DOI: 10.4274/forbes.galenos.2021.40427
Forbes J Med 2022;3(2):99-105

Review / Derleme

Pediatric Disaster Triage System

Pediatrik Afet Triyaj Sistemi

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Cite as: Yalçın G, Anıl M. Pediatric Disaster Triage System. Forbes J Med 2022;3(2):99-105

ABSTRACT

It is important to be aware of and prepare for the possible consequences of disasters. In the event of any disaster, disaster triage is to do what is most beneficial for the large number of injured by using the limited resources. After the disaster, the injured victims are classified according to their injury status with an effective and fast triage. When available resources are used optimally under triage guidance, mortality and morbidity are reduced. Every country must have a disaster management plan. Children's anatomical and physiological characteristics are different from adults and they are vulnerable to disasters. Although one-third of the disaster victims were children, pediatric issues were not adequately addressed in the planning. In this article, it is aimed to provide information about the triage systems determined and accepted to be used for child victims aged 0-8 in disasters.

Keywords: Disaster, triage systems, child

ÖZ

Afetlerin olası sonuçları konusunda farkında olmak ve bunlara hazırlıklı olmak önemlidir. Afet triajı; meydana gelen herhangi bir afet durumunda, sınırlı imkanları kullanarak çok sayıda kazazede için en faydalı olanı yapmaktır. Afet sonrasında etkin ve hızlı bir triaj ile kazazedeler, yaralanma durumlarına göre sınıflandırılır. Eldeki kaynaklar triyaj rehberliğinde en uygun şekilde kullanıldığında mortalite ve morbidite azalmaktadır. Her ülkenin, afet yönetim planı olmak zorundadır. Çocukların anatomik ve fizyolojik özellikleri erişkinlerden farklıdır ve afetlere karşı savunmasızdırlar. Afette kazazedelerin üçte biri çocuk olduğu halde planlamalarda pediatrik konulara yeterli değinilmemiştir. Bu yazıda afetlerde 0-8 yaş arası çocuk yaralılarda kullanılmak üzere belirlenmiş ve kabul edilmiş triaj sistemleri hakkında bilgi verilmesi amaçlanmıştır.

Anahtar Kelimeler: Afet, triage sistemleri, çocuk

Received/Geliş: 26.07.2021
Accepted/Kabul: 12.10.2021

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INTRODUCTION

It is important to be aware of and prepare for the possible consequences of disasters. In the event of any disaster, disaster triage (DT) is to do what is most beneficial for the large number of injured by using the limited resources. After the disaster, the injured victims are classified according to their injury status with an effective and fast triage. When available resources are used optimally under triage guidance, mortality and morbidity are reduced. Every country must have a disaster management plan. Children have anatomical and physiological characteristics that differ from those of adults and they are vulnerable to disasters. Pediatric preparations in disaster situations are poor. Efforts are being made at the local, state, county, and federal levels to create resources to help prepare for disaster planning. In planning, children should be identified and evaluated first. It should include methods to reduce the emotional impact on children and their families. Data indicate that more than one-third of victims of disasters are children, but the system planning has excluded pediatric issues.[1]

In this article, it is aimed to provide information about the triage systems determined and accepted to be used for child victims in disasters.

A disaster can be defined as any event that exceeds the intervention and response capacity of a system. Children have higher morbidity and mortality during a disaster than adults and age is inversely related to increased morbidity and mortality in disaster situations. For this reason, it is imperative to consider and plan the needs of children in disaster situations. First responders should have access to appropriate pediatric equipment and the opportunity to practice using it frequently. A nationally standardized pediatric DT protocol would provide the advantage for compliance between jurisdictional. This paper describes systems that will allow for the rapid, objective and repeatable triage of many children (ages 0-8) victims of disasters.

