Archives of Academic Emergency Medicine. 2020; 8(1): e47

OPEN ACCESS

ORIGINAL RESEARCH

Prioritized Criteria for Casualty Distribution following Trauma-related Mass Incidents; a Modified Delphi Study

Mohammad Reza Khajehaminian[1], Ali Ardalan[2,3], Sayed Mohsen Hosseini Boroujeni[2], Amir Nejati[4]*, Omid Mahdi Ebadati[5], Mahdi Aghabagheri[6]

1. Department of Health in Emergencies and Disasters, School of Public Health, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran.
2. Department of Health in Emergencies and Disasters, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran.
3. Harvard Humanitarian Initiative, Harvard T.H. Chan School of Public Health, Cambridge, USA.
4. School of Nursing (Broujen), Shahrekord University of Medical Sciences, Shahrekord, Iran.
5. Department of Mathematics and Computer Sciences, Kharazmi University, Tehran, Iran.
6. Meybod Nursing School, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

Received: February 2020; Accepted: March 2020; Published online: 7 April 2020

Abstract: **Introduction:** In the aftermath of mass casualty incidents (MCIs), many decisions need to be made in a fast and influential manner in a high pressure environment to distribute the limited resources among the numerous demands. This study was planned to rank the criteria influencing distribution of casualties following trauma-related MCI. **Methods:** This study utilized a modified Delphi methodology, concentrating on extracted criteria attained from preceding systematic literature reviews. The 114 extracted criteria were classified into eight sections including space, staff, equipment, system and structures, triage, treatment, transport, and uncategorized criteria and were imported into an online survey tool. In the first round, experts were asked to rank each criterion on a five-point Likert scale. The second round incorporated feedbacks from the first round, stating percent and median scores from the panel as a whole. Experts were then called upon to reassess their initial opinions regarding uncertain remarks from the first round, and once again prioritize the presented criteria. **Results:** Fifty-seven criteria were regarded as relevant to the following sections: space: 70% (7/10); staff: 44% (4/9); system / structure: 80% (4/5); equipment: 39.1% (9/23); treatment; 66.7% (6/9); triage: 73.7% (14/19); transport: 38.7% (12/31) and other sections: 12.5% (1/8). The ïňĄrst round achieved nearly 98% (n=48) response rate. Of the 114 criteria given to the experts, 68 (almost 60%) were approved. The highest percentage of approval belonged to the system and structures sections (4/5=80%). The response rate for the second round was about 86% (n=42). A consensus could be reached about nearly 84% (57) of the 68 criteria presented to experts. **Conclusion:** "Casualty Level of Triage on the Scene" and "Number of Available Ambulances" were the two criteria that obtained the highest level of consensus. On the other hand, "gender of casualty", "Number of Non-Medical staff in each Hospital" and "Desire to transport family members together" got lowest level of consensus. This sorted list could be used as a catalogue for developing a decision support system or tool for distribution of victims following mass casualty incidents.

Keywords: Mass casualty incidents; wounds and injuries; decision making; supply and distribution

Cite this article as: Khajehaminian M R, Ardalan A, Hosseini Boroujeni S M, Nejati A, Ebadati O M, Aghabagheri M. Prioritized Criteria for Casualty Distribution following Trauma-related Mass Incidents; a Modified Delphi Study. Arch Acad Emerg Med. 2020; 8(1): e47.

*Corresponding Author: Amir Nejati; Department of Health in Emergencies and Disasters, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran. Phone: +989121256690, Email address: anejati@tums.ac.ir

1. Introduction

Victims of Mass Casualty Incidents (MCIs) ought to be distributed among the accessible hospitals so that no single hospital is excessively overloaded and at the same time casualty needs are met in accordance with hospitals abilities (1). Henceforth, in the aftermath of MCIs, many decisions need to be made in a fast and influential manner in a high pressure environment to distribute the limited resources among the numerous demands (2, 3). This process is comprised of multiple functions including triage, treatment and transport, which necessitate making numerous and complex decisions (4) and also allocating resources (5). Obviously, it is best to make any decision on the distribution of victims accurately and purposefully (6, 7). In this regard, efforts have been made to prepare a decision support system to assist prehospital and hospital emergency care managers and facilitate the distribution of casualties among available health care facilities (8-13). Although few studies have been conducted to identify influential criteria in distribution of casualties following MCIs (6, 7, 14), there is still a lack of prioritized criteria to guide decision makers in effective distribution of casualties. This study was planned to prioritize the criteria affecting the distribution of casualties following trauma-related MCIs.

2. Methods

2.1. Study design and setting

This study utilized a modified Delphi methodology, concentrating on criteria extracted from a preceding systematic review (7). The major motives to apply this methodology were extensive use of this technique in health research, geographic spreading of experts and precluding the effects of noticeable view on the experts' ideas (15). The study started in January and was completed in June 2018.

2.2. Participants

The number of experts in Delphi panel can be 3 to 80 (16, 17); however, there is no universally agreed number of experts (18). In this study, the authors recognized 62 Iranian experts in the field of MCI management and they were asked to participate in the study. As some authors suggested (19, 20), a summary of research aims and probable Delphi rounds (2 rounds) and estimated time of assurance were verbally (face to face or via telephone) elucidated to the identified experts. Forty-nine experts consented to participate in this study and 48 of them completed first round. Six experts didn't complete the second round. To avoid selection bias, the following criteria were used for choosing participants: (a) being affiliated in faculties, organization or institution engaged in incidents or disaster management (academic / researcher, and administrators of hospitals, prehospital emergency services or Red Crescent), (b) possessing at least 5 years of experience in disaster and incident management, (c) possessing clinical experience in trauma-related mass casualty incidents. These experts were chosen from emergency medicine specialists, emergency medical technicians, hospital physicians, nurses and midwifes. All experts had experience in MCI management, either in pre-hospital settings or within the hospital. It is highly suggested to select experts from various proficiencies and a wide geographic area (21). The experts' characteristics are shown in table 1.

