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ORIGINAL ARTICLE

Pre-hospital preparedness for pediatric mass casualty incidents in Riyadh

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ABSTRACT

Background: The percentage of affected children in mass casualty incidents (MCIs) in Saudi Arabia is high (39.1%). Thereby, this study aimed to assess the level of preparedness, preparedness plans, and the knowledge of pre-hospital workers related to pediatric patients in MCI. Also, to identify training methods needed in order to highlight the critical points of improvement regarding emergency medical services (EMS) personnel awareness.

Methods: This was a descriptive cross-sectional study carried out among pre-hospital care providers of the Saudi Red Crescent authority stations and Ministry of Health EMS departments in Riyadh City. The questionnaires were distributed to 239 pre-hospital workers, who were selected by convenient sampling.

Results: A total of 200 pre-hospital workers completed the questionnaire, with a response rate of 84%, where 97.5% were males. Only 36% participants had pediatric trauma training in the past year and 64% participants had never triaged pediatric trauma patients.

Conclusion: There was lack of experience, knowledge, training, and preparedness among the participants about practices in MCI involving children.

Keywords: Pediatric incidents, pre-hospital preparedness, mass casualty incidents.

Introduction

Mass casualty incident (MCI) is an incident where the number of affected persons or the rate of their arrival to a healthcare facility outweighs the available resources and the capability to provide them promptly [1]. Different pre-hospital systems as emergency medical services (EMS) make extensive efforts to ensure preparedness and that they could appropriately handle any surges in healthcare needs resulting from disasters as MCI [2].

EMS are integrated systems, which provide personnel, equipment, and facilities required for delivery of efficient, organized and accurate health and safety services in a synchronized response in case of emergencies [3]. The EMS in Saudi Arabia is divided into two categories; Saudi Red Crescent Authority (SRCA), which provide pre-hospital emergency services, and Ministry of Health (MOH), which provides inter-facility emergency services. SRCA provides out of hospital emergency care for the public from the early decades (1943) of the development of healthcare in Saudi Arabia [4].

The Saudi General Authority for Statistics reported that the number of population in the Kingdom is about 31.74 million; out of these about 7.85 million (39.1%) are children aged from 0 to 18 years, and the largest percentage is from the age group of 0-4 years representing about 10.6% (2019) [5]. Pediatric patients have special psychological, physiological, and developmental characteristics; also, they are highly susceptible to injuries in MCI. Moreover, the medical problems that children experience requires specific medical care, so it is essential that pediatric needs are incorporated into every level of disaster planning [6,7]. This supports the needs and importance of providing pre-hospital personnel with the knowledge and training to manage an MCI involving children.

Providing medical care to pediatrics is more challenging than adults. The challenges faced by pre-hospital personnel while dealing with children include

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communication, physical examination, immobilization, equipment sizing, and dose calculation according to their weight. Pediatric specific training for pre-hospital personnel might improve their ability to care for children [8].

Shirm et al. [9], reviewed terrorist attacks targeting children in the United States in 2006. Only 19% of services reported to have specific pediatric triage protocol for MCIs, concluding that there were serious deficiencies in the preparedness plans of EMS for pediatrics in the United States. Another study conducted by Ferrer RR et al. [10], to assess the emergency exercises in healthcare organizations and evaluate the degree of involvement of pediatric population. The results showed lack of pediatric resources and specific training for pediatric care during a disaster, which means that a high priority should be given for planning to deal with pediatric emergency situations as it is highly vulnerable group.

Research about emergency preparedness and willingness to respond to potential terrorist incidents showed that 11% of pre-hospital healthcare providers were less willing to respond to terrorist emergency incidents. Lack of preparedness among the teams was a significant contributor to the hesitation to respond to the issue [11,12]. The emergency preparedness and response have been tailored to suit adults; while children are more vulnerable to be affected by disaster psychologically and physically [13]. Therefore, it is important that all the pre-hospital healthcare providers should be appropriately equipped to provide pediatric emergency care. There is substantial lack of studies that illustrate the level of awareness and knowledge of pre-hospital personnel regarding management and treatment of children during disasters, as well as preparedness plans for pediatric MCIs in Saudi Arabia. Thereby, this study aimed to assess the level of preparedness, preparedness plans, and the knowledge of pre-hospital workers related to pediatric patients in MCI. In addition, to identify training methods needed in order to highlight the critical points of improvement regarding EMS personnel awareness.

