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Assessment of Pediatrics Emergency Preparedness in Hospitals Emergency Departments: A Cross-sectional Study from Al Q assim Region, Saudi Arabia

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Abstract

Introduction: Paediatric emergencies contribute significantly to the patient burden in emergency units (EU). The variable availability of paediatric expertise, paediatric-specific equipment, appropriately trained staff, and standardised treatment guidelines adversely affects the optimal emergency care of children.

Aim: The study aimed to describe the availability of essential, functional paediatric emergency resuscitation equipment on the resuscitation trolley in 24-hour EUs within the Qassim health cluster hospitals.

Subject and methods: This cross-sectional study was conducted among all hospitals with emergency departments in the Alqassim Region under the Ministry of Health in Saudi Arabia. A closed-response survey was completed as a personal interview with emergency department directors. The questionnaire includes mainly measures of preparedness. A weighted preparedness score was calculated for each emergency department.

Results: A total of 14 participating hospitals were included. The total median (IQR) preparedness score was 123 (82.0 - 151.0). The median percentage score was 75.9%. The median percentage of missing was 24.1%, with a total median (IQR) missing score of 3.0 (0 - 12). The highest number of missing supplies were related to intraosseous needles or devices and umbilical vein catheters, which were unavailable in half of the participating hospitals. These were followed by tracheostomy tubes, arm board, and lumbar-puncture needles. In contrast, most medications needed for pediatric emergencies were available except for sodium bicarbonate 4.2% (missing in 9 hospitals).

Conclusion: This study supports the literature that some key elements of supplies and equipment were unavailable in pediatric emergency care settings. We recommend standardizing equipment and algorithms, training and evaluating authorized personnel, and critical event reporting within hospital institutions.

Keywords: Pediatric Emergency Preparedness; Supplies; Equipment

Literature review

Paediatric emergencies contribute significantly to the patient burden in emergency units (EU) [1-4]. This is supported by data indicating that the burden of patients under 18 years old was 25% in both Tanzania and South Africa, and children represent 27% of all EU visits in the United States of America (USA) [1-3].

The importance of EDs maintaining a state of readiness to care for children cannot be overemphasized because day-to-day readiness affects disaster planning, response, and patient safety [5].

The variable availability of paediatric expertise, paediatric-specific equipment, appropriately trained staff, and standardised treatment guidelines adversely affects the optimal emergency care of children [6].

A Canadian study involving 700 EUs, reported that intraosseous needles were not available in 15.9% of centres, infant bag valve mask devices in 3.5%, and infant laryngoscope blades in 3.5% [7].

In 2001, McGillivray et al. showed that essential pediatric equipment was unavailable in a large proportion of EDs in Canada. Of note, an infant-warming device was unavailable in 59% of EDs, intraosseous needles in 16%, pediatric defibrillator paddles in 10%, infant blood pressure cuffs in 15%, infant bag-mask devices in 4%, and infant laryngoscope blades in 4%. Lack of equipment was associated with low pediatric volume, greater distance to a pediatric referral center, physician staff members who had not had formal Advanced Pediatric Life Support training, and a pediatric resuscitation volume of 3 cases per year [8].

Although the expert consensus report is an indicator of the suggested paediatric emergency equipment required, there is no available literature in the Qassim region in Saudi Arabia to confirm that this is being implemented in healthcare facilities.

Aim of the study

The aim of the study is to describe the availability of essential, functional paediatric emergency resuscitation equipment on the resuscitation trolley in 24-hour EDs within the Qassim health cluster hospitals.

Specific objectives

1. To assess the degree of pediatric preparedness of emergency departments in the Alqassim region, Saudi Arabia.
2. To determine the factors that influence preparedness.

Study Area/Setting

All hospitals that have emergency departments in the Alqassim Region under the Ministry of Health.

Ethical Considerations

- Arabic and English Consent forms are attached for voluntary participation in this study.
- All participants will be provided with a written informed consent form. They have the freedom to participate in the study or decline to participate without affecting their right to health care.

- Participation in this study is confidential, and no one outside our research team will know about any participant enrollment or any information that includes their personal details.
- All records will be kept securely and confidentially, and analyses for reports and publications will be anonymized. There are two levels of security: (i) the data will be kept on a network file server to which access is available only to a limited number of authorized users; (ii) user permissions ensure that even when logged on to the server, the database is invisible to all but specifically authorized users. The server is behind a "firewall," isolating it from the organization's network. It is physically protected in a locked room to which only computer staff have access, backed up every evening. Access to the building is controlled.