When all data from 2000 to 2020 were analyzed, a total of 13,862 records were reported, including all continents and all types of disasters reported in EMDAT. 11,143 entries had missing information regarding economic losses, which amounts to 80.38% of the total.[2]

According to the 2020 World Risk Report (WRI 2020), 181 countries are rated as vulnerability to disasters. Among these countries, Turkey, although the level of risk is among low class countries (5.03 WRI), with the lack of adaptive capacity score (72.92%) and exposure risk score (12.29%) is among among the medium risky countries.[3] Additionally, the Risk Management Index (INFORM) by the Task Force of the European Union and the Institutional Recovery and Preparation Committee, 191 countries are listed in terms of humanitarian crises and disasters. Turkey, in this evaluation with 5.0 index points, is a country that has moderate risk (between 4.64 and 10.0). However, when this three-year period was examined, an increase in risk was observed. Turkey is under a great risk of natural disasters such as earthquakes and tsunamis.[4,5]

During disasters, there is an imbalance between existing resources and medical needs. In a DT, it can be very difficult to get the best help the victims and sometimes it must be left to die.[6] Triage strategies have been developed to reduce this situation. DT is an important skill. Although there are many systems to guide practitioners, there is little scientific evidence to prove the validity of the existing systems.[7] Rapid evaluations (less than a minute) should be made for each patient in triage. Incorrect triage can offset the needs of victims and can lead to preventable death or deformity (under-triage), or the size of minor injuries can be overestimated, which can lead to death or injury of the patients with more serious injuries (over-triage).[8]

In the disaster area, a priority category must be specified for each victim, and categories for rescuers (tags attached to each patient) must be visually identified.[9]

Color Scale

Triage is the use of limited resources during a disaster. The first team to arrive at the scene should begin the triage process. The first step in this process will be to provide the first evaluation of the patients and to determine the evacuation methods. In Turkey, a color system is created by the Ministry of Health and used for triage evaluation in disasters.[10] The priorities are defined as follows: Green; walkable, people who do not need urgent care, those who do not need to be transported by ambulance. The yellow color, waiting period is a little bit longer. This group includes serious and potentially life-threatening non-minor injuries. Transport can be delayed for 1-2 hours and should be reassessed as often as possible. If these patients do not get transported in time, the mortality rate of the victims will increase. The red color is the priority and emergency treatment of this group should be done, those who should go with the ambulance that comes first. The black is dead or wounded with a very low chance of survival. These victims in disasters are considered black who will not get health care or emergency care will be provided in the last place, even if they are not dying medically.

Letter Scale

Another coding system in the triage process is the letter scale used by North Atlantic Treaty Organization. According to this scale, T1 stands for red, T2 for yellow, T3 for green and T4 for black.[11]

Symbol Scale

The symbol scale is used in some protocols. Rabbit red, turtle yellow, pedestrian green and cross black is used instead.[11]

The data used when performing DT are physiological markers, mechanisms of injury, required resources, and/or trauma scores. In triage protocols, common data such as ability to walk, mental status, respiration and pulse are used to categorize victims. walking and non-rescued/dead patients were immediately immediately identified.

The first line of care for these patients will be provided by out-of-hospital providers or by disaster medical assistance teams (DMAT) arriving in the area of the incident. Substantial deficiencies in the preparedness plans of DMAT resources and planning for the care of children have been observed.[1] People who conduct triage in the pediatric age group may be emotionally traumatized. Effective triage makes it more difficult and over-triage is more frequently performed in pediatric victims in the event of a disaster.[12] There are two important situations in assessing the performance of a pediatric triage protocol. First, it must be sensitive enough to identify victims according to what they need most. Second, should be ensure that the available resources are

used in the best possible manner by postponing treatment for those who do not need immediate intervention. Several pediatric triage systems exist, but none have been validated. There is no perfect system because each has its strengths and weaknesses. Two types of these systems have been identified for children, which include Simple Triage and Rapid Treatment (JumpSTART) and Pediatric Triage Tape (PTT).[13]

