

Brief Report

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A Brief Report of Response Team Members' Perspectives on an Interteam Full-Scale Mass Casualty Incident Exercise in Norway

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Abstract

Introduction: A mass casualty incident (MCI) is unpredictable and involves many casualties at the same time and place. This brief report will present the results from an evaluation a full-scale MCI exercise, aiming to increase preparedness for such events, from the perspectives of future health-care professionals, as well as personnel in various emergency teams taking part in MCI response.

Methods: All participants in a 2-day, full-scale MCI exercise ($N = 206$) were invited to participate in an investigator-developed survey.

Results: In total, 124 participants (60.2%) responded to the questionnaire. Most of the respondents were satisfied with the information and frames of the full-scale MCI exercise. Based on their experiences, over half of the respondents perceived that the county ambulance, police, and fire departments were well prepared in case of an MCI in the future. Reported areas of improvement were specifically related to communication lines and triage.

Conclusion: Weakness in communication lines and triage were assumed a threat to effective handling of MCIs. However, further studies are needed to decide the content needed in MCI exercises to effectively increase regional preparedness for such events.

A mass casualty incident (MCI) has been defined as “an event that generates more patients at a time than locally available resources can manage using routine procedures.”¹ Such events are most commonly unpredictable, and prompt action is needed, often over time.² Moreover, emergency arrangements and additional assistance of personnel may be required.³ This also includes coordination both at an intrateam level (e.g., ambulance services) and at an interteam level (e.g., between police, fire, and ambulance teams).

The World Health Organization (WHO) has stated that simulation exercises can help develop, assess, and test the functional capabilities of emergency systems, procedures, and mechanisms to respond to outbreaks and public health emergencies.⁴ Weinstein et al.⁵ conducted a scoping review of literature on MCI education, training, and exercises that lead to competencies. The papers mainly focused on hospital preparedness, pediatric MCIs, and medical doctors or nurses. Research on the capacity for interoperability between emergency teams, or that evaluates the perspectives of future health-care professionals on disaster medicine issues, is limited.

This brief report will present the results from an evaluation of a full-scale MCI exercise, from the perspectives of future health-care professionals as well as personnel in various emergency teams taking part in MCI response. The purpose of the exercise was primarily education of future health-care personnel in MCI issues, and also to increase MCI preparedness in the county.

Methods

Setting

In Norway, 4 emergency lines are publicly available: 1-1-0 in cases of fire, 1-1-2 to the police, 1-1-3 in cases of medical emergencies, and 1-4-1-2 for persons with hearing impairments. In cases of MCIs, the lines most commonly will be interconnected, so called triple-warning, independent of which number the caller uses. Both ambulance, police, and fire department services include car, boat, and helicopter rapid-response vehicles. Car ambulances are usually staffed by 2 emergency medical technicians (EMTs). In addition, 3-year bachelor programs in paramedicine were established in 2014. Nurses and physicians also man ambulances, and

helicopters also include a pilot and a crew member. The basic education for police officers is a bachelor's degree. Firefighters' basic education is internal at the fire station and then supplemented with an 8-week course at "Norges brannskole" (Norway's firefighter school).

The exercise

Over 2 days in May 2023, a full-scale exercise was conducted as a collaboration between the paramedicine bachelor program at the county university college ($n = 76$) and other emergency response actors in the county. In addition, 10 emergency care nursing students from the university college participated. The emergency response actors included employees from 2 different municipalities ($n = 2$), the military ($n = 4$), the firefighter department ($n = 3$), the police ($n = 3$), the emergency primary health-care center (nurses, $n = 14$), the Red Cross (paramedics, $n = 2$), the county hospital (nurse, $n = 1$), and the customs ($n = 1$). Also, 10 ambulances took part in the exercise, each manned with a driver ($n = 10$ apprentices from vocational school) and 4 personnel (2 first-semester and 2 final-semester paramedicine students, respectively). Paramedicine students in their final semester ($n = 36$) had roles as ambulance personnel one day and as in-hospital personnel the other day. Paramedicine students in their first semester ($n = 40$) had roles as ambulance personnel one day and as markers the other day. The emergency care nursing students acted as clinicians in the emergency department one day and were observers on the second day. In addition, about 80 markers from 2 different high schools, one rural and one central, participated. These high schools offer a 2-year vocational level education in ambulance practice, as a preparation before 2 years internship in the ambulance services. In total, about 206 participants were active in the exercise. Six experienced and specially trained paramedics ($n = 5$), a physician experienced with emergency response, and a simulation senior consultant planned and facilitated the exercise and were available during the exercise if further information was needed or if something unforeseen happened.