Subjects and Methods

This was a descriptive cross-sectional study that included pre-hospital healthcare providers working in SRCA. This includes paramedics, Emergency Medical Technician (EMT), and physicians in Riyadh City, Saudi Arabia. The study was conducted between June 2019 and September 2019. Validated questionnaire was adopted from previous published research [14]. It was distributed electronically among the participants who were selected by convenience sampling. We have used different social media platforms to distribute our survey (e.g., Whatsapp, Telegram)

To ensure the reality of questionnaire, Cronbach's Alpha test was used and the total degree of validity and reliability was (0.829) which is high value and approaching the correct one and it refers to the validity of the questionnaire for the application and the reliability of its results.

According to the Head Quarter of SRCA, there are 630 pre-hospital personnel working in the field. Using Raosoft sample size calculator tool (based on the total number of prehospital workers in Riyadh), the recommended sample size was 239. The collected data was coded and analyzed, then the results were presented as frequencies and percentages.

Ethics

This study was approved by King Saudi University Institutional Review Board (IRB) on 28/08/2019 reference number (19/0984/IRB)

Results

Total 239 pre-hospital personnel were tested and 200 of them responded, with a response rate of 84%. Of the 200 participants, 97.5% (195) were males and 2.5% (5) were females (Figure 1).

The age groups of the participants were as following: 51.5% of them were from 30 to less than 40 years old, 39.5% were less than 30 years, and 9% were of 40 and above years (Figure 2).

From the total participants, 40% were working within the pre-hospital care for about 6-10 years, 23.5% were working for 4-5 years, 12.5% were working for about 11 years and more, 12% were working for 2-3 years whereas 12% were working for less than 1 year (Figure 3).

The statistical analysis showed that 62% participants were trained as pre-hospital workers, while 38% came from other healthcare backgrounds (medical, nursing and EMT).The training courses that the participants had in the

