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High-fidelity Multidisciplinary Competition-based Simulation Tasks in Prehospital Emergency Medical Service

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Introduction: Simulation task teams were conducted, with each team consisting of a medical doctor, a nurse, an emergency life-saving technician, and an ambulance crew certified for rescuer tasks. The scenarios were competitive, using high-fidelity manikins and standardized actor patients *on-site* and at stations, referred to as *Rallye Medicina*. This study aimed to evaluate tasks in a Japanese medical rally in 2019 for effectiveness. Multiple attribute utility technology was used, as the task was intended to achieve multiple goals. ***Subjects and Methods:*** Three tasks—pediatric emergency care, care of injured drivers in traffic accidents, and response to multiple casualties in terrorism—out of seven drills were analyzed. Four goals—improving teamwork within the emergency response team, enhancing emergency care skills, increasing patient survival rates, and building public trust in emergency care—were determined. Five stakeholder groups consisting of four types of emergency professionals, one administrator group, and a panel of emergency medical doctors specializing in medical rally, were designated. Stakeholders determined the relative importance of the goals, and the panel assessed the goal achievement rate based on the actual and target values of each achievement. Utility scores for tasks were calculated by group. ***Results:*** Utility scores in the groups, overall, were as follows: 80.2 for pediatric care, 79.1 for drivers' care, and 88.5 for mass casualty response. All five groups had the highest utility score for mass casualty response among the tasks, with the same priority order. ***Conclusions:*** Conducting and participating in the medical rally achieve goals in real-world settings. Simulation tasks would be crucial for the education and revision of local institutions' plans for emergency preparedness, with consideration for potential disasters such as mass casualties.

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INTRODUCTION

Simulation is an essential tool for medical education, which is especially advantageous for training in emergency medicine as cases, events, and disasters rarely occur on site and at the out-patient departments in hospitals. Such simulations are modelled to train students, graduates, and professional health providers. For the training of prehospital emergency medical service (pre-EMS), personnel at such drills involve health professionals and experts across disciplines, such as physicians [1, 2], nurses [3], paramedics/technicians [4], and the ambulance vehicle/helicopter crew [5].

The literature till date [6–8] reports methods of inter- and multidisciplinary education using scenario-based simulation for pre-EMS education involving both undergraduate and graduate physicians, nurses, paramedics, and technicians along with other related health professionals. Multiple studies reported that the indices of the simulation's effectiveness, such as awareness, perception, experience, self-confidence, knowledge, skills, and team work, significantly improved from the drills and exercises [1–8].

The simulation exercises for pre-EMS training involves actors/actresses playing out standardized high-fidelity scenarios *on site* or at stations for the health personnel in a team-based competitive style, traditionally called *Rallye Medicina*, in Latin, (MR) in Czech [9, 10]. In Japan [11, 12], the MR involve four EMS professionals, physicians, nurses, emergency life-saving technicians (LS), and the ambulance crew (AC) certified officially as rescuers upon graduating from firefighting academy.

MRs have been held across prefectures in Japan, occurring approximately over 10 times during these two decades; in locations such as in Tsukuba [13], Senri [14], and Sanuki (Kasai T, Otomune K, The way disaster medical training from the Sanuki medical rally held for 15 years. 14th Asia Pacific conference on disaster medicine, Hyougo, Japan, October 2018, Abstract Book, pp152, 2018.). MRs have been conducted in Thailand as well [15], with the 1st ASEAN MR being held in 2018 at Bangkok, Thailand, with participants across countries (Ohno T, Kido Y, Kai T, Kondo H, Miyamoyo M. Disaster medical survey results at the 1st International Medical Rally. Jpn J Disaster Med 2016;577; Abstract in Japanese language alone presented at annual scientific meeting, translated into English by the current authors).