Prior to the exercise, all participants received written information about the scenario (see [Box 1](#)), locations, communication lines (including a plan in case of real-life events), their own roles, how to dress, how to act, and the learning outcomes. Also, a public warning about the exercise was published in the local media.

Data Sources

All participants in the full-scale exercise were invited to participate in a survey after the exercise. An investigator-developed questionnaire was used (see [supplement 1](#)). The questionnaire was piloted in an expert group of 3 paramedics and an emergency physician, who

all found the questions and response alternatives relevant, understandable, and consistent. The questionnaire included one question related to satisfaction with the information provided regarding different aspects of the exercise ($n = 8$), one question related to satisfaction with different aspects of the exercise itself ($n = 5$), and four questions regarding different aspects of the exercise areas ($n = 6$), scored on a 5-point Likert scale, where 1 = very dissatisfied, 2 = dissatisfied, 3 = neither dissatisfied or satisfied, 4 = satisfied, 5 = very satisfied, and 6 = not relevant. In addition, the participants were given an option to write in text after each of the six questions. Finally, there were three questions about 1) what the participant thinks could improve the county preparedness, 2) what the participant found especially positive about the exercise, and 3) what the participant found especially negative about the exercise, all with text response alternatives.

The data collection was handled through nettskjema.no, a survey solution developed and hosted by the University of Oslo (nettskjema@usit.uio.no).

Results

Participants

In total, 124 responses to the questionnaire were received (60.2%). [Table 1](#) gives an overview of the respondents' affiliation.

Participants from the Red Cross did not respond to the questionnaire. However, they sent an email describing their experiences in text.

Descriptive Data

[Table 2](#) presents the results of the questions related to satisfaction with the information provided before the exercise, frames for the exercise, and the exercise areas.

[Table 2](#) shows that respondents were mostly satisfied or very satisfied with the information and frames for the full-scale MCI exercise. Respondents were least satisfied with information about learning outcomes in total.

[Table 3](#) presents the respondents' responses to the questionnaire regarding city and county preparedness for MCIs

In total, 20 of the respondents commented in text on the information provided. Repeatedly, they wished for information at an earlier stage and more information to the markers about how to play their role. Also, 24 of the respondents commented on the frames for the exercise. Here, the comments were mainly positive,

Table 1. Respondents' affiliation ($N = 124$)

Affiliation	<i>n</i> (%)
Markers (high school students)	45 (36.2)
Paramedicine students	31 (25.1)
Emergency primary health-care center	14 (11.3)
Ambulance department	12 (9.6)
Observers*	8 (6.5)
Emergency care nursing students	6 (4.8)
Military	4 (3.2)
Fire	2 (1.6)
Police	2 (1.6)

*Not possible to find out where the observers were affiliated. These may be the facilitators.

Box 1. The full-scale exercise scenario

A concert is arranged near the university college with a Scandinavian controversial band known to criticize religions and state leaders. This has led to demonstrations in front of the city hall and around the city, and police resources have been distributed to cover all gatherings. At the concert, a group of extremists starts to fire weapons and knife-stab concert audience. Panic arises, and people run toward an old fortress located outside the city. The group of extremists emerges on a ferry arriving at the old fortress, where they continue to shoot and stab innocent bystanders. The exercise has 3 different locations with potential victims: the concert area, the ferry, and the old fortress. Victims/patients must be triaged/prioritized/treated and transported to an appropriate location, either at the emergency department in the hospital or to the emergency primary health-care center.

Table 2. Respondents' satisfaction related to different aspects of the full-scale exercise in MCI (*N* = 124)