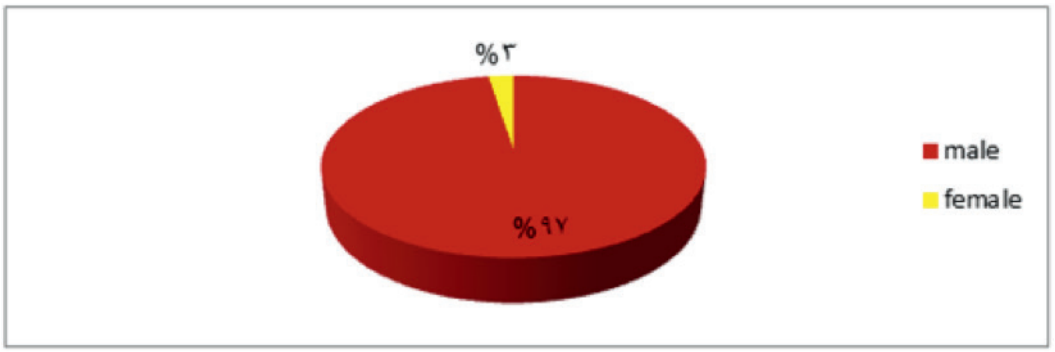

Figure 1. *Gender distribution of the participants.*

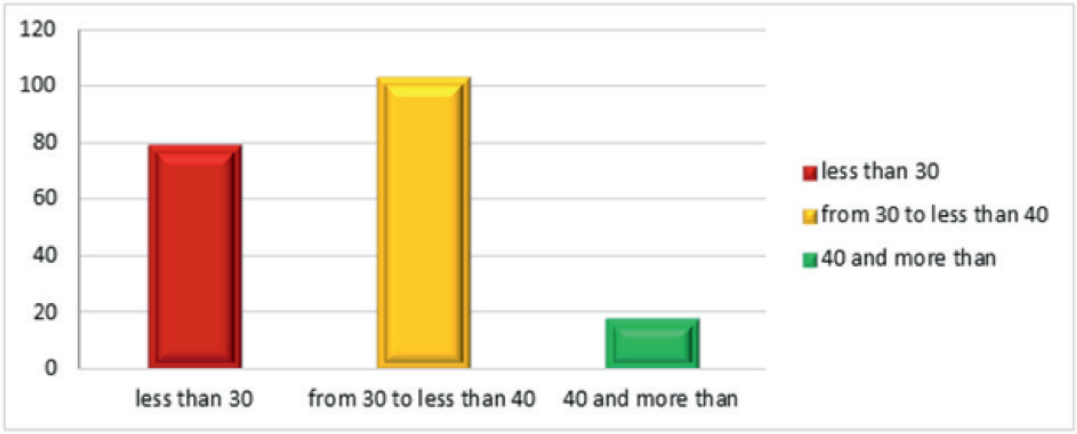

Figure 2. *Age distribution of the participants.*

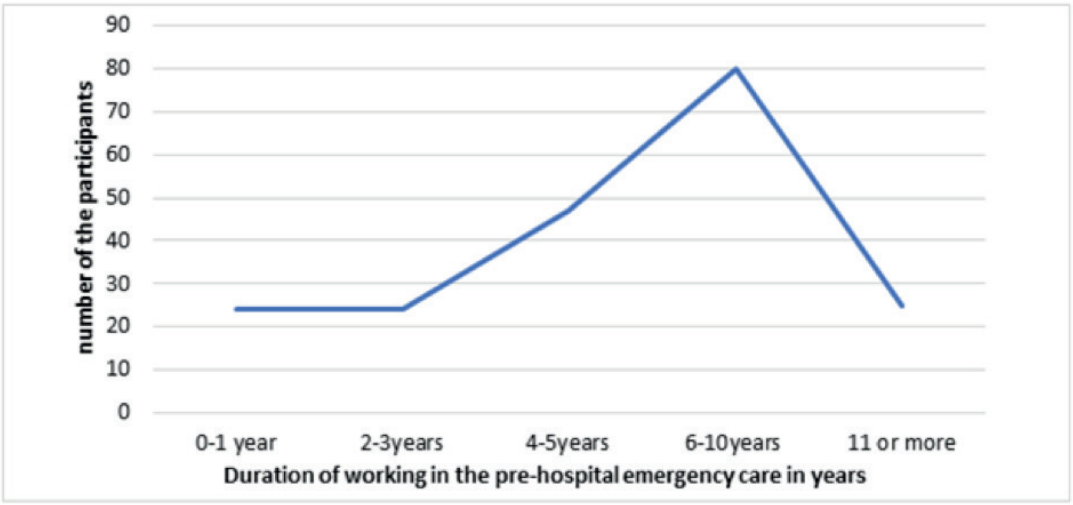

Figure 3. *Duration of working in the pre-hospital emergency care by the participants.*

Table 1. *Frequency of taking training courses by the participants.*

Courses	Never		Once a year		Every other year		Every fourth year	
	N	%	*N*	%	*N*	%	*N*	%
NRP	79	39.5	22	11.0	32	16.0	20	10.0
Pediatric advanced life support	68	34.0	24	12.0	38	19.0	22	11.0
APLS	37	18.5	22	11.0	43	21.5	49	24.5
PHTLS	22	11.0	22	11.0	44	22.0	92	46.0
AMLS	62	31.0	14	7.0	31	15.5	38	19.0

last year was Pre-hospital Trauma Life Support (PHTLS) (23%), 23% had a training course of advanced pediatric life support (APLS), 13% had a training course of Neonatal Resuscitation Program (NRP), 6.5% had a training course of Advanced Medical Life Support (AMLS), 5.5% had a training course of Pediatric Advanced Cardiopulmonary Resuscitation (CPR), 13% had other training courses, and 3% had no training courses (Table 1).

Triage process is critical in pre-hospital settings, especially during MCIs involving pediatrics. Pre-hospital personnel are the front line in case of MCIs. Almost 15.5% participants reported low degree of knowledge regarding triaging pediatric patients. Almost 72 (36%) participants had an experience with triaging pediatric trauma patients in MCIs. Pediatric triage tape is used to triage pediatrics and only 28 (14%) were using it and 6 (3%) were using other triage systems. Triage systems ease pre-hospital personnel work, 33 (16.5%) of the participants agreed to "some degree" that there is a need for triage systems specifically for pediatric patients (Table 2).