2.3. Data gathering

In each round, research aims were presented clearly and experts were asked to prioritize the criteria presented in the questionnaire using a five-point Likert scale. A pilot study was done engaging two teachers in disaster medicine, and the reviewers made some minor modifications to the questionnaire statements before starting each round. Distribution of questionnaire and data gathering were conducted utilizing a web-based survey tool. The findings of the first round were presented to the experts as percentage and median of agreement rate on each statement in the first round. Three reminders were sent to those who had not responded. Since the findings of a preceding systematic literature review were utilized in this probe, two Delphi rounds were expected. There are no strict suggestions in the literature regarding the number of Delphi rounds, and the number of rounds is often predefined (21-23). There is no clear suggestion for level of agreement in Delphi literature, but 75% has been recommended as the minimum in some documents (21). Considering the large number of presented criteria, the classic inclusive approach of Delphi was not followed. Criteria that did not reach the minimum level of agreement were eliminated and the consensus criteria were included in the next step (exclusive approach). Data gathering and processing were carried out at the end of each round. After the first round, the responses were merged; the respondents' critical comments and effective feedback were assessed; and when appropriate, they were incorporated. We defined correctness as being related, practical and original. To answer any questions, the contact number of one of the researchers was included in the submitted questionnaire in each round.

2.4. The Delphi procedures

Round 1

The content of the first round questionnaire was based on the findings from a systematic literature review (7). All extracted criteria were listed as 114 statements classified into eight sections. The statements were imported to an online survey tool. The first section was relevant to experts' characteristics, and the 8 following sections were (1) space, (2) staff, (3) equipment, (4) system and structures, (5) treatment, (6) triage, (7) transport, and (8) uncategorized criteria influencing casualties' distribution following trauma-related MCI. In round 1 experts were asked to prioritize each criteria on a five-point Likert scale (Very high priority, High priority, Neutral, Low priority, Very low priority). There was a space for each section that the experts were encouraged to suggest additional criteria that they believed were missing. For analysis, the five-point Likert scale was adapted to a three- point Likert scale with "1– 2" representing low priority, "3" representing neutral and "4-5" representing high priority, as recommended in other probes (19, 23-25). At least 75% of experts had to rank a criterion in the very high or high rank (score 4 or 5) for it to be chosen as a consensuses criterion. Data were analyzed utilizing MS Excel to measure central tendency and dispersion indices. After analyzing the first round, minor modifications were applied to some statements according to participant comments in order to improve lucidity. Additionally, statements that were thought to be not in line with the objective of the study or were deemed a replication or were combinatory criteria were eliminated. In the subsequent round, based on feedbacks from the preceding round changes were incorporated. Before sending the questionnaires' link to experts in any round, the reviewers judiciously reviewed its content and revised them where required.

Round 2

The questionnaire distributed in round 2 included all statements that experts had agreed upon. Round 2 incorporated feedbacks from Round 1 stated as percent and median scores from the panel as a whole. Experts were called upon to reassess their initial opinions on the statements from round 1, and once again prioritize presented criteria.

2.5. Ethical consideration

Experts were guaranteed that their responses to the questionnaire would be kept absolutely confidential, but participants were aware of the presence of other experts. This situation can be named as "quasi-anonymity" (20) and it is an inducement to participate in the Delphi study and can improve the response rate (21, 26). This research has been ethically confirmed by Institute Review Board of Tehran University of Medical Sciences with the registration Number IR.TUMS.SPH.REC.1395.509.

3. Results

Characteristics of study participants are described in table 1. The first and second round achieved 98% and 86% response rate, respectively. Out of the 114 presented criteria, 57 criteria were accepted in the following sections: space: 70% (7/10); staff: 44% (4/9); system / structure: 80% (4/5); equipment: 39.1% (9/23); treatment; 66.7% (6/9); triage: 73.7% (14/19); transport: 38.7% (12/31) and other sections: 12.5% (1/8), (Table 2).

Round 1

To improve the reliability of the study, the investigators gathered the raw data and then raw data were analyzed by an analyzer blinded to the mentioned process. The criteria affecting casualty distribution in trauma-related MCI, based on a previous study (7) are listed in table 3. To clarify the findings, a code is given to each criterion. From the 62 identified experts, 49 agreed to participate in the study. In the first round, 114 criteria were given to the experts, 68 (almost 60%) of which were approved. The highest percentage of agreement belonged to system and structures sections (4/5=80%) and the agreement rate in other sections were as follows: space (7/10=70%), staff (4/9=44%), equipment (13/23=57%), treatment (6/9=67%), triage (14/19=74%), transport (16/31=52%), uncategorized criteria (4/8=50%). Based on experts' feedbacks, the following modifications were applied and then the flawed items were removed from the list (Code 23 due to being too general), (Codes 26, 29, 31 were replications of 27), (Code 68 was replication of 39 and 43), (Code 85 was replication of 86) and (codes 104, 113, 114 were represented by some other criteria). Overall, 37 of the 114 criteria could not achieve the consensus and were eliminated. No extra criterion was suggested by experts. As explained earlier, considering to the aim of study, the classic approach of Delphi study was not followed and accepted criteria (n=68) were included in the questionnaire for the second round.

Round 2

From the 68 criteria presented to experts, about 84% (57) could obtain consensus. All presented criteria in space (n=7), staff (n=4), system and structure (n=4), treatment (n=6), and triage (n=14) could obtain consensus. The consensus rates in other sections were as follows: equipment (9/13=69%), transport (12/16=75%), uncategorized criteria (1/4=25%). After completion of the second round, it was decided that a consensus had been obtained and further rounds were not required.

4. Discussion

This study prioritized the criteria affecting decision making for distribution following mass casualty incidents and found 57 high ranked criteria in this regard. The response rate reached 98% in the first round and 86% in the second round. Although decrease in the number of participants in the second round may have many justifications, it could be ascribed to the large number -114 criteria- of assessed statements. If a certain portion of participants refuse to continue a Delphi study, findings will be disturbed (15). Nonetheless, in this study, the number of participants had not greatly altered between the 2 rounds and therefore, findings were reliable (table 1). Finally, accepted criteria in round 2 (table 4) were all sorted in accordance with the level of agreement. The level of consensus for each accepted criteria may suggest how a certain criterion is affecting decision-making. "Casualty Level of Triage on the Scene" and "Number of Available Ambulances" were the two criteria that obtained the maximum level of consensus (100%). On the other hand, "gender of casualty" (4.2%), "Number of Non-Medical staff in each