The participating competitors of such MRs conduct simulation drills and team exercises based on several simulation tasks. Their performances are scored by instructors with standardized scoresheets. Debriefings are conducted after these simulation tasks, and based on the teams' scores, those performing care of high quality are suitably acknowledged.

The Fire and Disaster Management Agency (FDMA), Bureau of Firefighting and Rescue (BFR), under Ministry of Internal Affairs and Communications (MIAC), Japan, deem that physician and nurse-staffed vehicles/helicopters be run by LS or AC licensed for urgent and serious cases and events. The *on site* 4-type pre-EMS personnel is to be staffed by the four aforementioned types of professionals. A key statistic published by the local authorities of Shimane Prefecture reported that such emergency occasions emerged ten times per year on average in Yasugi City, Shimane Prefecture, Japan, reaching a total of 120 incidences during an 11-year period until 2022. It is crucial for every such units of 4-personnel pre-EMS units to commit to programs like MR.

The most traditional program, the *Rallye Rejviz,* has only two studies published so far [9, 10]; one analysing the psychological parameters involved in emotion regulation during paramedics' exercising tasks, and the other reported how prior participation was significantly related to their teams scoring high scores.

While MRs have been conducted in Europe and Asia in these two decades or more, there is limited information on effectiveness or efficacy of simulation tasks performed in Japan, too. Thus the current study aimed to evaluate the efficacy of the simulation tasks conducted in the MR held at Shimane, Japan, in 2019 (MR-S 2019) in the scenario-based high fidelity exercise [11, 12]. As these drills relate to multiple interrelated disciplines, in this study, the multi-attribute utility technology (MAUT) [16–18] method was applied to measure multiple outcomes. Under the multi-criteria decision analysis framework, which was developed for complicated healthcare programs [19–21], MAUT has gained popularity across a wide range of healthcare fields [16–18].

SUBJECTS AND METHODS

Subjected three simulation tasks chosen from seven tasks in MR-S 2019

The seven tasks outlined in Table 1 were conducted at MR-S 2019 by twelve competing teams, each constituting four EMS professionals, i.e. a physician, nurse, LS, and AC. The simulations were rolled by trained actors. The teams' performance were scored each by at least 2 expert instructors on quality of examination, treatment, team cooperation, and communication according to standardized marking process.

Among the seven simulation tasks (Table 1), three were chosen as the subjects in the current study by the authors. These can be summarized, shown in Appendix, as following: (1) a motor accident in a neighbourhood to injure bystanders (IT), (2) two children in primary school simultaneously undergoing an anaphylactic shock during lunch and being dehydrated during physical exercise (pediatric emergency care, PE), (3) a mass casualty event (MC) of many injured or killed citizens from a bomb attack in a downtown shopping mall and hewed by sword.

Alike with those in Table 1 and Appendix, MR-S 2019 have had modelled actual events, incidents, cases, and casualties in general. It was the three simulation tasks chosen as the subjects, since Japan MRs usually employ a task each on IT, PE, on MC in common.

End-points/goals of simulation tasks

The authors decided on four end-points or goals for each of the three tasks: (1) increased professional skill, (2) increased team work, (3) increased survival rate of patients and casualties, (4) greater public trust in the EMS unit reflecting the quality of the healthcare and ambulance personnel. The preceding literature justified the former two goals tested, but the latter two were set based on the authors' opinion and expertise.

Stakeholders designated and their provision with relative importance data

Stakeholders under multidisciplinary interactions were designated in 2020–2021 by the authors from competitors, instructors for judge, assistants, and organizing/managing personnel for administration, all of who participated in MR-S 2019. According to the authors' purpose of the current study, stakeholders were assigned into five groups; the four groups were nominated based on their EMS profession, i.e. physician (n = 8), nurse (n = 8), LS (n = 7), and AC (n = 7); as to experience in MR-S 2019, within each group, a couple of stakeholders did participated at the first time in 2019, but another couple of them were repeaters as competitors. The one other group oversaw the management and organization as volunteers.

