Title* Using Simulation to Measure and Improve Pediatric Primary Care Offices Emergency Readiness

Authors*

Amanda L. Garrow, PhD, Simulation Education Specialist, Children's National Hospital

Pavan Zaveri, MD, Medical Director, Simulation Program, Division of Emergency Medicine, Children's National Hospital

Matthew Yuknis, MD, Assistant Professor of Clinical Pediatrics, Indiana University School of Medicine

Kamal Abulebda, MD, Associate Professor of Clinical Pediatrics, Division of Critical Care Medicine, Riley Hospital for Children at Indiana University Health

Marc Auerbach, MD, Associate Professor of Pediatrics and Emergency Medicine, Yale University School of Medicine

Eileen M. Thomas, EdD, Simulation Education Specialist, Children's National Hospital

Corresponding Author*

Amanda L. Garrow, Children's National Hospital, 111 Michigan Avenue, Washington DC, 20010

Email: agarrow@gwu.edu

Telephone: +1 703 364 8521

Department & Institution*

Simulation Program, Children's National Hospital, Washington DC

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Structured Abstract*

Introduction

Emergencies in the pediatric primary care office are high risk, low frequency events which offices may be ill prepared to manage. A simulation-based collaborative improvement program to improve office based emergency response was developed and delivered. This program involved measuring pediatric emergency readiness of outpatient pediatric offices; providing feedback/debriefing with a plan to repeat measurement in six months.

Methods

This program consisted of two components: preparedness checklists and in situ simulations. The preparedness checklists were derived from the American Academy of Pediatrics guidelines to assess these offices' readiness concerning equipment, supplies, medication and guidelines. Two in-situ simulations; respiratory distress and seizure, were conducted with the interprofessional teams; performance was scored using checklists. At six months the same measurements of pediatric emergency readiness and performance will be completed; data sets will be compared for improvements.

Results

Twelve pediatric office visits were conducted October through December 2018. Baseline data showed wide variety in preparedness (Range: 47-87%) and performance checklist results (range: 43-100%). Recommendations were made to standardize equipment, medications and procedures across all sites.

Conclusions

Our simulation-based collaborative improvement program was successful in measuring pediatric primary care office preparedness. Simulation has potential to improve patient safety in a variety of settings. Through using simulation to measure office emergency preparedness, areas of knowledge deficit and latent safety threats were identified and addressed.

Manuscript Content*

Introduction

Pediatric emergencies are high risk, low frequency events which can be frightening and frustrating without the appropriate tools and protocols, and adequate staff training. This paper describes the development and implementation of a novel simulation-based collaborative improvement program between pediatric primary care offices and a pediatric academic medical center. A three year review of Emergency Medical Services (EMS) encounters originating in ambulatory settings in Indianapolis showed that the most common presentations requiring EMS transport were respiratory distress, psychiatric/behavioral emergencies, and seizures[1]. These findings correlate with those of previous studies[2]. Interestingly, less than 1% of all EMS calls originated in ambulatory settings, illustrating why pediatric offices may be ill prepared to manage these patients.

Of importance, Yuknis et al.[1] found that whilst respiratory distress was the most common emergency, no patients required advanced airway management. These findings suggest that the availability of basic life support equipment paired with the adequate skills should be the focus of office based emergency preparedness. Examples of these skills include administering oxygen therapy and nebulized albuterol.

The American Academy of Pediatrics[3] (AAP) developed guidelines for providers with regard to equipment and training in outpatient settings. This guideline describes two equipment categories: ‘essential’ for those with an EMS response time of less than 10 minutes and ‘strongly suggested’ for those with longer EMS response times. The EMS response time has implications for the management of pediatric emergencies; those with longer times may require additional equipment for advanced airway management and intravenous access. However, it is important to note that as advocated by Toback[2] equipment choices should be informed by the

providers' level of experience and comfort in using them. Toback[2] emphasizes the importance of education and training in emergency response. Since the introduction of the AAP guidelines[3] it has been reported that in 2015, 23% of pediatric clinics did not consider themselves to be 'office prepared' and only 25% practiced mock codes[4].

Our primary aim was to measure and improve emergency preparedness in pediatric offices. A secondary aim was to describe common themes in emergency preparedness across a regional group of offices to guide the development of generalizable improvement interventions. We hypothesized that the preparedness scores would improve from baseline to follow up.