Around 78% participants agreed that pediatric trauma patients put them in higher degree of stress than adult trauma patients. Some of the participants develop anxiety symptoms when dealing with pediatric trauma patients such as freezing (14%), disturbed stomach (13%), and nausea (10.5%). Regarding the possible symptoms that

Table 2. *The degree of adequate training of the participants.*

Question	Very low		Low		Some		High		Very high	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
To what degree do you consider that you have adequate training to care for trauma patients?	4	2.0	3	1.5	40	20.0	96	48.0	57	28.5
To what degree do you consider that you have adequate training to care for pediatric trauma patients?	7	3.5	26	13.0	83	41.5	68	34.0	16	8.0
To what degree do you consider that you have adequate training to care for pediatric trauma patients injured in a mass-casualty event?	9	4.5	27	13.5	84	42.0	62	31.0	18	9.0
To what degree do you consider that training increases your ability to care for pediatric trauma patients?	1	.5	11	5.5	34	17.0	79	39.5	75	37.5
To what degree do you consider that you have adequate knowledge regarding pediatrics' vital signs and normal values?	4	2.0	19	9.5	65	32.5	80	40.0	32	16.0
To what degree do you consider yourself comfortable during assessing pediatrics' vital signs and normal values?	7	3.5	17	8.5	81	40.5	64	32.0	31	15.5
To what degree do you consider yourself to be knowledgeable to triage pediatric trauma patients?	6	3.0	25	12.5	86	43.0	66	33.0	17	8.5

Table 3. *Degree of knowledge, experience, and preparedness of the participants to care for pediatric trauma patients.*

Question	Very low degree		Low degree		Some degree		High degree		Very high degree	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
To what degree do you consider that you have the knowledge to care for pediatric trauma patients?	3	1.5	36	18.0	84	42.0	59	29.5	18	9.0
To what degree do you consider that you have experience in caring for pediatric trauma patients?	6	3.0	35	17.5	107	53.5	37	18.5	15	7.5
To what degree do you consider yourself prepared to care for pediatric trauma patients?	6	3.0	33	16.5	87	43.5	62	31.0	12	6.0
Would your degree of preparedness be affected if there was a mass-casualty event involving pediatric trauma patients?	Yes				No					
	N		%		*N*		%			
	171		85.5		29		14.5			

the participants might have after their care of pediatric trauma patients were 29.5% had sadness and grief, 26.5% had recurring memories and thoughts, 26% had Anxiety, 16.5% had fatigue, 14% had anger and irritability, 14% had restlessness and agitation, 12% had sleep disturbances, 11% had difficulty to concentrate, 5% had difficulties to resume normal daily routines, 24% hadn't any symptoms, and 8% had never cared for pediatric trauma patients.

Furthermore, only 26.5% participants' workplaces were conducting training exercises that include caring for pediatric trauma patients once a year, 7.5% of them are conducting these training exercises twice or more per year, and 66% don't conduct any training exercises that include caring for pediatric trauma patients. Only 3% of the participants had specific types of the training programs including "Mass Casualty" in their workplaces, while most of participants (52.5%) did not received any training programs about MCIs. About 98% participants believed that more training programs would improve the care for pediatric trauma patients (Table 3).

Discussion

There is an obvious lack of studies about preparedness for MCI's that involve children in our country. Therefore, the study aimed to study the magnitude of this issue in our country to come up with valuable data that could guide us to be more prepared in the pre-hospital setting in case of MCI's that involve this vulnerable population. Children are the most vulnerable group in the population in case of disasters [15]. They might not be able to protect themselves or get away from a threat during disasters; also they are at higher risk for inhaled toxicity with an airborne agent. Thus, special training is required in order to manage and treat them [16].

The percentage of pediatric age group represents 25% of the total population in the United States, however there is a marked deficiency in pediatric disaster preparedness across the country. Disaster planners and others are not focusing on pediatric needs, and this makes the plans inadequate [17]. Most health care facilities perform disaster drills and trainings to improve the management and response for a MCI, but only a few of them include children in these trainings. In the United States, most services (69.3%) reported that they have participated in local or regional exercises in the past year, approximately half of them only reported that the exercise involved pediatric patients [18].