Table 1. Seven tasks enrolled in Rally Medicina at Shimane, Japan in 2019

Title	Subjected	Scenario	Reference, Guide
Baby Labour		woman discharged a baby in a car damaged by accident	BLSO/ALSO, NCPR
Child	Yes	Two school children suffered from dehydration and food anaphylaxis	JPTEC, PEARS/PALS
Internal Medicine		Disturbed Consciousness in adults	PCEC
Earthquake Disaster		Casualty trapped awaiting rescue	CSRM, JDRT, DMAT
Trauma	Yes	A walker hit by a small-scaled truck	JPTEC
CPR		Sternum Suppression Skill evaluated	BLS
Terrorism Casualty	Yes	Bomb attack caused casualty, and some attacked by terrorists with swords	MCLS

BLSO: Basic Life Support in Obstetrics, ALSO: Advanced Life Support in Obstetrics, NCPR: Neonatal Cardio-pulmonary Resuscitation, JPTEC: Japan Prehospital Trauma Evaluation and Care, PEARS/PALS: Pediatric Emergency Assessment, Recognition and Stabilization/Pediatric Advanced Life Support, PCEC: Prehospital Coma Evaluation & Care, CSRM: Confined Space Rescue and Medicine, JDRT: Japan Disaster Relief Team, DMAT: Disaster Medical Assistance Team, BLS: Basic Life Support, MCLS: Mass Casualty Life Support

The stakeholders were asked to complete a questionnaire-based assessment form requesting to fill points from 0 to 100 marks to rank the relative importance (RI) of 4 goals each.

Goal achievement rates obtained from a panel of physicians designated with expertise in Rallye Medicina for emergency medical service

A panel (Panel) of EMS expert physicians (n = 6) who had installed and implemented MRs at some locations centrally in the prefectural regions, Japan, were invited in 2021–2022 by the current authors to respond to the questionnaire as follows. Each of them had to fill in expert-specialized questionnaire on rating each of three simulation tasks performed in competitions. Since there are no studies on the rating data so far, we utilized these expert opinions.

As to three simulation tasks, target value of achievement (TVA) and actual value of achievement (AVA), were decided in the following. To fill in the questionnaire, all Panel physicians evaluated the TVA and AVA as the competing groups met each goal, scoring from 0% ('not achieved at all' in TVA or AVA) to 100% ('perfectly achieved' in TVA or AVA) in 5-point increment scale. The goal achievement rate (GAR, GAR = AVA/TVA x 100%) were finally calculated, taking the mean values TVA and AVA from Panel's response. GAR is a measure to show the extent to which a goal is achieved if the simulation task is conducted by competitor teams.

Utility score calculations with relative importance and goal achievement rate, and Statistical procedure

According to MAUT, data on RI of 4 goals obtained from 5 stakeholder groups and those on goal achievement rate (GAR) from Panel were used to work out the utility score (US) for simulation tasks. US values were finally compared in terms of priority for tasks by stakeholder groups.

Ethics

All stakeholder groups and Panel filled in a standardized questionnaire concerning demographic characteristics, e.g. occupational history, experience and/or affiliation in EMS, e.g. certificates from the EMS related academics, jobs under FDMA, BFR, MIAC, Japan, and so on. Both stakeholder groups and Panel provided their written informed consent with providing data on their demographics of occupations and EMS related experience/academic background, and on response to questionnaire. The authors' ethics documentation in concordance to Helsinki declaration and stated the provided data used only for static analysis anonymously. It was approved by IRB, University or Shimane Faculty of Medicine.

RESULTS

Demographics in stakeholder groups and expert physician panel

The demographics of stakeholder groups (n = 5) and of Panel (n = 5) are shown in Table 2. Initially, six physicians were invited to Panel, but one of them was excluded as the response to a question on AVA was missing, resulting in analysis of five Panel physicians. As to stakeholders, 8 physicians were invited, but the two did not respond, resulting in 6 physicians subjected; as to 7 LS invited at first, two did not, resulted in 5 LS subjected (Table 2).