Materials and Methods

Study Subjects

Inclusion criteria

All hospitals in Alqasim region hospitals.

Exclusion criteria

Primary health care centers.

Study Design

A descriptive, cross-sectional study design will be employed.

Sample Size

The sample size was 14 hospital out of total 16 hospitals in alqassim region .

Sampling Technique

Study participants will be recruited from 16 hospitals in the Alqasim Region, Saudi Arabia, using a convenience sampling technique. We will recruit participants until we achieve sufficient number of staff that will represent our study population. The study investigator will supervise the process of data collection and take the required actions.

Data Collection methods, instruments used, measurements

A Closed-response survey will be filled out as a personal interview with emergency department directors. This was based on the American Academy of Pediatrics/ American College of Emergency Physicians joint policy statement, "Care of Children in the Emergency Department: Guidelines for Preparedness." The questionnaire includes mainly socio-demographic characteristics and a questionnaire that measures preparedness. A weighted preparedness score (scale of 0-100) was calculated for each emergency department.

Data Management and Analysis Plan

After filling and collecting the questionnaires, data will be entered MS Excel and analyzed using (SPSS) software. All variables will be coded before entry and will be checked before analysis. Cross tables will be carried out for general characteristics and preparedness. A Chi-square test will be employed for the association between categorical variables. Considering the significant result, inferential statistics will be assessed through a P value of less than 0.05 and a 95% confidence interval level.

Statistical analysis

The data were analyzed using the statistical package for social sciences, version 26 (SPSS, Armonk, NY: IBM Corp, USA). All results were presented as numbers, percentages (%), and median (IQR).

Results

Variable	*N (%)*
Uyun Al Jawa General Hospital	01 (07.1%)
Uglat Asugour General Hospital	01 (07.1%)
Riyadh Al Khabra General Hospital	01 (07.1%)
Qusaiba General Hospital	01 (07.1%)
Qbah General Hospital	01 (07.1%)
Maternal And Children Hospital - Buraydah	01 (07.1%)
King Saud Hospital - Unayzah	01 (07.1%)
King Fahad Specialist Hospital - Buraydah	01 (07.1%)
Buraydah Central Hospital	01 (07.1%)
Ar Rass General Hospital	01 (07.1%)
Al Mithnab General Hospital	01 (07.1%)
Al Bukayriyah general hospital	01 (07.1%)
Al Badayea General Hospital	01 (07.1%)
Al Asyah General Hospital	01 (07.1%)

Table 1: Name of the participating hospital institutions (n=14).

We collected data from 14 hospitals across the Qassim Region. The details of the participating hospitals are given in Table 1.

Variable	*Yes (%)*
Weight scale, in kilograms only for infants and children	12 (85.7%)
Pain-scale-assessment tools appropriate for age	12 (85.7%)
Intravenous blood/fluid warmer	11 (78.6%)
Tool or chart that incorporates both weight (in kilograms) and length to assist doctors and nurses in determining equipment size and correct drug dosing (by weight and total volume), such as a length-based Resuscitation tape.	11 (78.6%)
Patient warming device	08 (57.1%)
Restraint device	07 (50.0%)

Table 2: Availability of general equipment (n=14).

Table 2 shows the list of the availability related to general equipment. A total of 12 hospitals indicated that weighing scales and pain-scale assessment tools are available at their hospitals. However, only 8 and 7 hospitals indicated the availability of patient warming and restraining devices.

Variable	*Yes (%)*
Blood pressure cuffs: Neonatal	06 (42.9%)
Blood pressure cuffs: Infant	07 (50.0%)
Blood pressure cuffs: Child	11 (78.6%)
Blood pressure cuffs: Adult	10 (71.4%)
Ultrasonography devices	12 (85.7%)
Electrocardiography monitor/defibrillator with pediatric and adult capabilities, including pediatric-sized pads/paddles	13 (92.9%)
Thermometer	14 (100%)
Pulse oximeter with pediatric and adult probes	14 (100%)
Continuous end-tidal CO2 monitoring device	09 (64.3%)

Table 3: Availability of monitoring equipment (n=14).

Regarding the availability of monitoring equipment (Table 3), 11 hospitals (78.6%) reported having blood pressure cuffs for children, but only 6 hospitals had them for neonates. In addition, all hospitals had thermometers as well as pulse oximeters.