Table 1: Baseline characteristics of experts who completed the Delphi rounds

Variables	Number of participants	
	Round1 (n=48)	Round2 (n=42)
Gender		
Female	6 (12.5)	6 (14.3)
Male	42 (87.5)	36 (85.7)
Level of education		
Bachelor's Degree	11 (22.9)	7 (16.7)
Master's Degree or MD	29 (60.4)	27 (64.3)
Ph.D. or Medical Specialist	8 (16.7)	8 (19.0)
Field of study		
Prehospital emergency care	5 (10.4)	4 (9.5)
Nurse	23 (47.9)	19 (47.6)
Midwife	1 (2.1)	1 (2.4)
Physician	19 (39.6)	17 (40.5)
Professional/employment		
EOC officer	8 (16.7)	5 (11.9)
Prehospital administrator	12 (25.0)	11 (26.2)
Hospital administrator	7 (14.6)	5 (16.7)
Academic / Researcher	12 (25)	12 (28.6)
Emergency medicine specialist	7 (14.6)	7 (16.7)
Red Crescent Administrator	2 (4.2)	2 (4.8)
Age (year)		
Mean ± SD	41.7 ± 6.3	40.8 ± 5.9
Length of experience (years)		
Mean ± SD	10.2 ± 5.2	9.7 ± 4.6
5-10	25 (52.1)	23 (54.8)
10-15	15 (31.3)	28.6)
15-20	7 (14.6)	6 (14.3)
>20	1 (2.1)	1 (2.4)

Data are presented as mean ± standard deviation (SD) or frequency (%); EOC: Emergency Operation Center

Table 2: The status of criteria in each Delphi rounds according to each section

Criteria	Accepted Criteria		
	Round1	Round2	Total
Space	70% (7/10)	100% (7/7)	70% (7/10)
Staff	44% (4/9)	100% (4/4)	44% (4/9)
System / Structure	80% (4/5)	100% (4/4)	80% (4/5)
Equipment	57% (13/23)	69% (9/13)	31.9% (9/23)
Treatment	67% (6/9)	100% (6/6)	66.7% (6/9)
Triage	74% (14/19)	100% (14/14)	73.7% (14/19)
Transport	52% (16/31)	75% (12/16)	38.7% (12/31)
Uncategorized	50% (4/8)	25% (1/4)	12.5% (1/8)

Hospital" (20.8%) and "Desire to transport family members together" (20.8%) had the lowest level of consensus. Considering the increasing complication and lack of certainty in many circumstances, assisting managers by providing quantitative models for them to facilitate decision-making and planning is critical (27). Providing quantitative criteria is a difficult task. Two studies have previously tried to identify the criteria influencing decision making in mass casualty incidents (8, 14). The only study that has specifically addresses identification and prioritization of criteria affecting distribution of casualties following MCI is the study by Hall et al. (14) .This study used qualitative thematic analysis, identified 56 factor affecting patient distribution following MCIs and then prioritized the identified factor using modified Delphi method. One of the key features of this study is identification of experts who had peer-reviewed publications in the field of disaster management to participate in factor prioritization. However, some of the factors presented in this study can be separated to factors. For example, factors such as "Hospital characteristics" (ie, number, size, type, capacity, ownership, preparedness, experience), "Availability of transportation vehicles" (ie, ambulance, helicopter, bus,

Table 3: The status of all presented criteria in each round

	All Criteria (n = 114)	Round1			Round2			Status
	Space							
1	Number of Involved Hospitals (9, 10, 28-36)	81.25	4.21	0.73	86	4.21	0.84	Accepted
2	Number of Available Hospitals (13, 36-39)	89.58	4.44	0.67	92	4.50	0.63	Accepted
3	Number of Eligible Alternative Health Care Facilities (40)	35.42	3.21	0.93				R1 Rejected
4	Hospital Bed Occupancy Rate (10)	83.33	4.17	0.75	76	4.02	0.72	Accepted
5	Patient Presentation Rate of each Hospital (32, 41, 42)	68.75	3.79	0.79				R1 Rejected
6	HACSC (Hospital Acute Care Surge Capacity) (34, 43)	83.33	4.13	0.83	88	4.17	0.62	Accepted
7	HACSC6 (Hospital Acute Care Surge Capacity in 6 hour) (34)	85.42	4.04	0.71	79	4.05	0.76	Accepted
8	HBSC (Hospital bed surge capacity) (34)	81.25	3.90	0.77	81	4.05	0.73	Accepted
9	HACST (Hospital Acute Care Surge Threshold) (34)	81.25	3.85	0.89	76	4.07	0.75	Accepted
10	Capacity Factor (44)	72.92	3.83	0.90				R1 Rejected
	Staff							
11	Number of Nurses in each Hospital (31-33, 41, 45)	81.25	4.31	0.87	90	4.50	0.80	Accepted
12	Number of Physicians in each Hospital (31-33, 36, 39, 41, 46)	77.08	4.15	0.91	76	4.05	0.91	Accepted
13	Number of Critical Care Nurses in each Hospital (8)	68.75	3.83	0.87				R1 Rejected
14	Number of Critical Care Physicians in each Hospital (8)	62.5	3.83	0.94				R1 Rejected
15	Number of on-scene Emergency Medical Technicians (36, 37, 45)	79.17	4.21	1.08	86	4.29	0.92	Accepted
16	Number of Surgeons in each Hospital (8, 33, 36, 41)	87.5	4.31	0.92	86	4.38	0.85	Accepted
17	Number of on-scene Physicians (36)	43.75	3.21	1.14				R1 Rejected
18	Number of on-scene Specialist Physicians (47)	31.25	3.10	1.19				R1 Rejected
19	Number of Non-Medical staffs in each Hospital (41)	20.83	2.96	0.98				R1 Rejected
	System / Structure							
20	Hospital Level of Trauma (9, 10, 28, 31, 32, 35-39, 42, 48, 49)	93.75	4.38	0.67	81	4.29	0.97	Accepted
21	Activation of Hospital Disaster Plan (28, 29, 32, 34, 41, 47)	85.42	4.35	0.837	83	4.29	0.86	Accepted
22	Specialized Department in each Hospital (9, 28, 29, 32, 33, 37, 45, 49)	77.08	4.04	0.71	81	4.02	0.87	Accepted
23	Hospital Capability (9, 29-31, 37, 39, 40, 45, 47)	89.58	4.29	0.76				R1 Omitted
24	Number of Rapid Response/Trauma Teams in each hospital (32)	85.42	4.19	0.83	81	4.14	0.78	Accepted
	Equipment							
25	Total Number of Beds in each Hospital (8, 28, 36, 37, 39, 46)	85.42	4.21	0.73	67	3.76	0.82	R2 Rejected
26	Real Time Hospital Bed Capacity (9, 10, 13, 29-32, 37, 39-41, 46, 49)	85.42	4.23	0.74				R1 Omitted
27	Real Time Hospital Bed Capacity for each Level of Triage (31, 49)	87.5	4.40	0.70	83	4.21	0.84	Accepted
28	Total No. of General Ward Beds in each Hospital (33)	81.25	3.92	0.53	52	3.71	0.83	R2 Rejected
29	Number of Available General Ward Beds in each Hospital (33)	81.25	4.08	0.79				R1 Omitted
30	Total Number of ICU Beds in each Hospital (8, 28, 32, 36, 42, 45)	83.33	4.06	0.69	93	4.50	0.63	Accepted
31	Number of Available ICU Beds in each Hospital (33)	89.58	4.33	0.77				R1 Omitted
32	Number of Operating Rooms in each Hospital (28, 31, 32, 36, 37, 42, 50)	87.5	4.40	0.70	95	4.50	0.59	Accepted
33	Number of Available Operating Rooms in each Hospital (8, 45)	91.67	4.46	0.76	88	4.50	0.71	Accepted
34	Number of Ventilators in each Hospital (33, 42)	87.5	4.06	0.69	79	3.98	0.81	Accepted
35	Number of Available Ventilators in each Hospital (41)	89.58	4.29	0.82	76	4.05	0.94	Accepted
36	Number of Recovery Beds in each Hospital (28)	60.42	3.75	0.85				R1 Rejected
37	Number of Bedside Cardiac Monitors in each Hospital (28, 45)	54.17	3.67	0.80				R1 Rejected
38	Number Available Bedside Cardiac Monitors in each Hospital (41)	62.5	3.83	0.90				R1 Rejected
39	Number of X-Ray Machines in each Hospital (31, 48, 50)	79.17	4.17	0.80	69	3.90	0.98	R2 Rejected
40	CT-Scan Availability in each Hospital (8, 45)	77.08	4.04	0.87	62	3.79	0.98	R2 Rejected
41	MRI Availability in each Hospital (31)	22.92	2.92	1.08				R1 Rejected
42	Number of Emergency Department Beds in each Hospital (31, 34, 36)	93.75	4.63	0.67	98	4.74	0.50	Accepted
43	Number of Resuscitation Beds in Emergenc Department of each Hospital (45, 48)	83.33	4.21	0.93	79	4.05	0.88	Accepted
44	Number of Trauma Rooms in Emergency Department of each Hospital (32, 45)	87.5	4.40	0.88	79	4.10	0.93	Accepted
45	Amount of Pharmaceutical Supply in each Hospital (33)	70.83	4.00	0.98				R1 Rejected
46	Amounts Consumables Supply in each Hospital (33, 45)	60.42	3.65	0.92				R1 Rejected
47	Amount of Pre-hospital Medical Supply (33, 45)	56.25	3.56	1.06				R1 Rejected
	Treatment							
48	On-scene Treatment Time (13, 31)	60.42	3.67	1.12				R1 Rejected
49	Hospital Treatment Time (9, 31, 34, 50, 51)	62.5	3.77	0.92				R1 Rejected
50	Casualty's Need for Surgical Treatment in Hospital (35, 36)	87.5	4.40	0.70	93	4.33	0.61	Accepted