Relative importance, ratio weight, and normalized weight of four goals for simulation tasks

The relative importance (RI) of the four goals were collected from all stakeholders, and the normal standardized relative importance were calculated. This is summarized in Table 3 for overall the five stakeholder groups and each stakeholder group.

Furthermore, the mean ratio weight ($\bar{x}$) and normalized weight (W_i) for each goal (i = 1–4) were calculated (Table 3). Here, $\bar{x}$ is the mean of RI scores of the five stakeholders for each goal, and W_i was obtained by $\bar{x}$ divided by a sum ($\Sigma\bar{x}$) of all $\bar{x}$ values. For instance, the $\bar{x}$ of the goal 'increasing teamwork of emergency response team' (84.52) was obtained by the sum of the stakeholders' relative importance scores divided by the number of stakeholders [i.e. (87.50 + 91.25 + 63.00 + 88.00 + 92.86 = 422.61)/5, i.e. 84.52], and its W_i (0.27) was obtained by dividing 84.52 by the sum of all $\bar{x}$ scores for the four goals (i.e., 315.65). W_i was used to calculate a final utility score (US) for each goal, while i was termed according to 4 goals (i = 1–4).

Table 2. Demographics of stakeholders and of expert panel for *Rallye Medicina* at Shimane, Japan in 2019

						EMS Panel
Stakeholder						
Group	Physician	Nurse	LS	AC	Administrator	Physician
n	6	8	5		5	6
Duration (M, year)	25.8	17.5	17.6	19.6	As volunteer 13.6	34.2
(±SD)	(13.0)	(7.5)	(7.5)	(5.2)	(7.5)	(10.8)
EMS Professional						
Occupation	Physician	Nurse	LS and/or AC	Rescuer	LST, RG, HP, LGO, AR	Physician
Duration (M, year)	10.0	8.8	16.0	16.3	13.6	30.4
(±SD)	(6.5)	(6.3)	(7.2)	(5.3)	(8.8)	(11.7)

EMS: Emergency medical service, LST: Life-saving technician, RG: Radiographer, HP: Ambulance helicopter pilot, LGO: local government officer, AR: Academia researcher, AC: Ambulance crew
EMS Professionals represent a part of occupational history professionally involved in EMS within health related occupations in general.

Table 3. Relative importance of goals, the ratio weight , mean ratio weight, and normalized weight of goal relative importance for multiple stakeholders

Goal	Stakeholder										Mean ratio weight ($\bar{x}$)	Normalized weight (W_i)
	Physician (n = 6)		Nurse (n = 8)		LST (n = 5)		AC		AM			
	RI	RW	RI	RW	RI	RW	RI	RW	RI	RW		
Teamwork	87.5 (10.70)	0.283	91.25 (9.27)	0.272	63.00 (16.61)	0.248	88.00 (7.48)	0.271	92.86 (10.30)	0.263	84.52	0.268
Skill	63.33 (15.99)	0.205	82.50 (6.61)	0.245	56.00 (23.96)	0.220	78.00 (16.00)	0.239	83.57 (19.32)	0.237	72.68	0.230
Survival Rate	77.50 (8.04)	0.251	82.5 (9.68)	0.245	65.00 (26.83)	0.256	80.00 (14.14)	0.245	88.57 (15.52)	0.251	78.71	0.249
Public Trust	80.83 (7.31)	0.261	80.00 (13.28)	0.238	70.00 (28.11)	0.276	80.00 (12.65)	0.245	87.86 (16.87)	0.249	79.74	0.253
Sum	309.16	1.000	336.25	1.000	254.00	1.000	326.00	1.000	352.86	1.000	315.65	1.000

RI: Relative importance (Mean ± SD), RW: ratio weight (RI/ΣRI), Mean ratio weight ($\bar{x}$) = ΣRI/5,
Normalized weight (W_i) = $\bar{x}/\Sigma\bar{x}$

The ratio weight of each goal for each stakeholder is also shown in Table 3, which was a RI score for each goal divided by a sum of scores for each stakeholder. For example, the ratio weight of increasing teamwork of emergency response team (0.28) for physicians was obtained by dividing 87.50 by 309.16. These values of five stakeholders were used for sensitivity analysis.