Variable	*Yes (%)*
Endotracheal tubes (Uncuffed ETT): 2.5mm	07 (50.0%)
Endotracheal tubes (Uncuffed ETT): 3.0mm	09 (64.3%)
Endotracheal tubes (Uncuffed ETT): 3.5mm	11 (78.6%)
Endotracheal tubes (Uncuffed ETT): 4.0mm	10 (71.4%)
Endotracheal tubes (Uncuffed ETT): 4.5mm	09 (64.3%)
Endotracheal tubes (Uncuffed ETT): 5.0mm	08 (57.1%)
Endotracheal tubes (Uncuffed ETT): 5.5mm	07 (50.0%)
Endotracheal tubes (Cuffed ETT): 2.5mm	05 (35.7%)
Endotracheal tubes (Cuffed ETT): 3.0mm	05 (35.7%)
Endotracheal tubes (Cuffed ETT): 3.5mm	08 (57.1%)
Endotracheal tubes (Cuffed ETT): 4.0mm	09 (64.3%)
Endotracheal tubes (Cuffed ETT): 4.5mm	08 (57.1%)
Endotracheal tubes (Cuffed ETT): 5.0mm	11 (78.6%)
Endotracheal tubes (Cuffed ETT): 5.5mm	11 (78.6%)
Endotracheal tubes (Cuffed ETT): 6.0mm	13 (92.9%)
Endotracheal tubes (Cuffed ETT): 6.5mm	13 (92.9%)
Endotracheal tubes (Cuffed ETT): 7.0mm	12 (85.7%)
Endotracheal tubes (Cuffed ETT): 7.5mm	13 (92.9%)
Endotracheal tubes (Cuffed ETT): 8.0mm	13 (92.9%)
Feeding tubes: 5F	10 (71.4%)
Feeding tubes: 8F	13 (92.9%)
Laryngoscope handle	13 (92.9%)
Laryngoscope blades: Curved 2	13 (92.9%)
Laryngoscope blades: Curved 3	14 (100%)

Laryngoscope blades: Straight 0	12 (86.7%)
Laryngoscope blades: Straight 1	11 (78.6%)
Laryngoscope blades: Straight 2	11 (78.6%)
Laryngoscope blades: Straight 3	09 (64.3%)
Magill forceps: Pediatric	09 (64.3%)
Magill forceps: Adult	13 (92.9%)
Nasopharyngeal airways: Infant	06 (42.9%)
Nasopharyngeal airways: Child	12 (85.7%)
Nasopharyngeal airways: Adult	13 (92.9%)
Oropharyngeal airways: Size 0	11 (78.6%)
Oropharyngeal airways: Size 1	12 (85.7%)
Oropharyngeal airways: Size 2	14 (100%)
Oropharyngeal airways: Size 3	13 (92.9%)
Oropharyngeal airways: Size 4	14 (100%)
Oropharyngeal airways: Size 5	12 (85.7%)
Stylets for endotracheal tubes: Pediatric	12 (85.7%)
Stylets for endotracheal tubes: Adult	12 (85.7%)
Suction catheters: Infant	13 (92.9%)
Suction catheters: Child	14 (100%)
Suction catheters: Adult	14 (100%)
Tracheostomy tubes: 2.5mm	01 (07.1%)
Tracheostomy tubes: 3.0mm	01 (07.1%)
Tracheostomy tubes: 3.5mm	04 (28.6%)
Tracheostomy tubes: 4.0mm	06 (42.9%)
Tracheostomy tubes: 4.5mm	08 (57.1%)
Tracheostomy tubes: 5.0mm	05 (35.7%)
Tracheostomy tubes: 7.0mm	04 (28.6%)
Yankauer suction tip	13 (92.9%)
Bag-mask device (manual resuscitator), self-inflating: Infant Size 450mL	13 (92.9%)
Bag-mask device (manual resuscitator), self-inflating: Adult Size 1000mL	14 (100%)
Clear oxygen masks (standard and nonrebreathing): Infant	09 (64.3%)
Clear oxygen masks (standard and nonrebreathing): Child	14 (100%)
Clear oxygen masks (standard and nonrebreathing): Adult	13 (92.9%)
Masks to fit bag-mask device adaptor: Neonatal	06 (42.9%)
Masks to fit bag-mask device adaptor: Infant	08 (57.1%)
Masks to fit bag-mask device adaptor: Child	12 (85.7%)
Masks to fit bag-mask device adaptor: Adult	13 (92.9%)
Nasal cannulas: Infant	10 (71.4%)
Nasal cannulas: Child	13 (92.9%)
Nasal cannulas: Adult	14 (100%)
Nasogastric tubes (sump tubes): Infant 8F	11 (78.6%)