Table 3: The status of all presented criteria in each round

	All Criteria (n = 114)	Round1			Round2			Status
51	Casualty's Need for On-scene Stabilizing Treatment (29, 36)	85.42	4.23	0.74	90	4.43	0.67	Accepted
52	Availability of On-scene Treatment (47)	85.42	4.35	0.78	90	4.40	0.66	Accepted
53	On-Scene Treatment Impact (47)	87.5	4.35	0.85	88	4.26	0.73	Accepted
54	Expected Number of Lifesaving Surgeries in each Hospital (49)	72.92	3.88	0.88				R1 Rejected
55	Number of Casualties in Needed of Ventilator (35)	81.25	4.21	0.79	83	4.17	0.70	Accepted
56	Number of Casualties in Needed of ICU Care Units (35)	87.5	4.29	0.68	90	4.33	0.65	Accepted
	Triage							
57	Casualty's Level of Triage on the Scene (9-13, 28, 30-33, 35-42, 47, 48, 50, 51)	93.75	4.71	0.58	100	4.88	0.33	Accepted
58	Casualty's Level of Triage at Hospital (10, 32, 36, 48)	93.75	4.54	0.61	88	4.48	0.71	Accepted
59	Over Triage Rate of Casualties (10, 36, 48)	66.67	3.77	0.74				R1 Rejected
60	Under Triage Rate of Casualties (10, 36, 48)	62.5	3.77	0.85				R1 Rejected
61	Trauma Score of Casualty (8, 11, 12, 31-33, 35, 36, 38, 39, 42, 45, 46, 50, 51)	85.42	4.25	0.69	86	4.19	0.67	Accepted
62	Number of Casualties in each Triage Level (11, 12, 31, 33, 34, 38-41, 48-51)	89.58	4.44	0.67	88	4.31	0.68	Accepted
63	Vital Signs (BP, RR, PR) of Casualty (13, 33, 41, 47)	87.5	4.29	0.73	88	4.19	0.63	Accepted
64	Survival Probability of Casualty (31, 33, 39, 50, 51)	87.5	4.29	0.79	79	3.98	0.90	Accepted
65	Casualty's Deterioration Rate (31, 33)	83.33	4.19	0.81	81	3.98	0.75	Accepted
66	Total Number of Casualties (11-13, 28, 31, 33, 37, 38, 41, 45, 48-51)	89.58	4.46	0.68	95	4.45	0.59	Accepted
67	Pulse Oximetry of Casualty (13, 33, 41)	50	3.44	0.91				R1 Rejected
68	Physical Examination Findings of Casualty (13, 36, 42, 49)	85.42	4.02	0.80				R1 Omitted
69	GCS of Casualty (33, 41, 47)	83.33	4.23	0.77	86	4.17	0.66	Accepted
70	Casualty's Type of Injuries (8, 12, 13, 32, 33, 35, 37, 38, 42, 47-49, 51)	89.58	4.33	0.66	81	4.05	0.79	Accepted
71	Pregnancy Status of Female Casualty (42, 47)	87.5	4.44	0.81	79	4.14	0.81	Accepted
72	Number of Child Casualties (47)	87.5	4.33	0.80	88	4.26	0.66	Accepted
73	Number of severe/moderate patients admitted to surgical departments in the last 24 hours in each hospital (8, 34)	77.08	4.06	0.88	76	4.12	0.83	Accepted
74	Possibility of Casualty's Contamination (13, 28, 41)	89.58	4.42	0.93	93	4.52	0.86	Accepted
75	Casualty's Age (13, 33, 47)	50	3.52	1.04				R1 Rejected
	Transportation							
76	Incident Location (8-13, 28, 29, 32, 36, 38, 39, 42, 48, 49)	81.25	4.17	0.96	86	4.19	0.67	Accepted
77	Hospital Location (9, 10, 29, 32, 38, 39)	83.33	4.23	0.71	88	4.26	0.73	Accepted
78	Distance from MCI Location to each Hospital (31, 32, 36-39, 41, 45, 46, 48, 49)	89.58	4.44	0.73	90	4.43	0.67	Accepted
79	Medical Center in Close Proximity of Incident (9, 48, 49)	83.33	4.33	0.75	74	4.19	0.94	R2 Rejected
80	Location of EMS Stations (30)	85.42	4.27	0.86	86	4.21	0.75	Accepted
81	Available Means of Transportation (13, 37, 41)	95.83	4.42	0.64	83	4.29	0.81	Accepted
82	Number of Available Ambulances (30-33, 35-37, 39, 41, 42, 45, 47-49)	100	4.73	0.44	100	4.60	0.50	Accepted
83	Type of Ambulance (33, 36, 37, 39, 42, 46-48)	64.58	3.88	0.86				R1 Rejected
84	Number of patients that can be transported by Ambulance simultaneously (39, 41)	70.83	3.94	0.72				R1 Rejected
85	Estimated Driving Time from Scene to each Hospital (8-10, 29, 32, 36, 39, 47)	77.08	4.04	0.71				R1 Omitted
86	Round Trip Time for Ambulances (31)	81.25	4.13	0.75	76	4.10	0.88	Accepted
87	Number of Casualty Buses (32)	89.58	4.27	0.64	86	4.24	0.76	Accepted
88	The Quality of Roads (48)	72.92	3.94	0.85				R1 Rejected
89	Traffic Information (48)	87.5	4.38	0.70	79	4.17	0.76	Accepted
90	Number of Available Helicopters (32, 35-37, 48, 49)	79.17	4.10	0.94	67	3.93	1.16	R2 Rejected
91	Maximum Capacity of each Helicopter (36)	77.08	4.04	0.93	62	3.74	1.04	R2 Rejected
92	Helicopter Landing Area near the Incident Location (28, 41, 49)	77.08	4.04	0.93	69	3.98	1.07	R2 Rejected
93	The distance from closest Helicopter Landing Area to the Scene (36)	72.92	3.90	0.85				R1 Rejected
94	Helicopter Landing Place near Hospital (41)	83.33	4.21	0.98	79	4.10	0.98	Accepted
95	Estimated time for each HEMS Mission/epoch (32, 36)	62.5	3.77	0.92				R1 Rejected
96	Possibility of fixed wing utilization in casualties' evacuation (36)	58.33	3.65	1.09				R1 Rejected
97	Number of fixed wing aircrafts (36)	54.17	3.56	1.10				R1 Rejected
98	Maximum Capacity of each Fixed wing aircraft (36)	56.25	3.60	1.08				R1 Rejected
99	Number Casualties in need of secondary Transfer (35, 48)	56.25	3.73	0.88				R1 Rejected