It was found in the current study that there were many gaps that should be addressed. According to the participants, there was an obvious difference between the frequencies of attending trauma courses versus pediatric trauma courses. For example, about 76.5% believed that they had adequate training for dealing with trauma patients while only 42% believed that they had adequate training for

dealing with pediatric trauma patients. Triaging patients is crucial during MCI and with children involvement, it became more challenging specially without experiencing such situation [19]. In the current study, about 64% participants did not have any experience with triaging pediatric trauma patients in MCIs. It is important for pre-hospital workers to be knowledgeable to triage pediatric trauma patients, however in this study, only 41.5% participants reported that they are knowledgeable to triage pediatric trauma patients, which indicated a weakness area that must be solved. Pediatric training courses are useful to increase both skills and knowledge to manage an event of MCI involving children, as 94% participants reported that training increases their ability to care for pediatric trauma patients.

The majority of the participants are not confident that they had adequate paediatric training courses especially during MCI. Dealing with pediatric patients in emergencies represents an obstacle in many areas in the world; where a study conducted in Germany showed a pediatric emergency rate of 3.5% and concluded that those patients were not managed adequately and recommended intensified education for caring with this age group of patients [20].

EMS agencies responses to adult patients are more than pediatrics; a previous study conducted by Moore et al. [21] showed that only 10% of the EMS total patients were pediatric patients. Also, this study demonstrated a significant lack of conducting training programs that include pediatric trauma patients specially in MCI events, where 66% participants reported that they never had such courses, and only 26.5% reported that they had pediatric trauma courses once a year.

Pediatrics' physiology is different from that of adults, so adult protocols might not be suitable for children. The presence of pediatric triage system is useful for pre-hospital personnel to manage and triage pediatric trauma patients, and 95.5% participants in the current study consider that there is a need for such system.

Health care providers are exposed to different kinds of stress situations, and the greater the exposure to occupational risk factors as heavy workload, long shift hours, lack of sleep, etc., higher the risk of developing negative mental health outcomes, [22] depression [23], anxiety [24], and posttraumatic stress disorders [25]. It has been illustrated that professional healthcare providers who were less prepared for disaster events were more likely to develop negative mental health outcomes such as post-traumatic stress disorder and burnout during disasters [26]. Stress associated with pediatric trauma patient's management is a challenge that pre-hospital workers face. Around 95.5% participants in the current study considered that trauma incidents involving children put them in a higher degree of stress than trauma incidents involving adults. A previous study conducted by Bentley et al. [27] showed that the DASS-21 classified 1,589 EMS professionals as depressed, 1,406 as anxious, and 1,382 as stressed. This clarifies the strong association between lack of preparedness of EMS professionals and their affection by mental stress.

Limitations

The limitations of this study are inclusion of participants from only one city (Riyadh) and a sample size.

Conclusion

There was a lack of experience, knowledge, training, and preparedness among the participants about practices in MCI involving children, also taking care of pediatric patients is more stressful to them compared to adult patients. It is recommended to conduct more training courses specific for pediatric trauma patients, especially in case of MCI events, and to apply preparedness plans and pediatric triage systems for pre-hospital providers in Saudi Arabia. Also, psychological counseling should be provided for pre-hospital personnel.

List of Abbreviations

AMLS	Advanced Medical Life Support
APLS	Advanced Pediatric Life Support
CTAS	Canadian Triage and Acuity Scale
CPR	Cardiopulmonary Resuscitation
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
MCIs	Mass Casualty Incidents
MOH	Ministry of Health
NRP	Neonatal Resuscitation Program
PTT	Pediatric Triage Tape
PTSD	Post-Traumatic Stress Disorder
PHTLS	Pre-hospital Trauma Life Support
SRCA	Saudi Red Crescent Authority

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this study.

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Consent to participate

Written informed consent was obtained from all the participants.

Ethical approval

Approval was obtained from Health Research IRB at College of Medicine, King Saud University via Ref # 19/0984/IRB.

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