Nasogastric tubes (sump tubes): Child 10F	14 (100%)
Nasogastric tubes (sump tubes): Adult 14F-18F	14 (100%)
Laryngeal mask airway: Size 1	07 (50.0%)
Laryngeal mask airway: Size 1.5	08 (57.1%)
Laryngeal mask airway: Size 2	13 (92.9%)
Laryngeal mask airway: Size 2.5	12 (85.7%)
Laryngeal mask airway: Size 3	11 (78.6%)
Laryngeal mask airway: Size 4	13 (92.9%)
Laryngeal mask airway: Size 5	11 (78.6%)

Table 4: Availability of Respiratory equipment and supplies (n=14).

Regarding the availability of respiratory equipment and supplies (Table 4), the highest uncuff ETT available was size 3.5mm, available in 11 hospitals, followed by size 4mm, available in 10 hospitals. The highest available sizes for cuffed ETT were 8mm, 7.5mm, 6mm, and 6.5mm; 13 hospitals were found to have each size. Feeding tubes were mainly available in size 8F (13 hospitals). Laryngoscope handle and laryngoscope bladed curved 2 each were available in 13 hospitals. Magill forceps for adults were available in 13 hospitals. Nasopharyngeal airways for adults were available in 13 hospitals. All hospitals reported having oropharyngeal airways with sizes 2 and 4. Stylets for endotracheal tubes in pediatrics and adults were available in 12 hospitals. Suction catheters for children and adults were available in all hospitals. However, the lack of supplies related to tracheostomy tubes can be seen, particularly in sizes such as 2.5 mm, 3mm, 3.5mm, and 7mm. All hospitals had big mask devices for adults (1000 mL), clear oxygen masks for children, nasal cannulas for adults, and nasogastric tubes for children and adults. Half of the participating hospitals had no laryngeal mask airway size 1.

Variable	***Yes (%)***
Arm boards: Infant	02 (14.3%)
Arm boards: Child	07 (50.0%)
Arm boards: Adult	09 (64.3%)
Catheter-over-the-needle device: 14 Gauge	09 (64.3%)
Catheter-over-the-needle device: 16 Gauge	11 (78.6%)
Catheter-over-the-needle device: 18 Gauge	12 (85.7%)
Catheter-over-the-needle device: 20 Gauge	12 (85.7%)
Catheter-over-the-needle device: 22 Gauge	12 (85.7%)
Catheter-over-the-needle device: 24 Gauge	12 (85.7%)
Intraosseous needles or devices: Pediatric	06 (42.9%)
Intraosseous needles or devices: Adult	07 (50.0%)
Intravenous catheter-administration sets with calibrated	10 (71.4%)
Chambers and extension tubing and/or infusion devices with the ability to regulate the rate and volume of infusate	12 (85.7%)
Umbilical vein catheters: 3.5F	06 (42.9%)
Umbilical vein catheters: 5.0F	07 (50.0%)
Central venous catheters: 4.0F	06 (42.9%)
Central venous catheters: 5.0F	05 (35.7%)
Central venous catheters: 6.0F	08 (57.1%)
Central venous catheters: 7.0F	11 (78.6%)

Intravenous solutions: Normal Saline	14 (100%)
Intravenous solutions: Dextrose 5% in normal saline	14 (100%)
Intravenous solutions: Dextrose 10% in water	12 (85.7%)

Table 5: Availability of Vascular Access Supplies and Equipment (n=14).

In Table 5, deficiencies in the availability of arm boards were seen particularly with infants (only 2 hospitals). Catheter-over-the-needle devices were almost available in all sizes. Intraosseous needles, umbilical vein catheters, and central venous catheters were deficient. In contrast, intravenous solutions (normal saline and dextrose 5%) were available in all hospitals, but 10% of dextrose was not available in all hospitals (2 hospitals missing).