Table 3: Comparison of studied risk factors of preterm delivery between term and pre term pregnancy

	All Criteria (n = 114)	Round1			Round2			Status
100	Occurrence of the incident near the geographical border of disaster management (32)	68.75	3.73	0.93				R1 Rejected
101	Injury to Hospital Interval (33, 35, 39, 44, 46) geographical border of disaster management (32)	85.42	4.31	0.87	90	4.19	0.677	Accepted
102	The Last Time of Casualty delivery to the Determined Hospital (10)	50	3.54	0.89				R1 Rejected
103	Injury to Patient Contact Interval (33, 44)	83.33	4.35	0.80	83	4.17	0.76	Accepted
104	The Last Time of Casualty delivery to the Determined Hospital (10) and moderate patients with an IHI under the MTA) (44)	89.58	4.48	0.68				R1 Omitted
105	Desire to Transport family members together (8)	20.83	2.96	0.96				R1 Rejected
106	Number of Self Referencing Casualties to Hospital (28, 29, 32, 34, 35, 38, 40, 42, 44, 49)	62.5	3.77	0.94				R1 Rejected
	Uncategorized							
107	Mechanism of Injury (41)	81.25	4.27	0.81	62	3.74	0.94	R2 Rejected
108	Type of Incident (33, 41)	83.33	4.25	0.78	74	3.95	0.94	R2 Rejected
109	Gender of Casualty (13, 33, 47)	4.167	2.31	0.92				R1 Rejected
110	Severity of Incident (Burden of Casualties) (41, 43)	91.67	4.40	0.64	90	4.29	0.71	Accepted
111	Time of incident (11, 38, 40, 42)	58.33	3.71	0.84				R1 Rejected
112	Casualty's Need for Extrication (29, 35)	75	4.08	0.81	71	3.95	0.91	R2 Rejected
113	TMC (Total Medical Capacity) (43)	93.75	4.33	0.72				R1 Omitted
114	R (Medical Rescue Capacity) (44)	89.58	4.17	0.66				R1 Omitted

LOC: Level of Consensus; SD = Standard Deviation

military, police, private vehicles with medical authorization, nonmedical vehicles)" and "Injury characteristics" (ie, number, type, severity)" may be separated to more definite factors and each definite factor weighted differently in Delphi rounds. Some other factors, such as "Standard procedures for mass casualty incident" and "Teamwork and attitude", are qualitative and general, and different conceptions of their meaning may exist. Considering the mentioned issues with the paper since its author suggested developing a decision support tool to assist first responders in casualty distribution following MCIs. In the present study, we eliminated the criterion (hospital capability) that were not objective by obtaining expert feedbacks and authors attempted to present and prioritize quantitative or objective criteria derived from previous systematic literature review. Therefore, it is believed that presented criteria are suitable for development of decision support tool for casualty distribution following MCIs. Another study conducted by Adini et al. (8), aimed to develop a "load index model" to aid in decision making in mass casualty incidents. In this study, authors did a comprehensive literature review, performed a structured interview and then used modified Delphi for producing the shortlist of criteria related to patient distribution following MCIs. Although this study achieved some valuable results, sufficient information regarding its methodology has not been reported. This is also evident in the Delphi part of the study. In this regard, authors didn't mention some main points including the procedures of comprehensive literature review, number of criteria extracted from the review, the process of structured review, details of experts in Delphi panel and number of Delphi rounds. However, it should be mentioned that mixed methodology was used and presenting all these parts in one paper would be challenging. Despite the possibility of adding new criteria to presented Delphi forms, no additional criteria were proposed by experts. However, since the presented criteria in this study were extracted from a systematic literature review (7), this could be due to the comprehensiveness of the extracted criteria in this study.