Aspect	Dissatisfied <i>n</i> (%)	Neither/ nor <i>n</i> (%)	Satisfied <i>n</i> (%)	Not relevant <i>n</i> (%)
Information about place of attendance	5 (4)	6 (4.8)	107 (86.4)	6 (4.8)
Information about time of attendance	7 (5.6)	7 (5.6)	105 (84.8)	5 (4)
Information about how to dress	11 (8.9)	12 (9.7)	86 (69.3)	15 (12.1)
Information about the scenario	5 (4)	15 (12.1)	103 (83.1)	1 (0.8)
Information about what was going to happen at the exercise areas	10 (8.1)	26 (21)	87 (70.1)	1 (0.8)
Information about tasks during the exercise (missing = 2)	15 (12.3)	18 (14.8)	85 (69.6)	4 (3.3)
Information about where to be, when (missing = 2)	19 (15.6)	20 (16.4)	62 (50.8)	21 (17.2)
Information about learning outcomes in total (missing = 19)	9 (8.6)	13 (12.4)	50 (47.6)	33 (31.4)
The facilities (access to toilet, food, beverages) (missing = 2)	26 (21.3)	25 (20.5)	61 (50)	10 (8.2)
Time schedule (missing = 1)	11 (8.9)	19 (15.3)	91 (74)	2 (1.6)
Access to equipment (missing = 1)	21 (17.1)	17 (13.9)	71 (57.8)	14 (11.4)
Area: Fortress, in total (missing = 1)	2 (1.6)	5 (4.1)	98 (79.7)	18 (14.6)
Area: Fortress, learning outcome (missing = 2)	8 (6.6)	15 (12.3)	75 (61.4)	24 (19.7)
Area: Concert, in total (missing = 5)	4 (3.4)	19 (16)	60 (50.3)	36 (30.3)
Area: Concert, learning outcome (missing = 4)	6 (5)	13 (10.8)	63 (52.5)	38 (31.7)
Area: EPHC, in total (missing = 6)	4 (3.4)	16 (13.6)	51 (43.2)	47 (39.8)
Area: EPHC, learning outcome (missing = 5)	9 (7.5)	14 (11.9)	48 (40.3)	48 (40.3)
Area: ED, in total (missing = 8)	2 (1.7)	14 (12.1)	46 (39.6)	54 (46.6)
Area: ED, learning outcome (missing = 8)	5 (4.3)	12 (10.3)	43 (37.1)	56 (48.3)

ED = emergency department, EPHC = emergency primary health-care center, MCI = mass casualty incident. Response alternatives very dissatisfied (1) and dissatisfied (2) collated to "dissatisfied." Response alternatives satisfied (4) and very satisfied (5) collated to "satisfied." Details about respondents' evaluation of surroundings, conduction, materials/equipment, and facilitation related to each of the exercise areas (fortress, concert, ED, EPHC) have not been included in the table.

Table 3. Respondents' perspectives on the city and county preparedness for MCIs

	Disagree <i>n</i> (%)	Neither/nor <i>n</i> (%)	Agree <i>n</i> (%)
I think the ambulance department in our county is well prepared for MCIs similar to the exercise (missing = 3)	16 (13.2)	36 (29.7)	69 (57.1)
I think the fire department in our county is well prepared for MCIs similar to the exercise (missing = 4)	3 (2.5)	39 (32.5)	78 (65)
I think the police department in our county is well prepared for MCIs similar to the exercise (missing = 4)	15 (12.5)	40 (33.3)	65 (54.2)
Our county has personnel with relevant competence to handle MCIs similar to the exercise (missing = 3)	4 (3.3)	34 (28.1)	83 (68.6)
I feel secure that our county can handle MCIs in the future (missing = 3)	9 (7.4)	37 (30.6)	75 (62)

MCI = mass casualty incident. Response alternatives totally disagree (1) and disagree (2) collated to "disagree." Response alternatives agree (4) and totally agree collated to "agree."

such as "Very good scenario, and the exercise area outside was very appropriate." Also, 3 of the students emphasized feeling a need for better preparedness regarding available equipment and what they could meet in each area. Text responses that were similar across exercise areas were that lack of equipment led to lack of realism and that they failed to establish a collection point early enough.

Other Analyses

Regarding observations during the exercise, 25 respondents added comments on what they think should be improved to increase the county preparedness for MCIs. Better communication and a possibility to communicate to common lines and keeping in mind the risk for hypothermia were the only issues being reported repeatedly. Several of the other comments were related to clinical treatment of

the patients, such as "stop the bleeding in yellow patients," "need to triage faster," and "improve primary survey." One of the respondents emphasized the need to think more broadly and involve more resources—for example, potential blood donors, use physicians from private hospitals, and involve pharmacies to access drugs and fluids needed.

In total, 41 respondents added comments about especially positive experiences from the exercise. Specifically, training in collaboration was underlined as a positive learning outcome throughout. One of the respondents wrote, "The collaboration between departments and internally in the departments respectively. This was even better the second day." Also, the possibility to exercise the whole patient pathway, from outside to inside the hospital, was pointed out. However, 5 of the respondents stated a lack of management and communication between participants.