JumpSTART Pediatric Triage

JumpSTART is a protocol that treats initial triage in child victims (Figure 1).[14] It was developed in 1995 for use with the START triage system and has been adopted in many countries, particularly in the US and Canada.[15] START is easily applied by health personnel in the disaster area.[7-16] It is the most widely used protocol in the world, especially in disasters. Even after a short training, 85% of trainees can be used correctly.[17] JumpSTART is evaluated in children under eight years of age with AVPU [A (alert) V (verbal) P (pain) U (unresponsive)] with vital parameters similar to the START algorithm.[15] JumpSTART provides additional emotional support for rescuing child victims by providing the best care.[14] JumpSTART differs from START in that it recommends five breaths for a child with the pulse. JumpSTART also explains the number of breaths normal in the pediatric population. At JumpSTART, patients who can walk first are taken to the green area, then the respiration is evaluated.[11] In respiratory evaluation, if there is no respiration and/or gasping, the airway should be opened by changing position. If the victim starts breathing after the airway has been turned on, airway clearance is maintained and taken to the red area. If the airway has not begun to breathe after it has been turned on, circulation control is performed. If the peripheral pulse is not available, it is marked with a black code. Five rescue breaths are administered if there is no respiration, but peripheral pulses are taken despite the head-jaw maneuvers and/or clearing of foreign objects in the mouth. If a child begins to breathe, they are taken to the red area. If there is no respiration despite the intervention, it is considered dead and marked with a black color code. If there is spontaneous breathing during the first visit of the victim, the respiratory rate is evaluated. If the number of pulses is less than 15 or more than 45, they are taken to the red area. If the number of respirations is between 15 and 45 per minute, circulation control is performed.

In the circulatory evaluation, peripheral pulse check is performed on the least injured extremity. If the peripheral pulse is not available; it is taken to the red area. Bleeding control was performed in cases of severe bleeding. If the peripheral pulse is taken, the consciousness is checked.

In assessing the level of consciousness, AVPU is used. Verbal warning response is not appropriate for assessing the state of consciousness in children. Alert means the child's eyes are open and she can speak spontaneously or make a sound. Verbal means that the child can respond to commands. Pain means that the child can respond to a painful warning. Unconscious means the child is unresponsive to any warning. If the child does not respond appropriately or does not respond at all, the priority is considered to be recovered and taken to the red area. If the child is alert, it can wait and be taken to the yellow area.[14-20]

Pediatric Triage Tape

In Turkey, the JumpSTART triage system for children is the most widely used in disasters. PTT is used in the United Kingdom and many other countries. It is the child's version of Triage Sieve that uses physiological measures proportional to a child's height that is proportional to weight and age. This assures appropriate age assessment. A tape is placed next to the child from the head to the foot and an appropriate algorithm is conducted according to the protocol (Figure 2). The assessments were based on three items. These are the ability to walk, respiration and pulse.[21] To help the victims, a tape that measures the height of the patients is required. This tape shows the appropriate parameters that should be used to triage a child. It provides four sizes of children: 50–80 cm, 80–100 cm, 100–140 cm, and over 140 cm. Four different color codes are used. These are red for immediate, yellow for urgent, green for delayed and black for the dead. In the immediate situation, the respirotary rate (<10 or >30) or/and the pulse rate (pulse >120/min or capillary refill >2 sec) of the victims are noticeably abnormal. In an urgent situation, pulse rate is below 120/min or capillary refill less than 2 seconds. In the delayed situation, child who is walking; or an infant who is alert and moving all limbs. In a dead situation, the child is not breathing and does not breathe after the airway is opened by jaw thrust.[22] However, the PTT is not good for sensing the immediate priority of children by this criterion.[21]

Chemical, Biological, Radiological, or Nuclear Incidents

Triage systems are designed primarily for traumatic incidents and usually do not fit into Chemical, Biological, Radiological, or Nuclear (CBRN) incidents. It is controversial where triage will be in CBRN incidents. Both the START and JumpSTART triage protocols are not suitable for contaminated areas or casualties.