5. Limitation

The most vulnerable part of Delphi studies might be "expert selection". No globally accepted criteria exist for the required number of experts that should be selected and their characteristics in Delphi studies. In this study, as explained earlier, researchers set some criteria for selecting experts. Another limitation of Delphi studies is the level of consensus. Considering the importance of the topic, researchers set a level of consensus. In this study, we used a set point that was recommended by most literature. In order to resolve this problem, all accepted criteria have been sorted and the level of agreement for each criterion, whether accepted or rejected, was displayed in the table. Presenting a large number of statements (114) could be counted as a study limitation and as described earlier, it could be the main cause reduction in the number of participants in the second round; therefore, it was possible to complete the online questionnaire in several sessions.

Table 4: All accepted criteria in Delphi study prioritized based on level of consensus

Section	Code	Criteria	LOC	Mean	SD
Triage	57	Casualty's Level of Triage on the Scene (9-13, 28, 30-33, 35-42, 47, 48, 50, 51)	100	4.88	0.33
Transport	82	Number of Available Ambulances (30-33, 35-37, 39, 41, 42, 45, 47-49)	100	4.60	0.50
Equipment	42	Number of Emergency Department Beds in each Hospital (31, 34, 36)	98	4.74	0.50
Equipment	32	Number of Operating Rooms in each Hospital (28, 31, 32, 36, 37, 42, 50)	95	4.50	0.59
Triage	66	Total Number of Casualties (11-13, 28, 31, 33, 37, 38, 41, 45, 48-51)	95	4.45	0.59
Equipment	30	Total Number of ICU Beds in each Hospital (8, 28, 32, 36, 42, 45)	93	4.50	0.63
Treatment	50	Casualty's Need for Surgical Treatment in Hospital (35, 36)	93	4.33	0.61
Triage	74	Possibility of Casualty Contamination (13, 28, 41)	93	4.52	0.86
Space	2	Number of Available Hospitals (13, 36-39)	92	4.50	0.63
Staff	11	Number of Nurses in each Hospital (31-33, 41, 45)	90	4.50	0.80
Treatment	51	Casualty's Need for On-scene Stabilizing Treatment (29, 36)	90	4.43	0.67
Treatment	52	Availability of On-scene Treatment (47)	90	4.40	0.66
Treatment	56	Number of Casualties in need of ICU Care Units (35)	90	4.33	0.65
Transport	78	Distance from MCI Location to each Hospital (31, 32, 36-39, 41, 45, 46, 48, 49)	90	4.43	0.67
Transport	101	Injury to Hospital Interval (33, 35, 39, 44, 46)	90	4.19	0.67
Uncategorized	110	Severity of Incident (Burden of Casualties) (41, 43)	90	4.29	0.71
Space	6	HACSC (Hospital Acute Care Surge Capacity) (34, 43)	88	4.17	0.62
Equipment	33	Number of Available Operating Rooms in each Hospital (8, 45)	88	4.50	0.71
Treatment	53	On-Scene Treatment Impact (47)	88	4.26	0.73
Triage	58	Casualty's Level of Triage at Hospital (10, 32, 36, 48)	88	4.48	0.71
Triage	62	Number of Casualties in each Triage Level (11, 12, 31, 33, 34, 38-41, 48-51)	88	4.31	0.68
Triage	63	Vital Signs (BP, RR, PR) of Casualty (13, 33, 41, 47)	88	4.19	0.63
Triage	72	Number of Child Casualties (47)	88	4.26	0.66
Transport	77	Hospital Location (9, 10, 29, 32, 38, 39)	88	4.26	0.73
Space	1	Number of Involved Hospitals (9, 10, 28-36)	86	4.21	0.84
Staff	15	Number of on-scene Emergency Medical Technicians (36, 37, 45)	86	4.29	0.92
Staff	16	Number of Surgeons in each Hospital (8, 33, 36, 41)	86	4.38	0.85
Triage	61	Trauma Score of Casualty (8, 11, 12, 31-33, 35, 36, 38, 39, 42, 45, 46, 50, 51)	86	4.19	0.67
Triage	69	GCS of Casualty (33, 41, 47)	86	4.17	0.66
Transport	76	Incident Location (8-13, 28, 29, 32, 36, 38, 39, 42, 48, 49)	86	4.19	0.67
Transport	80	Location of EMS Stations (30)	86	4.21	0.75
Transport	87	Number of Casualty Buses (32)	86	4.24	0.76
System*	21	Activation of Hospital Disaster Plan (28, 29, 32, 34, 41, 47)	83	4.29	0.86
Equipment	27	Real Time Hospital Bed Capacity for each Level of Triage (31, 49)	83	4.21	0.84
Treatment	55	Number of Casualties in need of Ventilator (35)	83	4.17	0.70
Transport	81	Available Means of Transportation (13, 37, 41)	83	4.29	0.81
Transport	103	Injury to Patient Contact Interval (33, 44)	83	4.17	0.76
Space	8	HBSC (Hospital bed surge capacity) (34)	81	4.05	0.73
System	20	Hospital Level of Trauma (9, 10, 28, 31, 32, 35-39, 42, 48, 49)	81	4.29	0.97
System	22	Specialized Department in each Hospital (9, 28, 29, 32, 33, 37, 45, 49)	81	4.02	0.87
System	24	Number of Rapid Response/Trauma Teams in each hospital (32)	81	4.14	0.78
Triage	65	Casualty's Deterioration Rate (31, 33)	81	3.98	0.75
Triage	70	Casualty's Type of Injuries (8, 12, 13, 32, 33, 35, 37, 38, 42, 47-49, 51)	81	4.05	0.79
Space	7	HACSC6 (Hospital Acute Care Surge Capacity in 6 hour) (34)	79	4.05	0.76
Equipment	34	Number of Ventilators in each Hospital (33, 42)	79	3.98	0.81
Equipment	43	Number of Resuscitation Beds in Emergency Department of each Hospital (45, 48)	79	4.05	0.88
Equipment	44	Number of Trauma Rooms in Emergency Department of each Hospital (32, 45)	79	4.10	0.93
Triage	64	Survival Probability of Casualty (31, 33, 39, 50, 51)	79	3.98	0.90
Triage	71	Pregnancy Status of Female Casualty (42, 47)	79	4.14	0.81
Transport	89	Traffic Information (48)	79	4.17	0.76
Transport	94	Helicopter Landing Place near Hospital (41)	79	4.10	0.98
Space	4	Hospital Bed Occupancy Rate (10)	76	4.02	0.72
Space	9	HACST (Hospital Acute Care Surge Threshold) (34)	76	4.07	0.75
Staff	12	Number of Physicians in each Hospital (31-33, 36, 39, 41, 46)	76	4.05	0.91
Equipment	35	Number of Available Ventilators in each Hospital (41)	76	4.05	0.94
Triage	73	Number of severe/moderate patients admitted in surgical departments in the last 24 hours in each hospital (8, 34)	76	4.12	0.83
Transport	86	Estimated Driving Time from Scene to Hospital (8-10, 29, 32, 36, 39, 47)	76	4.10	0.88