Variable	***Yes (%)***
Extremity splints, including femur splints: Pediatric	07 (50.0%)
Extremity splints, including femur splints: Adult	11 (78.6%)
Spine-stabilization method/devices appropriate for ages: Infant	06 (42.9%)
Spine-stabilization method/devices appropriate for ages: Child	08 (57.1%)
Spine-stabilization method/devices appropriate for ages: Adolescent	10 (71.4%)
Lumbar-puncture needles: Infant 22 Gauge	04 (28.6%)
Lumbar-puncture needles: Pediatric 22 Gauge	07 (50.0%)
Lumbar-puncture needles: Adult 18-21 Gauge	07 (50.0%)
Supplies/kit for patients with difficult airway conditions (to include but not limited to supraglottic airways of all sizes, such as the laryngeal mask airway, 2-needle cricothyrotomy supplies, surgical cricothyrotomy kit)	07 (50.0%)
Tube thoracostomy tray	08 (57.1%)
Chest tubes to include: Infant 10F-12F	07 (50.0%)
Chest tubes to include: Child 16F-24F	09 (64.3%)
Chest tubes to include: Adult 28F-40F	12 (85.7%)
Newborn delivery kit (including equipment for initial resuscitation of a newborn infant: umbilical clamp, scissors, bulb syringe, and towel)	12 (85.7%)
Urinary catheterization kits and urinary (indwelling) catheters: 6F	09 (64.3%)
Urinary catheterization kits and urinary (indwelling) catheters: 8F	11 (78.6%)
Urinary catheterization kits and urinary (indwelling) catheters: 10F	12 (85.7%)
Urinary catheterization kits and urinary (indwelling) catheters: 12F	11 (78.6%)
Urinary catheterization kits and urinary (indwelling) catheters: 14F	13 (92.9%)
Urinary catheterization kits and urinary (indwelling) catheters: 16F	13 (92.9%)
Urinary catheterization kits and urinary (indwelling) catheters: 18F	13 (92.9%)
Urinary catheterization kits and urinary (indwelling) catheters: 20F	12 (85.7%)
Urinary catheterization kits and urinary (indwelling) catheters: 22F	09 (64.3%)

Table 6: Availability of Fracture-Management Devices (n=14).

Table 6 shows the deficiencies in the supply of facture-management devices. In particular, the lack of supplies was seen in the extremity splints, spine-stabilization method/devices, lumbar-puncture needles, supplies for patients with difficult airway conditions, and chest tubes, while the urinary catheterization kits and urinary catheters supplies seem adequate with the lowest available were size 6F and 22F (each available in 9 hospitals).

Variable	*Yes (%)*
Atropine	14 (100%)
Adenosine	14 (100%)
Amiodarone	14 (100%)
Antiemetic agents	14 (100%)
Calcium chloride	14 (100%)
Dextrose: D10W	12 (85.7%)
Dextrose: D50W	12 (85.7%)
Epinephrine: 1:1,000 Solutions	13 (92.9%)
Epinephrine: 1:10,000 Solutions	12 (85.7%)
Lidocaine	14 (100%)
Magnesium sulfate	14 (100%)
Naloxone hydrochloride	14 (100%)
Procainamide	10 (71.4%)
Sodium bicarbonate: 4.2%	05 (35.7%)
Sodium bicarbonate: 8.4%	13 (92.9%)

Table 7: Availability of Resuscitation Medications (n=14).

Regarding the availability of resuscitation medications (Table 7), it was shown that nearly all medications were available in almost all hospitals, except for sodium bicarbonate (4.2%), with only 5 hospitals indicating its availability.

Variable	*Yes (%)*
Antimicrobial agents (parenteral and oral)	14 (100%)
Anticonvulsant medications	14 (100%)
Antipyretic drugs	14 (100%)
Bronchodilators	14 (100%)
Corticosteroids	14 (100%)
Inotropic agents	14 (100%)
Sedatives	14 (100%)
Vasopressor agents	14 (100%)
Activated charcoal	13 (92.9%)
Topical, oral, and parenteral analgesics	13 (92.9%)
Antidotes (common antidotes should be accessible to the ED)	13 (92.9%)
Neuromuscular blockers	13 (92.9%)
Vaccines	12 (85.7%)

Table 8: Availability of Other drug groups (n=14).

Regarding the availability of other drugs, 8 out of 13 drugs written in the guidelines were available in all hospitals; the rest (5 out of 13) were nearly available, with only vaccines missing in at least 2 hospitals (Table 8).