Methods

The simulation-based collaborative improvement program was conducted and facilitated by two simulation education specialists with experience in pediatric emergency care from the pediatric academic medical center. The program was modeled after the Improving Pediatric Acute Care Through Simulation (ImPACTS) interprofessional collaborative whose work has focused on emergency department care[5]. There are twelve pediatric offices associated with the pediatric academic medical center, and all were included. There were two components to the program: preparedness checklists and in situ simulations.

Preparedness checklist: The preparedness checklists were derived from the AAP guidelines[3] to assess office readiness in equipment, supplies, medication and guidelines. With all sites within 10 minutes of EMS; the essential equipment checklist was utilized. On the initial visit each site was assessed and all items were checked. If the practitioner was unable to locate a piece of equipment or policy it was considered not available.

In situ simulations: The in situ simulations were conducted with the inter-professional team which included physicians, nurses, medical assistants and patient service representatives. All cases were conducted in the actual office space to promote authenticity; teams were required to

bring their own resources, as the focus was on processes rather than individual performance. However, to reduce the use of consumable items, some items were replaced with reusable simulation equipment. Participants were oriented to simulation concepts such as psychological safety and the need to suspend disbelief. In addition, the features of the manikin (5 year old HAL, Gaumard Scientific, Miami, FL) were explained and a script was given to the person who would role play as parent.

Two scenarios were developed by the simulation education specialists and pediatrician at the pediatric academic medical center; a 7 year old child presenting with asthma and a 5 year old child who seizes in the waiting room. The scenario ended when EMS arrived and the team handed over the care. Two experienced simulation education specialists facilitated the simulations and debriefs. Typically each scenario ran for 10-15 minutes followed by a 30 minute debrief concluding with evaluations by the participants.

Each simulation scenario had a performance checklist which was completed in real time by the facilitators. We measured emergency preparedness through simulation-based evaluation of the processes of care delivered to the child. These checklists were reviewed and developed by content experts on the ImPACTS team. Iterative changes were made following the initial simulations. For example, 'time of seizure documented' was added. In addition, each team was scored for performance on teamwork, communication, situation awareness, decision-making and role responsibility using the Clinical Teamwork Score validated tool (CTS)[6] . These were scored immediately following the visit; the two facilitators discussed the team performance and reached consensus regarding the score given. Following each site visit, data including preparedness checklist, performance checklists and CTS scores was inputted on the ImPACTS database using Qualtrics.

Results

Twelve pediatric offices were visited between October through December 2018, with a total of 143 clinicians participating. This included physicians, registered nurses, nurse practitioners, medical assistants and patient service representatives (see Table 1). Group size varied from 6 to 23 participants.

AAP Readiness Scores

Table 2 presents an overview of each sites' results compared with mean percentage for office preparedness divided into essential equipment, policies and procedures, and overall percentage meeting the AAP guidelines[3]. The AAP Readiness Scores showed wide variety in essential equipment (43-86), policy and procedures (13-88) and overall score (47-87).

Performance Checklists

Table 3 presents the performance checklist for the respiratory distress and seizure scenario, and a teamwork score based on the CTS for each office. Table 4 summarizes the results of the offices' performance on each element of the performance checklist. Overall, teams ranged from 57-87% of task completion when managing respiratory distress, and 53-100% of tasks for managing a seizing patient. For overall teamwork, the range was 43-75%.

Table 4 demonstrates that initiating documentation, appropriate use of equipment and administration of steroids were the most challenging elements of the respiratory scenario. Patient positioning, documentation, assessment of circulation and administration of rectal diazepam were the most challenging elements in the seizure scenario.

Latent Safety Threats

The most common latent safety threats identified were expired medications (5 sites), unable to dial 911 directly from landline (2 sites), missing equipment (1 site), and unclear instructions to operate the oxygen tank (1 site).

Discussion

Twelve pediatric care offices underwent a pediatric readiness assessment and simulation-based education improvement program. Staff members were appreciative of this program of education; they were engaged and committed, rescheduling patient appointments to accommodate the visits. This intervention provided an opportunity to address a number of issues including: technical skills, teamwork and communication strategies and latent safety threats in these practices.