Target value of achievement, actual value of achievement, and goal achievement rate obtained from physicians' panel expertized in Rallye Medicina.
Table 4 shows the target value of achievement (TVA) and actual value of achievement (AVA) obtained from Panel. There were calculated the goal achievement rate (GAR) of each of four goals according to three tasks, shown in Table 4, calculated from AVA divided by TVA (GAR = AVA/TVA x 100). GAR, i.e. U_{ij} (j = 1–3, named after three simulation tasks) used for scale transformation afterwards to produce utility score (US), is a measure to show the extent to which a goal is achieved if the simulation task is conducted by competitor teams.

Table 4. Goal achievement rate for the simulation tasks

Goal (i = 1–4)	Simulation Task (j)								
	Emergency Pediatrics			Traffic Injury			Mass Casualty Event		
	TVA	AVA	GAR (U_{ij})	TVA	AVA	GAR (U_{ij})	TVA	AVA	GAR (U_{ij})
Teamwork	84	72	85.71	88	72	81.82	88	72	81.82
Skill	76	64	84.21	76	62	81.58	68	60	88.24
Survival Rate	60	52	86.67	66	52	78.79	62	54	87.10
Public Trust	62	40	64.52	62	46	74.20	68	66	97.06

TVA: Target value of achievement, AVA: Actual value of achievement, GAR: Goal achievement rate, GAR = AVA/TVA x 100, U_{ij}: scale transformation (= AVA divided by TVA) (%), W_iU_{ij}: utility score (US) of each goal (= W_i multiplied by U_{ij})

Table 5. Weighted sum of utility score of goal for simulation task

Goal (i = 1–4)	Normalized weight of relative importance (W_i)	Simulation task (j = 1–3)					
		Emergency Pediatrics		Traffic Injury		Mass Casualty	
		GAR (U_{ij})	Utility Score	GAR (U_{ij})	Utility Score	GAR (U_{ij})	Utility Score
Teamwork	0.268	85.71	22.97	81.82	21.93	81.82	21.93
Skill	0.230	84.21	19.37	81.58	18.76	88.24	20.3
Survival Rate	0.249	86.67	21.58	78.79	19.62	87.10	21.69
Public Trust	0.253	64.52	16.32	74.2	18.77	97.06	24.56
Sum of US			80.24		79.08		88.48
Priority (order)			(2)		(3)		(1)

GAR: Goal Achievement rate, U_{ij}: Scale transformation to utility score, Utility score (US) = GAR (U_{ij}) multiplied by W_i

Table 6. Sensitivity in sum of weighted utility for simulation task by stakeholder

Stakeholder (k = 1–5)	Simulation task (j = 1–3)					
	Emergency Pediatrics		Traffic Injury		Mass Casualty Event	
	Utility score	(Priority)	Utility score	(Priority)	Utility score	(Priority)
Physician	80.11	(2)	79.03	(3)	88.44	(1)
Nurse	80.53	(2)	79.21	(3)	88.32	(1)
Life Saving Technician	79.79	(2)	78.89	(3)	88.79	(1)
Ambulance Crew	80.4	(2)	79.15	(3)	88.38	(1)
Administrator	80.32	(2)	79.11	(3)	88.46	(1)
Overall Group	80.24	(2)	79.08	(3)	88.48	(1)

Utility score: sum of weighted goal utility with relative importance for stakeholder, Priority in parenthesis represent order of simulation task within stakeholder.