In CBRN incidents, death usually occurs in the first few minutes. The proposed CBRN is used only a contamination and toxidrome symptoms occur related to the CBRN incidents. The place of triage in CBRN cases is a matter of

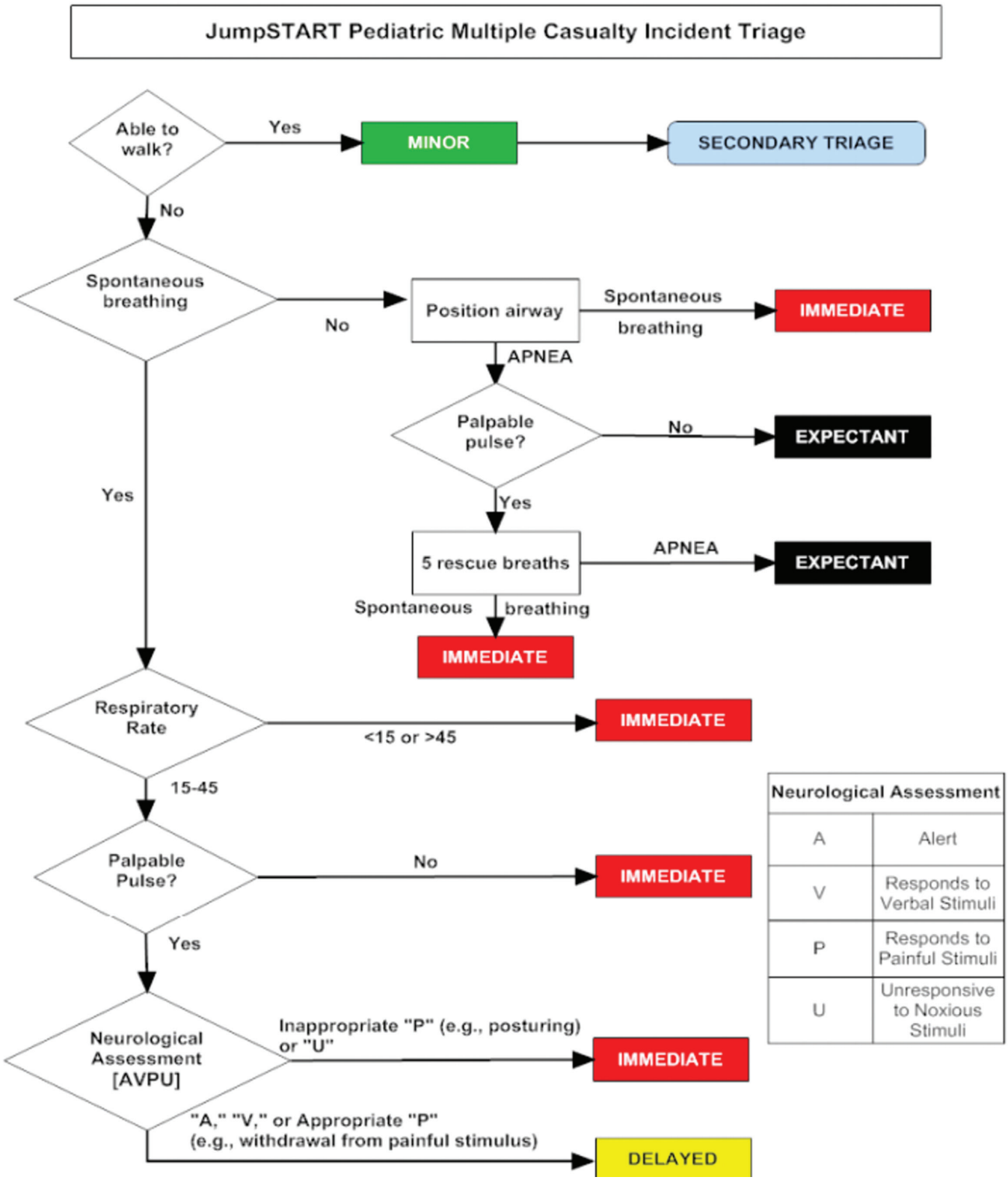

Figure 1. JumpSTART triage algorithm[15]

debate. JumpSTART triage protocols are not suitable for contaminated areas or casualties. There is no triage by the health personnel in the hot areas where the contamination is active. However, if there are civil defenses or other rescue teams wearing appropriate personnel protective equipment, they can triage before decontamination. There