SD: standard deviation; * System and structures. LOC: Level of Consensus; SD = Standard Deviation

6. Conclusions

Following MCIs, casualty distribution between a number of healthcare centers is challenging. Many factors could influence decisions in this regard. Comprehensive identification of effective criteria in this critical task can be very helpful. However, for accelerating decision making regarding casualty distribution or in case of developing an agile decision support tool, it is necessary to use criteria that have a higher effect. In this modified Delphi study, the criteria that have been identified as influential on the distribution of casualties following trauma-related MCIs, were prioritized. Since none of the criteria presented in this study can be ignored in casualty distribution, authors sorted all accepted criteria according to level of agreement. This sorted list could be used as a catalogue for developing a decision support system or tool for casualty distribution following MCIs.

7. Declarations

7.1. Acknowledgements

We would like to acknowledge the Health Research Council of Tehran University of Medical Sciences as well as anonymous reviewers for their advice and support to improve this paper.

7.2. Ethical approval and consent to participate

As a part of a larger research project, this study has been ethically approved by Institute Review Board of Tehran University of Medical Sciences with the registration Number IR.TUMS.SPH.REC.1395.509.

7.3. Author contribution

MK, MH, AA, AN designed the study and conducted data gathering and drafted the paper.
MK, MA and OE analyzed the data, revised the draft and approved the final manuscript.

Authors ORCIDs
Mohammad Reza Khajehaminian: 0000-0002-1321-787X
Amir Nejat: 0000-0001-9248-8768
Ali Ardalan: 0000-0002-5551-3693
Sayed Mohsen Hosseini Boroujeni: 0000-0003-4127-0261
Omid Mahdi Ebadati: 0000-0002-2688-9595
Mahdi Aghabagheri: 0000-0001-6288-3361

7.4. Funding/Support

This study was funded by Tehran University of Medical Sciences.

7.5. Conflict of interest

Hereby I (the corresponding author) confirm on behalf of all the authors of this manuscript that we are not affiliated with or involved in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

7.6. Data Availability

Authors of this study declare that all data of the current study, except for personal information of participants, are available and will be provided upon request.

References

1. Auf der Heide E. The Importance of Evidence-Based Disaster Planning. Annals of emergency medicine. 2006;47(1):34-49.
2. Paton D, Flin R. Disaster stress: an emergency management perspective. Disaster Prevention and Management: An International Journal. 1999;8(4):261-7.
3. Wilson DT, Hawe GI, Coates G, Crouch RSJEJoOR. Online optimization of casualty processing in major incident response: An experimental analysis. Eur J Oper Res. 2016;252(1):334-48.
4. Mills AF, Argon NT, Ziya S. Dynamic distribution of casualties to medical facilities in the aftermath of a disaster. working paper, Kelley School of Business, Indiana University; 2015.
5. Rehn M, Andersen JE, Vigerust T, Kruger AJ, Lossius HMJBem. A concept for major incident triage: full-scaled simulation feasibility study. 2010;10(1):17.
6. Khajehaminian MR, Ardalan A, Hosseini Boroujeni SM, Nejati A, Keshtkar A, Foroushani AR, et al. Criteria and models for the distribution of casualties in trauma-related mass casualty incidents: A systematic literature review protocol. Systematic reviews. 2017;6(1).
7. Khajehaminian MR, Ardalan A, Keshtkar A, Hosseini Boroujeni SM, Nejati A, Ebadati E OME, et al. A systematic literature review of criteria and models for casualty distribution in trauma related mass casualty incidents. Injury. 2018.
8. Adini B, Aharonson-Daniel L, Israeli A. Load index model: An advanced tool to support decision making during mass-casualty incidents. The journal of trauma and acute care surgery. 2015;78(3):622-7.
9. Amram O, Schuurman N, Hameed SM. Mass casualty modelling: a spatial tool to support triage decision making. International journal of health geographics. 2011;10:40.
10. Amram O, Schuurman N, Hedley N, Hameed SM. A web-

based model to support patient-to-hospital allocation in mass casualty incidents. The journal of trauma and acute care surgery. 2012;72(5):1323-8.