Utility scores among overall stakeholders from multiplying goal achievement rates by relative importance measurements

Using GAR (U_{ij} ; j = 1–3, named according to 3 simulation tasks) and W_i (i = 1–4, named after 4 goals) in overall 5 stakeholder groups, utility scores (US) for three simulation tasks, shown in Table 5, were calculated. US of the four goals by each of three simulation task were summed up, and finally as a total, US for PE, IT, and MC were obtained as 80.24, 79.08 and 88.48, respectively. It was revealed that US for MC was much higher than US for other two simulation tasks (PE, IT). It may be of notified that US of the public trust goal for MC showed a value of 24.6 much higher than those for the rest three goals on skill, team work, or survival rate.

Sensitivity in utility scores for simulation tasks by stakeholder group's performing

Finally, as a sensitivity analysis, using GAR, i.e. U_{ij}, and the ratio weight of each goal (Table 3) in each of five stakeholder group, which is a substitute for W_i, US for three simulation tasks were calculated (Table 6). Five types of stakeholders consistently evaluated highly of response to MC. The priority of three simulation tasks in US seemed the same among 5 stakeholder groups each as overall 5 groups.

DISCUSSION

Originality of the current study and their implications

The current study is the first to evaluate MR simulation tasks by the MAUT methodology for effectiveness in achieving the goal. While skill and knowledge were found to increase and improve with simulation education [1,3–5,7,8] and team leadership enhanced after technology-assisted simulation for trauma resuscitation [2], the current study also suggested that drilling MR tasks could perform increase in teamwork. Additionally, the survival rate of casualty and public trust in EMS may be increased with four types of professionals and possibly in association with administrative personnels.

Both stakeholders and Panel joining the current study agreed with 4 goals expecting in 3 simulation tasks and then the MAUT methodology assessed the achievement of goals by the competitor teams. As a result, all three simulation tasks represented utility scores at quite high or moderate values.

The semiquantitative data from our analysis can contribute to the arrangement and revision of simulation tasks for practice and drills. Especially, the data on the MC from bombing and hewing can be composed for education on preparations of local agendas of MC by terrorists, as well as natural, and human disasters.

Diseases, Injuries and Massacre modelled in scenario-based simulation tasks and evaluations in the literature

Mass casualty events from toxic chemicals, bombs and gun shooting, and gas explosion

The Tokyo Sarin Subway Attack by a religion cult, close to Japan Ministers' office arose in 1994 [22]. Among 5,500 people harmed, 35 were killed. In the overall emergency responses, only 5% were transported by official rescue/security and emergency paramedics vehicles. The responses from the local authority headquarter to the rescue control of main local hospitals were inefficient, also because of the out-patients clinics and EMS departments being overwhelmed due to a sarin toxicity outbreak.

Since the Tokyo sarin mass casualty, similar terrifying massive killing from chemical toxicity has been modelled and the scenario simulation for drills have been adopted by Japan MRs at many sites. *Rallye Rejviz* also adopted simulation tasks addressing the hazards of toxic chemical substances [23].

The multipole bombing at Boston Marathon, 1998, which saw three casualties and 264 injured people, is a well-known case of mass casualty terrorism [24]. In this event, hospitals had sent EMS professionals to the site and they collaborated with the triage category to complete the rescue operation in 45 minutes to transport the injured people to the hospitals. Prior to this event, local hospitals, emergency and rescue authority, and local governments did educate and train EMS personnels and hospital resources under the plan for MC. According to this paper, it was owing to the great preparedness against the MC.

In accordance with the Boston Marathon triage service, a one-hour simulation exercise in a computer-controlled room simulating bomb explosion [25] and gun shooting mass casualty [26] was developed for controlling triages.