Feedback from the Red Cross participants showed a need for better communication lines and establishment of gathering points so they would not have to search for patients needing transport. Moreover, they suggested several improvement areas for future full-scale exercises—for example, regarding food supply and that all participants must be informed about security issues when using a helicopter.

Discussion

Most of the participants in this full-scale MCI exercise reported to be satisfied or very satisfied with the information provided and the exercise areas. Many also provided ways to improve county preparedness, indicating that the participants learned through the exercise. However, areas of improvement were also presented—for example, regarding information about tasks during the exercise, time and place for attendance, access to facilities like toilet or food, and access to appropriate equipment. Studies have reported a high level of satisfaction with MCI exercises including both full-scale exercises and virtual tabletop exercises.^{6,7}

We have not identified studies with similar extensive samples, including both future prehospital personnel and other MCI response actors, the police or fire department, emergency primary health-care centers, and organizations like the Red Cross. However, Murray et al.⁸ developed, implemented, and evaluated a simulated tornado disaster. Participants were nursing students ($n = 58$), students at an associate community nursing program ($n = 16$), students at a paramedic training program ($n = 4$), and 14 military medics-in-training. Results indicated that students learned “how to apply the knowledge they gained in school to a real-life situation.” Also, Innis and Mack⁶ simulated a disaster for 121 nursing students and students and providers from 6 health-care and emergency management professions. However, only nursing students were surveyed ($n = 78$). Positive aspects reported were that “the simulation provided training in communicating with patients and collaborating with other health care providers.” A study of 310 health-care professional students in universities in Pakistan analyzed students’ knowledge, attitude, and readiness to practice in disaster medicine. Results showed that students “had moderate knowledge, attitude, and readiness to practice. Also, knowledge and attitude factors were significant predictors of readiness to practice.”⁹ A 2023 review found that MCI simulations in the literature “appear to focus on carrying out the exercise itself rather than learning points, possibly missing opportunities to improve response plans.”¹⁰

Our experience was that the exercise needed thorough planning across participating actors, access to appropriate locations, equipment, toilets, food, markers, and rapid-response vehicles. The exercise also involved personnel from the ambulance, police, and fire departments, the military, and the Red Cross, in addition to students and facilitators. Hence, to be able to or be allowed to conduct similar exercises in the future, the learning outcome and effect need to be established. Greater collaboration between academics and clinicians can ensure that interventions to improve emergency teamwork are both contextually grounded and empirically validated.

Limitations

Only 124 respondents were included, and the study was conducted in a county in Norway. This limits the generalizability of our findings. Moreover, the questionnaire used was investigator-developed. To increase the face and content validity, experts were

involved in the development, and pilot participants secured that the questionnaire was relevant, understandable, and comprehensive.

Conclusion

This is, to our knowledge, a unique study assessing a full-scale, interteam MCI simulation from the perspectives of future health-care professionals, as well as personnel in various emergency teams taking part in an MCI response. The exercise was valued as an educational tool to increase preparedness for MCIs. However, good information and appropriate equipment were assumed essential to achieve the learning outcomes. Moreover, weakness in communication lines and triage is a threat to effective handling of MCIs. Future studies should aim at assessing the effectiveness of full-scale simulations versus other educational initiatives. Moreover, effort should be made to ensure that results from evaluations of both full-scale exercises and real-life events are used to improve preparedness.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/dmp.2024.158>.

Data availability statement. All data generated or analyzed may be retrieved through contact with the first author.

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Author contribution. ACLL participated in planning the study, facilitating the expert-group inputs, development of the questionnaire, data collection, analysis, and writing and approval of the whole draft of the manuscript. FW participated in planning the study, development of the questionnaire, facilitating the intervention, critical revisions of the manuscript, and approval of the final version of the manuscript. KGS participated in planning the study, development of the questionnaire, facilitating the intervention, critical revisions of the manuscript, and approval of the final version of the manuscript. LEU participated in planning the study, development of the questionnaire, facilitating the intervention, data collection, critical revisions of the manuscript, and approval of the final version of the manuscript.

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Competing interest. The authors declare that they have no competing interests.

Ethical standard. The study was based on the research ethical principles in the Declaration of Helsinki, on willing participation, anonymity, and confidentiality. Participants were informed that a completed and submitted questionnaire was assumed as informed consent to participate. No illiterate participants or participants <16 years were included. According to Norwegian legislations, no approvals are necessary when data is de-identified, no sensitive information is collected, and patients are not included.

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