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RESEARCH ARTICLE

Mass Casualty Incidents and Disaster Participation in Real versus Simulated Events in Romania

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Background: The current study outlines some of the main particularities of both real and simulated mass casualty incidents (MCI) and disasters in Romania as reported by medical and paramedical participating personnel. **Methods**: A non-profit organization in Romania trained 1250 doctors, nurses and paramedics for proper MCI interventions through a dedicated programme for the last part of the year 2013. Half a year later, an email with a unique link to an online questionnaire was sent to each participant to assess their opinion over the participation in real or already simulated MCI or disasters. The questionnaire consisted of 25 specific topics, out of which only a fraction were considered for the current study. **Results**: Out of all participants, 145 doctors, 184 nurses and 115 paramedics provided valid answers, totaling 444 responders. Most participants were satisfied with the information about the location and type of the incident they would respond to. The amplitude of a given event is generally well anticipated under simulation conditions as compared to real events, where the amplitude tends to be higher rather than lower than expected (p=0.0082). About three quarters of participants under real or simulated events repeated or demanded repeating the information trafficked through mobile radios, almost a quarter misinterpreted the information, and almost a half reported delayed operations due to miscommunication. **Conclusions**: Simulations are a proper method of communication evaluation for mass casualty incidents and disasters, which can also stress the common communication issues encountered during a real MCI unfolding.

Keywords: mass casualty incidents, MCI, disasters, simulation, Romania

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Background

Mass casualty incidents (MCI) and disasters are relatively rare events that by definition overwhelm the intervention capacity of the responding agencies. May that be momentarily for MCI or over a longer period of time for disasters, both raise particular management problems that are the object of timely training in order to achieve the best possible results under real circumstances.

However, an efficient management is not the only concern for these events. During their unfolding, a larger number of problems arise like miscommunication between participants, delays or lack of necessary information – medical and operational [1]. Certainly, some of these issues are not avoidable not because of the human factor but because of the technical limitations like communicating through a unified TETRA channel, adding an extra layer of push-to-talk radio communication or the inability to specifically filter the participants' exchanged information with the current setup.

In Romania, simulated MCI exercises are carried out regularly with preset scenarios. Unannounced evaluations are generally more useful and are a better indication of an actual initial response, but they are a lot more expensive and require the participation of already limited resources.

Studies regarding the professionals' perspective over their participation on MCI and disasters are very rare and are not generally dedicated to the investigation of the actual limitations and problems that are faced during the unfolding of these types of events. Moreover, there is a lack of studies regarding a comparative opinion over these aspects between real and simulated events.

The current study focuses on some of the main particularities of both real and simulated MCI and disasters in Romania as reported by medical and paramedical participating personnel.

Methods

In accordance with the official procedures for MCI and disasters operation, a non-profit organization in Romania with a dedicated mission to support the development of the national emergency medical system trained 1250 doctors, nurses and paramedics for a proper MCI intervention through a dedicated programme for the last part of the year 2013. The program enrollment required professional coordinates and contact information, especially electronic, to be used later on. Each participant spent a week for the theoretical classes held by field specialists in conjunction with corresponding workshops, simulated exercises on the field, and personal online study on the dedicated portal of the training programme. At the end of the training, each participant was evaluated by an online thorough test. All participants passed the required examination.

Half a year later, an email with a unique link to an online questionnaire was sent to each participant from an official institutional electronic address to assess their opinion over the participation on real or already simulated MCI or disasters. For the ones who did not respond to the questionnaire, a reminder was sent a week later, followed by a final extra reminder another week afterwards for those who

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did not respond by that time. This approach was used in order to collect as much information as possible without the intent of abusing the personal contact data of the participants and considering the invitation will most likely fall into an inbox more or less populated by commercials and/or undesired electronic postings.