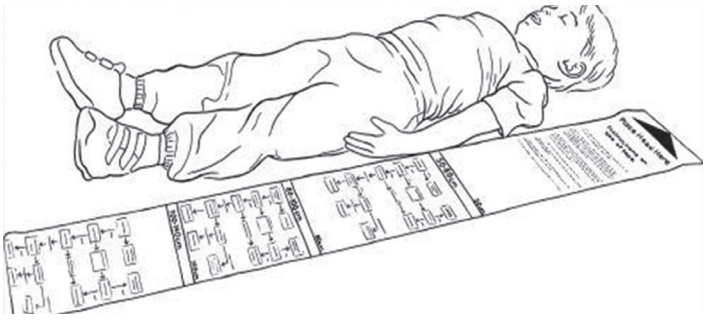

Figure 2. Pediatric Triage Tape[21]

is no time or environment to perform detailed triage in the hot area. Triage performed in a warm area, patients are divided into two groups as acute (red) and non-acute (green). First, these patients should be decontaminated. Triage by health personnel should be after decontamination in the cold area. This triage adresses the first primary triage for immediate action, then a secondary triage is used for decontamination.[23,24]

Three areas are created after the CBRN is secured in the scene. The clean treatment area is referred to as the cold zone, while the contaminated area is called the hot zone. Separating the hot and cold zones is the warm zone where decontamination occurs. Hot fields are planned and implemented by work, civil defense, and military teams. Only the fire company and specially trained personnel can enter the dirty zone. The warm zone is an area which is located at least 300 m from the hot area and safety precautions, easy access for vehicles, suitable for wind direction and flat land. Decontamination systems are installed in the warm area. Warmer field work is carried out by the cleaning staff. Cold zone is the area where the health personnel are dressed in personal protective clothing and ambulances. This was stated in the official newspaper published in Turkey (03.05.2012 date and 28281 numbers).[25] The CBRN protocol divides the victims into four classes (T1, T2, T3, and T4) and is generally available to victims over eight years of age. The first decision in the protocol is whether the victim can walk. If it can, the next assessment is the presence of toxicology to determine the classification of decontamination. If the victim cannot walk, the next decision is based on breathing ability. For victims with good respiration, the next decision is based on the ability to follow the following instructions if there is evidence of toxicity.[26]

Contamination of victims/casualties must be considered part of the initial assessment for a CBRN incident. Effective methods for rescue, decontamination, and medical treatment must be provided.[27,28]

Disaster preparation and planning are crucial because these events can happen at any time. Defined prehospital triage systems are crucial to saving lives and optimize resource management when these disasters happen.[29] Today, the most widely recognized mass-accidents triage algorithms are not based on evidence and there is no work directly related to these issues in the mass casualty. Additionally, no studies have evaluated the existing mass injury triage algorithms in terms of ease of use, reliability, and validity when introducing biological, chemical, or radiological agents. At the moment, the absence of a well-established, reliable, and uniformly accepted standardized mass-damage triage system remains an important matter.[30] Priority disasters indicate that one-third of the patients are children and infants and that the mortality rate of pediatric patients is significantly higher than that of adults.[31,32] Mace and Bern[33] found that pediatric patients comprised a significant percentage of disaster victims (up to 85% in one disaster). Disaster management of pediatric victims has been identified in conducted studies in different countries as a component of planning and training that is missing from many protocols and education programs.[34,35]

In March 2011, the National Disaster Medical and Public Health Center of USA organized a Child Disaster Preparedness Conference and started the process of developing a child disaster preparedness program.[35] This conference includes key principles for developing a childhood disaster preparedness curriculum, including the identification of target groups and appropriate protocol content CBRN disasters. A national, standard approach is required for triage.

