	7 (17)
Junior Doctors	15 (36.6)
Nurses/Paramedics	13 (31.7)
Intern Doctors	6 (14.6)
Department	
Emergency Medicine	26 (63.4)
Anesthesiology	4 (9.8)
Pediatrics	8 (19.5)
Others	3 (7.3)
Work experience in years	
> 4	7 (17.1)
2-4	11 (26.8)
1-2	7 (17.1)
< 1	16 (39)

Educational sessions like these can be excellent tools to educate individual providers in the standard of care for emergency medicine from nations where the specialty is more established. The distribution of levels of training and specialty indicate that providers interested in emergency medicine exist across all levels of training from pre-hospital to emergency medicine facility. Currently, the avenue to becoming an emergency specialist in Nepal is variable, whether it be through fellowship or residency [1]. Due to non-standardized training there is wide variability of knowledge across providers [7,8].

The evaluations of these educational sessions demonstrated the participants benefited from practicing hands on procedures and simulation cases by actively learning the essential skills necessary in emergency based critical care. The perceived confidence level increased significantly in various skills. As such, "hands-on" experience provides the essential confidence needed which greatly reduces the learner's stress when they encounter difficult cases in the emergency department. Evaluating their actions, and more importantly their behavior, teaches them valuable lessons in improving muscle memory, reducing reluctance to act, and ultimately improving situational response. The objective data gathered bears out the conclusion that these workshops improved provider confidence in managing critically ill patients.

As indicated by tables one and two, the prior training and experience of these learners was widely variable. However, the multidisciplinary nature of participants accurately simulates the actual emergency department environment, where providers in Nepal interact with consultants, paramedics, and interns on a case to case basis. The simulation experience reinforced a collaborative approach to critically ill cases with engagement

Table 2: Previous experience of the participants.

	Always	Often	Sometimes	Occasionally	Never
Managing critical pediatric cases	9 (22)	1 (2.4)	11 (26.8)	19 (46.3)	1 (2.4)
Participation in simulation based learning	0	2 (4.9)	16 (39)	13 (31.7)	10 (24.4)

Table 3: Confidence level of the participants before and after the work-shop.

SN	Participants confidence level in :	Pre workshop Mean \pm SD	Post workshop Mean \pm SD	95% Confidence Interval of the Difference		P value
				Lower	Upper	
1	Recognition of a sick child	3.5143 \pm 0.85307	4.1143 \pm 0.79600	1.08005	0.11995	0.016
2	Pediatric resuscitation	3.0000 \pm 1.00000	3.8857 \pm 0.63113	1.36266	0.40877	0.001
3	Pediatric airway management	3.3143 \pm 1.10537	4.0571 \pm 0.72529	1.25198	0.23374	0.005
4	Pediatric trauma management	2.9143 \pm 1.06747	3.8000 \pm 0.63246	1.35532	0.41611	0.001
5	Pediatric sepsis management	2.8571 \pm 1.08852	3.7714 \pm 0.68966	1.38831	0.44026	0.000
6	Intraosseous access	1.8286 \pm 1.09774	3.8857 \pm 0.75815	2.52059	1.5937	0.000
7	Pediatric arrhythmias management	2.2571 \pm 1.09391	3.5714 \pm 0.73907	1.80557	0.82301	0.000
8	Pediatric drugs calculation	2.8571 \pm 1.00419	3.4571 \pm 0.85209	1.11493	0.08507	0.024
9	Overall confidence	3.0571 \pm 0.90563	3.7714 \pm 0.59832	1.11011	0.31847	0.001

from all levels of healthcare providers. It is of our opinion that simulation education currently is the optimal tool to reinforce this collaborative care model in most high stress and high acuity patient care situations. Therefore, the results of these workshops support a didactic/hands-on learning experience to improve both medical care knowledge and clinical skills.

Limitations of this study include a highly variable participant demographic from paramedics to physicians. Education was not stratified to each different learner group within this workshop with all attendees attending the same sessions. Therefore, educational content may have been too advanced for certain participant groups and outside their scope of practice in an actual emergency department. Future workshops may have more impact if groups are separated based on roles in clinical practice. This could provide focused education tailored to the responsibilities and education of each participant. Clearly, though, multi-disciplinary engagement of all providers in practicing simulation scenarios is the most effective, more accurate method to simulate “the actual patient care environment”.

Additional workshops are planned to not only expand our educational footprint, but to reinforce and identify the retention of critical emergency skills and pediatric education for the emergency providers of Nepal.

Conclusion and Future Direction

Ultimately what can be accomplished in several short sessions is limited compared to the establishment of emergency medicine as a specialty or pediatric emergency medicine as a sub-specialty. The results of our study indicate that the potential for growth may not be so steep. Emergency critical care in Nepal is typically outsourced to consultants. The conferences conducted help to validate the practice of emergency medicine providers as specialty specific. The University of Toledo Medical Center plans to continue its investment of significant time and resources into growing medical education in Emergency Medicine and Pediatrics in Nepal through similar educational sessions and the cultural exchange of residents and students.

Further follow up with the participants to explore their behavioral change and outcome needs to be planned.

Declarations

Ethics approval and consent to participate

IRB waived and exempted the study at Dhulikhel Hospital in Dhulikhel Nepal due to lack of patient identifier information in this study. Only subjective survey information was included.

Consent for publication

Consent was obtained from all authors and participants. Consent though, not indicated due to educational format from workshop participants and no publication of individual personalized data.

Availability of data and materials

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

Competing interests

The authors declare that they have no competing interests.

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