Variable	*Missing N (%)*	*Category*
Intraosseous needles or device	07 (50.0%)	Vascular Access Supplies
Umbilical vein catheters	07 (50.0%)	Vascular Access Supplies
Tracheostomy tubes	05 (35.7%)	Respiratory supplies
Arm boards	05 (35.7%)	Vascular Access Supplies
Lumbar-puncture needles	05 (35.7%)	Fracture-Management Devices
Spine-stabilization method/devices appropriate for ages	04 (28.6%)	Fracture-Management Devices
Blood pressure cuffs	03 (21.4%)	Monitoring equipment
Endotracheal tubes (Uncuffed ETT)	03 (21.4%)	Respiratory supplies
Central venous catheters	03 (21.4%)	Vascular Access Supplies
Nasopharyngeal airways	02 (14.3%)	Respiratory supplies
Catheter-over-the-needle device	02 (14.3%)	Vascular Access Supplies
Extremity splints, including femur splints	02 (14.3%)	Fracture-Management Devices
Endotracheal tubes (Cuffed ETT)	01 (07.1%)	Respiratory supplies
Feeding tubes	01 (07.1%)	Respiratory supplies
Stylets for endotracheal tubes	01 (07.1%)	Respiratory supplies
Suction catheters	01 (07.1%)	Respiratory supplies
Masks to fit bag-mask device adaptor	01 (07.1%)	Respiratory supplies
Dextrose	01 (07.1%)	Vascular Access Supplies
Total missing score, median (IQR)	3.0 (0 - 12.0)	--

Table 9: Frequency of ER supplies/medication being missing (n=14).

Table 9 shows the frequencies of the missing supplies/medications per hospital. It revealed that intraosseous needles or devices (7 hospitals) and umbilical vein catheters (7 hospitals) were the most frequently missing supplies among the participating hospitals, followed by tracheostomy tubes, arm boards, and lumbar-puncture needles, missing in 5 hospitals, each respectively. The overall median (IQR) missing score was 3 (0 - 12). The highest missing category item was respiratory supplies (8 out of 18), followed by vascular access supplies (6 out of 18) and fracture-management devices (3 out of 18).

Domain	*No. of items listed in the guidelines*	*No. Available Median (IQR)*	*Median Percentage Score*	*Missing (%)*
General equipment	06	4.5 (1.0 - 6.0)	75.0%	15.0%
Monitoring equipment	09	7.0 (4.0 - 9.0)	77.8%	22.2%
Respiratory equipment and supplies	74	56.5 (35.0 - 71.0)	76.4%	23.6%
Vascular Access Supplies	22	15.0 (8.0 - 22.0)	68.2%	31.8%
Fracture-Management Devices	23	15.5 (5.0 - 23.0)	67.4%	32.6%
Other drugs group	15	13.5 (11.0 - 15.0)	90.0%	10.0%
Resuscitation Medications	13	13.0 (11.0 - 13.0)	100%	0
Total preparedness score	162	123 (82.0 - 151.0)	75.9%	24.1%

Table 10: Equipment and medication available in ER (n=14).

We also calculated the total score for the availability of equipment and medication in the ER. According to the results, the median scores of general equipment, monitoring equipment, respiratory equipment and supplies, vascular access supplies and equipment, fracture-management devices, other drug groups, and resuscitation medications were 4.5, 7.0, 56.5, 15, 15.5, 13.5, and 13, respectively. The overall median score of ER preparedness was 123 (82 - 151). The median percentage score was highest in resuscitation medications (100%) and lowest in facture-management devices (67.4%). The total preparedness median percentage score was 75.9%.

Discussion

This study explores pediatric emergency preparedness among clusters of hospitals in the Al Qassim Region of Saudi Arabia. The availability of supplies and equipment in the emergency trolley is a key contributor to preparedness in emergency care. The results of this study revealed that there were insufficient supplies of vascular access equipment, particularly intraosseous needles or devices, and umbilical vein catheters. Half of the participating hospitals had no supplies of the mentioned equipment. This is in agreement with the study of McGillivray et al. (2001), reporting that infant warming devices (59.4%), pediatric pulse oximeters (18.0%), intraosseous needles (15.9%), pediatric defibrillator paddles (10.5%), and infant laryngoscope blades (3.5%) were unavailable at a disturbingly greater number of emergency departments (EDs) across Canada [8]. Supporting these reports, Gausche-Hill et al. (2015) found that over 15% of participating EDs had missing umbilical vein catheters, central venous catheters, continuous end-tidal carbon dioxide monitoring equipment, pediatric Magill forceps, and size 00 laryngoscope blades [9].