Clarkson and Williams[29] found that the JumpSTART and START scores have low sensitivity. These triage systems failed to identify patients with serious injury and they are also failed to identify the majority. of However, Romig[14] proposed JumpSTART as a modification of the previously accepted START among the best-known tools.[30-36] JumpSTART is the most widely used pediatric-specific mass casualty incident triage tool in the United States.[14] Nadeau and Cicero[37] point out that, JumpSTART is used at 71% and long-lasting system in the USA.

In a study comparing SALT and JumpSTART, the time spent on JumpSTART was eight seconds faster per patient.[38] JumpSTART has superior sensitivity and specificity for the classification of children under the age of eight in patients with traumatic injuries.[39] Significant performance improvements were recorded in the pediatric triage immediately following a one-hour JumpSTART conference, discussion and case study. The continuation of the performance was maintained in the post-three-months training period. Pre-hospital staff and school nurses benefited from pediatric triage training equally.[40]

PTT has low sensitivity and specificity regardless of the outcome used for assessment, as well as poor agreement with the other triage tools.[22]

The algorithm of the proposed CBRN-capable mass casualty triage system can be applied rapidly by trained paramedics, but a significant under-triage rate (10.7%) was seen in this pilot test. Further refinement and testing are required. The effect on outcomes must be studied.[23]

The increasing frequency of disasters in the world and the increase in disaster-related illnesses, death, disability, labor, and financial losses require each country to be ready for disaster management. Disaster management is a development indicator and is the most sensible investment for sustainable development. It is necessary to identify, assess and manage risk and hazard analysis. Children are especially at risk in every catastrophe. Situations need to be included in disaster preparedness.

CONCLUSION

Disaster medicine; includes disaster management, triage, rescue, first aid, injured stabilization, emergency surgical procedures, hospital treatment, mental health and environmental health measures. Triage is a process that starts at the scene and continues during transport and in the hospital emergency services. Emergency and early treatment in disasters is one of the most important factors affecting patient prognosis.

Children can have developmental, anatomical and physiological vulnerabilities. They are more affected by the disasters than adults. Despite this, childcare planning and preparation for disasters is insufficient at the local, national and international levels. Therefore, the disaster had more negative effects on children than on adults.

Current and future national disaster preparedness initiatives should be expanded to include specialists who can respond to pediatric needs. Disaster preparation tools should be reshaped to fit pediatric conditions. To protect family integrity after a disaster, a national monitoring system should be developed, such as the National Center for Missing and Exploited Children's Center. Current disaster preparedness focuses on the general population and does not address children in the event of a catastrophe. Much progress has been achieved in family unification.[41]

In the hospital disaster plans, active support of all teams and equipment in the hospital should be provided. Every hospital should be included in the disaster plan of the area where the hospital is located and it must know these plans. To be well-organized, educated, and well-prepared community structure to prevent disruption caused by disasters; there is a need for qualified staff who have expertise in various disciplines with knowledge and skill in how to intervene in disasters. For healthcare workers, this is even more of a priority. Extensive efforts should be made to compensate for the deficiencies of the training that healthcare personnel have received within the formal education process with in-service courses and training. Healthcare personnel working in areas with high disaster risk must have basic knowledge and skills. For employees, certification programs and in-service training can be suggested. A DT is teamwork. Constant monitoring should be made to establish protocols, identify the team, and share the work to be done. Pediatricians should communicate with children and their families directly in disaster-related issues, while at the same time they should serve a more general community role to be prepare for the disorder.

Ethics

Peer-review: Internally peer-reviewed.

Authorship Contributions

Concept: G.Y., M.A., Design: G.Y., M.A., Data Collection or Processing: G.Y., M.A., Analysis or Interpretation: G.Y., M.A., Literature Search: G.Y., M.A., Writing: G.Y., M.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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