Technical skills: Many of the clinicians struggled to turn on the oxygen and were unfamiliar with the technique of administering albuterol with oxygen rather than through the nebulizer. This led to task fixation and a delay in treating the simulated patient. There was a lack of awareness of what resources were available to them. For example, providers would call for suction or rectal diazepam when these were not actually available in the office.

Teamwork and communication strategies: The teamwork behaviors expected in an acute setting such as identifying a leader and closed loop communication were not evident in the ambulatory setting. On discussion it was apparent that these teams work closely and constantly together unlike the acute settings where teams invariably change from day to day. Nevertheless we were able to encourage behaviors such as directed communication and clarity of roles. It is of interest to note that low scores on teamwork correlated with low scores on task performance and vice versa.

Latent safety threats: Upon inspection of equipment, we were able to identify a number of latent safety threats such as expired emergency medications and missing equipment. These were reported using the Safety Event Reporting System and actioned for follow up on our return visit.

Following these visits in consultation with the medical director for these sites, recommendations were made to standardize equipment, medications and procedures across all sites. The wide range of AAP readiness scores indicates that there are opportunities for sharing best practice across sites.

One of the strengths of this study was that that it was inclusive to all office staff. This had previously been identified as a limitation by Shenoi et al.[7] who delivered an education program for Primary Care Pediatricians. They were unable to include all office staff, whereas this study was able to engage all staff to facilitate interprofessional learning and provide valuable insight to those not usually included in emergency care. This is illustrated by this comment made in an evaluation:

> *"How well everyone worked together isn't new but being a PSR [patient service representative] I don't get to see emergency situations very often"*

Another strength is that every visit was conducted by the same two simulation education specialists enhancing consistency with delivery, debrief and scoring.

A challenge of this program was that some offices were large, for example site 5, was a particularly large office with over 20 participants in the simulation scenarios. This may have affected their score which was comparably low. This will be addressed in subsequent delivery by splitting the larger offices into two groups.

In conclusion, our simulation-based collaborative improvement program was successful in assessing the pediatric primary office preparedness. Simulation has potential to improve patient

safety in a variety of settings. Through using simulation to explore office emergency preparedness, areas of knowledge deficit and latent safety threats were identified and addressed. This intervention has potential to ultimately impact on patient safety and quality of care.

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Table 1. Total Distribution of Participants for Initial Visit

MD	RN	NP	MA	PSR	Manager	Other	Total Participants
39	**12**	**10**	**33**	**26**	**9**	**14**	**143**

Table 2. Initial Visit AAP Checklist Results (All scores presented as percentages)

Site	1	2	3	4	5	6	7	8	9	10	11	12	Mean
Essential Equipment	57	62	52	67	81	43	62	62	86	67	86	82	**67**
Policies & Procedures	38	50	63	38	63	63	63	38	88	63	75	13	**54**
Overall AAP Readiness	47	56	57	52	72	53	63	50	87	65	80	47	**61**

Table 3

Table 3. Initial Visit Performance Checklist Results (All scores presented as percentages)

Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Office Average**
Respiratory Distress Performance	86	79	79	71	57	71	87	86	71	79	79	79	**77**
Seizure Scenario Performance	80	100	80	80	53	67	80	80	80	87	87	73	**79**
Clinical Teamwork Scale (CTS)	65	69	55	74	43	54	73	75	65	71	60	61	**65**

Table 4. Summary of Itemized Performance Checklist

Respiratory performance checklist	**% offices completing task**
Patient assessed immediately	92%
Staff asks for help/activates code	92%
Airway and breathing assessed	100%
Documentation initiated	17%
Appropriate equipment used	100%
Pulse ox applied and reading obtained	100%
Able to use all equipment appropriately	66%
Circulation assessed	92%
Oxygen started	100%
Albuterol started	92%
Medications administered if available	0%
Airway and breathing reassessed	92%
EMS activation	100%
Seizure performance checklist	
Patient assessed immediately	100%
Staff asks for help/activates code	100%
Patient moved to safe position	83%
Time of seizure/events documented	50%
Airway and breathing assessed	100%
Patient positioned to open airway	66%
Appropriate equipment used	92%
Pulse ox applied and reading obtained	92%

Able to use all equipment appropriately	75%
Circulation assessed	41%
Oxygen started if hypoxic	100%
Medications administered if available	25%
Airway and breathing reassessed	100%
EMS activation	100%