Gas explosion-simulated event [27] brought in eight seriously injured persons and two teams consisting of paramedics, nurse, or physicians conducted a triage in a limited time which observers consisting of a variety of health providers also conducted. The triage categorization results were judged for both teams and observers. Therefore, observers also can examine theirs being correct or wrong.

However, except for the current study on MC from bombing, gun shooting, or gas explosion, there were none studies concerning high fidelity scenario-based simulation drills by multiple EMS professionals.

Injured drivers and passengers with trauma in car accidents

As to injuries from car accidents, a study [28] using manikins for bone fracture reported a scenario-based simulation tasks. Another study [29] with a manikin was arranged in a scenario wherein a manikin driver was within a car that could not be opened, causing the trained rescue experts to remove the driver. As for pneumothorax from car accident-derived trauma, there were no mimicking or simulation scenarios drilled for education and training of EMS professionals.

Pediatric emergency care

For a laboratory-based simulation tool, high fidelity manikins like a child had been developed and used [30]. The manikin infant appeared flush with eczema on the skin, mimicking anaphylactic manifestations, and needing treatment with venous injections of epinephrine in the appropriate dosage. Besides this simulation on education using high fidelity manikin, there are no reports on simulation-based drills among school children suffering from anaphylaxis.

Dehydration problems manifest in people walking on hills, and physicians in the USA have developed guidelines to prevent it [31], which reportedly helped a lot in the preparation of emergency rescue. However, none of such scenarios were simulated in this study.

Limitations of the study

There are several limitations to the study. First, there is a lack of relevant information for evaluating programs based on multi-attribute utility technology [16–18]. Specifically, there was no previous data on determining program goals and actual value of achievement (AVA). Thus, in the study, scores for the goals and AVA were decided based on expert opinions. Data concerning program goals and AVA would lead to a more accurate evaluation. Second, we need to acknowledge that the findings have limited external validity and is directly applicable to only similar such activities in Japan. Third, it should be noted that a utility score should be regarded as a rough guide in the program evaluation and a small difference between paediatric care (utility score = 80.24) and care of injured drivers in traffic accidents (utility score = 79.08) is insignificant. Strategies to utilize the order of priority obtained through multi-attribute utility technology is the topic for future research.

The current situations in disaster and emergency medicine, and future outlook

In Japan, local governments are taking the lead in considering full-scale responses to future large-scale disasters and related issues at the prefectural and municipal levels. We surmised that feedback from what is learned at MR-S 2019 will be important for utilizing the aforementioned related aspects of the region in the future.

Considering the numerous damages from many disasters and incidents in the world, the contents of our study are important not only for emergency care but also for public health including governmental bodies, public health professionals, and many fields of medicine, e.g. forensic medicine. It could be believed that cooperations among these lead to improved survival rates and increased social trust in EMS.

We must acknowledge, that the number of the studies on effectiveness in simulation drill alike the current study is small, and that the number of experts and stakeholders in the current study is small. Thus if we continue the current studies, we would have concrete results in pre-EMS.

CONCLUSIONS

Similar to our current study, a high fidelity, well-simulated and high reality modelled drills with a hard competition style may be translated to future real-life interventions. Scenario modelled in MR need to be innovated to aim for utility scores of good quality.

Arranging several drills that simulate different critical cases is necessary for training and should be treated as a complete program. Moreover, for the purpose of reconsidering plans of emergency rescue service by local authority and responsible institutions, mass casualty drill may be inevitable for education and exercise.

Ethical approval

According to the ethical guidelines for medical and health research human subjects in Japan, an ethical committee approval was not needed for this type of study. This was confirmed by the ethics committee of Shimane University Faculty of Medical and Nursing Sciences, Japan (08/30/2021). Informed consent: Stakeholders and panelists all provided their written informed consent with providing data. The authors' ethics documentation conforms to Provisions of Declaration of Helsinki.

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Conflicts of interest

None

Human or animal registry

N/A

Data availability statement

The data that support the findings of the current study are available from the corresponding author upon reasonable request.

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