11. Ganz A, Schafer J, Yu X, Lord G, Burstein J, Ciottone GR. Real-time scalable resource tracking framework (DIORAMA) for mass casualty incidents. Int J E-Health Med Commun. 2013;4(2):34-49.
12. Ganz A, Schafer JM, Yang Z, Yi J, Lord G, Ciottone G, editors. Mobile DIORAMA-II: Infrastructure less information collection system for mass casualty incidents. 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBC 2014; 2014: Institute of Electrical and Electronics Engineers Inc.
13. Lenert LA, Kirsh D, Griswold WG, Buono C, Lyon J, Rao R, et al. Design and evaluation of a wireless electronic health records system for field care in mass casualty settings. Journal of the American Medical Informatics Association : JAMIA. 2011;18(6):842-52.
14. Hall TN, McDonald A, Peleg K. Identifying factors that may influence decision-making related to the distribution of patients during a mass casualty incident. Disaster medicine public health preparedness. 2018;12(1):101-8.
15. Hsu C-C, Sandford BAJPa, research, evaluation. The Delphi technique: making sense of consensus. Practical assessment, research & evaluation. 2007;12(10):1-8.
16. Grisham TJIJoMPiB. The Delphi technique: a method for testing complex and multifaceted topics. 2009.
17. Mullen PMJJoho, management. Delphi: myths and reality. 2003.
18. Keeney S, Hasson F, McKenna HJJoan. Consulting the oracle: ten lessons from using the Delphi technique in nursing research. 2006;53(2):205-12.
19. Jirwe M, Gerrish K, Keeney S, Emami AJJoCN. Identifying the core components of cultural competence: findings from a Delphi study. 2009;18(18):2622-34.
20. McKenna HPJJoan. The Delphi technique: a worthwhile research approach for nursing? J Adv Nurs. 1994;19(6):1221-5.
21. Keeney S, Hasson F, McKenna H. Consulting the oracle: ten lessons from using the Delphi technique in nursing research. J Adv Nurs. 2006;53(2):205-12.
22. Keeney S, McKenna H, Hasson F. The Delphi technique in nursing and health research: John Wiley & Sons; 2010.
23. Radestad M, Jirwe M, CastrÃl'n M, Svensson L, Gryth D, RÃijter A. Essential key indicators for disaster medical response suggested to be included in a national uniform protocol for documentation of major incidents: a Delphi study. Scandinavian journal of trauma, resuscitation and emergency medicine. 2013;21:68-.
24. Horberg A, Jirwe M, Kalen S, Vicente V, LindstrÃűm V. We need support! A Delphi study about desirable support during the first year in the emergency medical service. Scandinavian journal of trauma, resuscitation and emergency medicine. 2017;25:89.
25. Mcilfatrick SJ, Keeney SJJoan. Identifying cancer nursing research priorities using the Delphi technique. J Adv Nurs. 2003;42(6):629-36.
26. Keeney S, Hasson F, McKenna HP. A critical review of the Delphi technique as a research methodology for nursing. International journal of nursing studies. 2001;38(2):195-200.
27. Power DJ, Sharda R. Model-driven decision support systems: Concepts and research directions. Decision Support Systems. 2007;43(3):1044-61.
28. Flemming A, Meyne S, Hildebrand F, Koppert W, Krettek C, Adams HA. The ComPaS@ Programme - Registration and allocation of treatment capacities in the event of mass casualties and disasters. Anasthesiol Intensivmed. 2012;53(3):130-42.
29. Wilson DT, Hawe GI, Coates G, Crouch RS. A multi-objective combinatorial model of casualty processing in major incident response. Eur J Oper Res. 2013;230(3):643-55.
30. Buono C, Huang R, Brown S, Chan TC, Killeen J, Lenert L. Role-tailored software systems for coordinating care at disaster sites: enhancing collaboration between the base hospitals with the field. AMIA Annual Symposium proceedings / AMIA Symposium AMIA Symposium. 2006:867.
31. Dean MD, Nair SK. Mass-casualty triage: Distribution of victims to multiple hospitals using the SAVE model. Eur J Oper Res. 2014;238(1):363-73.
32. Postma IL, Weel H, Heetveld MJ, van der Zande I, Bijlsma TS, Bloemers FW, et al. Patient distribution in a mass casualty event of an airplane crash. Injury. 2013;44(11):1574-8.
33. Tian Y, Zhou TS, Yao Q, Zhang M, Li JS. Use of an agent-based simulation model to evaluate a mobile-based system for supporting emergency evacuation decision making. Journal of medical systems. 2014;38(12):149.
34. Bayram JD, Zuabi S, Subbarao I. Disaster metrics: quantitative benchmarking of hospital surge capacity in trauma-related multiple casualty events. Disaster medicine and public health preparedness. 2011;5(2):117-24.
35. Postma IL, Winkelhagen J, Bloemers FW, Heetveld MJ, Bijlsma TS, Goslings JC. February 2009 airplane crash at Amsterdam Schiphol Airport: an overview of injuries and patient distribution. Prehospital and disaster medicine. 2011;26(4):299-304.
36. Adini B, Cohen R, Glassberg E, Azaria B, Simon D, Stein M, et al. Reconsidering policy of casualty evacuation in a remote mass-casualty incident. Prehospital and disaster

medicine. 2014;29(1):91-5.
37. Zoraster RM, Chidester C, Koenig W. Field triage and patient maldistribution in a mass-casualty incident. Prehospital and disaster medicine. 2007;22(3):224-9.
38. Pinkert M, Lehavi O, Goren OB, Raiter Y, Shamis A, Priel Z, et al. Primary triage, evacuation priorities, and rapid primary distribution between adjacent hospitals–lessons learned from a suicide bomber attack in downtown Tel-Aviv. Prehospital and disaster medicine. 2008;23(4):337-41.
39. Sung I, Lee T. Optimal allocation of emergency medical resources in a mass casualty incident: Patient prioritization by column generation. Eur J Oper Res. 2016;252(2):623-34.
40. Glassman ES, Parrillo SJ. Use of alternate healthcare facilities as alternate transport destinations during a mass-casualty incident. Prehospital and disaster medicine. 2010;25(2):178-82.
41. Bail HJ, Kleber C, Haas NP, Fischer P, Mahlke L, Matthes G, et al. Distribution planning of injured persons in mass disasters or catastrophes: Structuring of hospital capacities exemplified by the catastrophe network of the German Society for Trauma Surgery (DGU). Der Unfallchirurg. 2009;112(10):870-7.
42. Bloch YH, Schwartz D, Pinkert M, Blumenfeld A, Avinoam S, Hevion G, et al. Distribution of casualties in a mass-casualty incident with three local hospitals in the periphery of a densely populated area: lessons learned from the medical management of a terrorist attack. Prehospital and disaster medicine. 2007;22(3):186-92.
43. Bayram JD, Zuabi S. Disaster metrics: Quantification of acute medical disasters in trauma-related multiple casualty events through modeling of the acute medical severity index. Prehospital and disaster medicine. 2012;27(2):130-5.
44. Bayram JD, Zuabi S. Disaster metrics: a proposed quantitative model for benchmarking prehospital medical response in trauma-related multiple casualty events. Prehospital and disaster medicine. 2012;27(2):123-9.
45. Sefrin P, Messerer C. Optimisation of the interface between preclinical and hospital - The "wave plan" as an instrument for the allocation of the seriously injured among mass casualties. Anasthesiol Intensivmed. 2011;52(11):834-44.
46. Shaft D, Cohen R, editors. A multiagent approach to ambulance allocation based on social welfare and local search. 2013 12th International Conference on Machine Learning and Applications, ICMLA 2013; 2013; Miami, FL: IEEE Computer Society.
47. Castle N. Triage and transport decisions after mass casualty incidents. Emerg Nurse. 2006;14(1):22-5.
48. Einav S, Feigenberg Z, Weissman C, Zaichik D, Caspi G, Kotler D, et al. Evacuation priorities in mass casualty terror-related events: implications for contingency planning. Annals of surgery. 2004;239(3):304-10.
49. Lynn M. Mass casualty incidents: The nuts and bolts of preparedness and response for acute disasters2016. 1-95 p.
50. Cotta C. Effective patient prioritization in mass casualty incidents using hyperheuristics and the pilot method. OR Spectrum. 2011;33(3):699-720.
51. Jacobson EU, Argon NT, Ziya S. Priority Assignment in Emergency Response. Operations Research. 2012;60(4):813-32.