The availability of equipment to manage the circulation, breathing, and airway is critical [10]. The shortage of life-saving equipment and monitors could lead to poor emergency outcomes [11]. In our results, nasopharyngeal airways for infants were missing in more than half of participating hospitals. Cuffed ETTs were also missing, particularly in the small sizes, and it is apparent from our results that supplies related to tracheostomy tubes are lacking. Other notable missing items related to respiratory equipment and supplies were masks that fit bag-mask device adaptors for neonates and infants. In Ghana [12], clear evidence of deficiencies in emergency supplies has been documented. In particular, physical supplies for resuscitation, a laryngoscope, an endotracheal tube, and a bag-valve mask were missing. This was also observed among EDs in the USA [13]. The recommended supplies and equipment were only seen in 6% of the participating EDs, and the most frequently missing supplies were related to laryngeal mask airways for children and neonatal or infant equipment.

Moreover, we noted supplies for fracture-management devices were also missing at some point. For instance, lumbar-puncture needles were missing in 5 hospitals, spine-stabilization devices were absent in 4 hospitals, and extremity splints, including femur splints, were unavailable in 2 hospitals. Likewise, monitoring equipment such as blood pressure cuffs was lacking, and continuous end-tidal CO2 monitoring devices were missing in 5 hospitals. Also, we noticed that patient warming devices, as well as restraining devices, were not found in at least half of the participating hospitals. A study conducted in Ethiopia [14] found that devices to confirm tracheal intubation and equipment for the treatment of difficult intubation are lacking in all participating hospitals. In addition, end-tidal carbon dioxide monitoring and esophageal detector devices were unavailable in all hospital sites. However, in Ghana [11], essential emergency supplies such as pulse oximeters and thermometers were unavailable at EUs.

Conversely, according to the reports of Tsima et al. (2019), the availability of essential drugs for resuscitation at four district hospitals was only 20.4%, adding that some wards still kept drugs even if they were expired [15]. Supporting this scenario, Kudavidanage et al. (2015) also observed a lack of available medicines in clinical areas, including the ICU [16]. Only less than half had naloxone, Saline 10ml vials, CaCl 10% glucose, and GTN spray. Regular checking of the emergency trolley was also less than desired. This contradicts our findings, as nearly all resuscitation medications except sodium bicarbonate 4.2% (only 5 hospitals) were available in our hospitals. Other types of drugs used for emergencies were sufficient, including antimicrobial agents, anticonvulsant medications, antipyretic drugs, bronchodilators, corticosteroids, inotropic agents, sedatives, and vasopressor agents.

The median score of preparedness was 123 out of 162 total score points, with a median percentage score of 75.9%. The median percentage score was higher in resuscitation medication (100%), followed by other drugs group (90%) and monitoring equipment (77.8%), while facture-management devices have the lowest (67.4%). This is comparable to the study of Gausche-Hill et al. (2015), reporting a median percentage of recommended equipment availability of 91%. In contrast, several studies documented ER under-preparedness [11, 12, 14, 17]. The readiness of emergency care settings is vital to preventing undesirable outcomes, including death. To prevent unwarranted outcomes, evidence-based standard checklists should be enforced to ensure all supplies and equipment are available in the emergency trolley.

Limitations

The findings of this study were bound to some limitations. First, a small sample size (N=14) limited the findings' generalizability and made applying the results to a bigger population difficult. Second, the analysis was limited to descriptive statistics, and it could be more interesting to include inferential statistics to see the differences between each subgroup. Third, being a cross-sectional study requires a bigger sample size to represent the study population accurately; however, the small size makes it difficult to predict the potential bias involved in this study.

Conclusion

This study provides evidence that some of the most essential equipment and supplies were unavailable in pediatric emergency care settings. In particular, vascular access supplies and fracture-management devices had major deficiencies in terms of supply availability. The lack of available supplies may be a barrier to providing high-quality pediatric emergency care. Hence, the provision of a standardized checklist and layout for the supplies and equipment in the emergency trolley is recommended for more effective utilization. Finally, a multicenter study approach is needed at a national level to get better insights into ER preparedness for emergencies.

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