The questionnaire consisted of 25 specific topics, out of which only a fraction were considered for the current study. Some of the questions were addressed dynamically depending on the participants' profession (doctor, nurse, paramedic), others depending to the answers they gave on previous questions. The responders were able to provide answers either binary or by five-point Likert scales, depending on the topic. Those were expressed as follows:

- Have you participated in a real operation of a MCI or disaster?
- What role(s) did you assume?
- When requested to participate, did you know the precise location of the event and the type of event?
- When arriving at the event scene, the real amplitude of the event was: lower/the same/higher?
- To what extent did you encounter communication difficulties when using mobile radios or phones?
- Were your actions delayed because of a lack of necessary information?
- Did you repeat or request the repeating of mobile radio or phone communication?
- Did you misunderstand the mobile radio or phone communication?
- To what extend do you think wasted moments were present during your operations?
- To what extent were you able to remember your operations and the ones of other participants as well as victims' details and event information the second day after the event?

All participants were informed on the data collection methodology and were given specific information regarding their rights to enroll and opt out of the study at any time without any limitation or required reason. No such requests were registered.

The data collection ended half a year later after the last email invitation had been sent, this being the timeframe considered to be a reasonable choice for a person to ever respond to a study by means of an electronic invitation under the given circumstances.

The data being entered by each user was collected in a cloud database using the Parse.com platform, with secure access for the study organizers. When completed, the platform allowed for data exportation as a JSON file, which was used in order to perform the statistical analysis after conversion to a more popular database file format. Searching for outlier values was done with the Grubbs test on a significance level Alpha of 0.05, then GraphPad Prism version 6 was the dedicated software that performed Chi-square tests for the Likert variables, Fisher's exact test for categorical variables, and the Mann-Whitney test for continuous variables. Statistical significance will be considered for values of $p<0.05$, with a confidence interval of 95%.

Results

The study enrolled 305 doctors, 383 nurses and 562 paramedics, totaling 1250 professionals trained under the current procedural and legal frame for MCI and disasters. At the end of the study, 11 doctors, 47 nurses and 55 paramedics weren't able to receive the study email invitations because of erroneous email addresses that were used at the time of enrolment, and 145 doctors, 184 nurses and 115 paramedics provided valid answers, totaling 444 responders.

Out of the specified total, 152 participants (34.23%) opted that their responses would refer to real events they had attended, and the remaining 292 participants (65.77%) would refer to event simulations only.

Even though the study addressed personnel from the whole country, the participation differs from county to county. Some counties didn't provide any personnel for training at all. The county distribution (*Figure 1*) sums up doctors, nurses as well as paramedics.

As for the general parameters of the two groups, none of them contained any outlier values or following a Gaussian distribution, with a mean age of 36.7 ± 7.3 years for the group that participated in real events versus 34.8 ± 5.8 years for the group that participated in simulations only, with a significant $p=0.0250$. Out of the total number of participants, the real events group had 67.11% males and 32.89% females versus 58.90% males and 41.10% females the simulation group had – although not statistically significant, with $p=0.1002$ (*Figure 2*).

When announced of an incident like a MCI or disaster, most participants (83.55% under real circumstances versus 88.73% under simulation, $p=0.8924$) were satisfied with the information about the location and type of the incident they would respond to. Once arrived, there seems to be a statistically significant difference with $p=0.0082$ over the amplitude of the event at the event scene compared to the one being announced when first called to action between real and simulated situations, with the dominance of the preserving of the event amplitude on simulations – 46.26% versus real events – 32.23% (*Figure 3*).

Regarding the roles assumed by participants under real situations as opposed to simulations, there is a statistically significant difference with $p<0.0001$ with a more pronounced participation of doctors and nurses working on mobile units under real circumstances – 18.78% versus 6.37% for doctors and 16.24% versus 8.08% for nurses, compensated by the same categories of personnel working at the scene of the event in the Advanced Medical Point (AMP) under simulation circumstances – 5.12% versus 1.02% for triage officers, 10.29% versus 4.57% for doctors and 10.29% versus 3.55% for nurses (*Figure 4*).

Once the event starts, communications come into play, the majority of participants noting small or average intensity radio and phone communication issues, with no

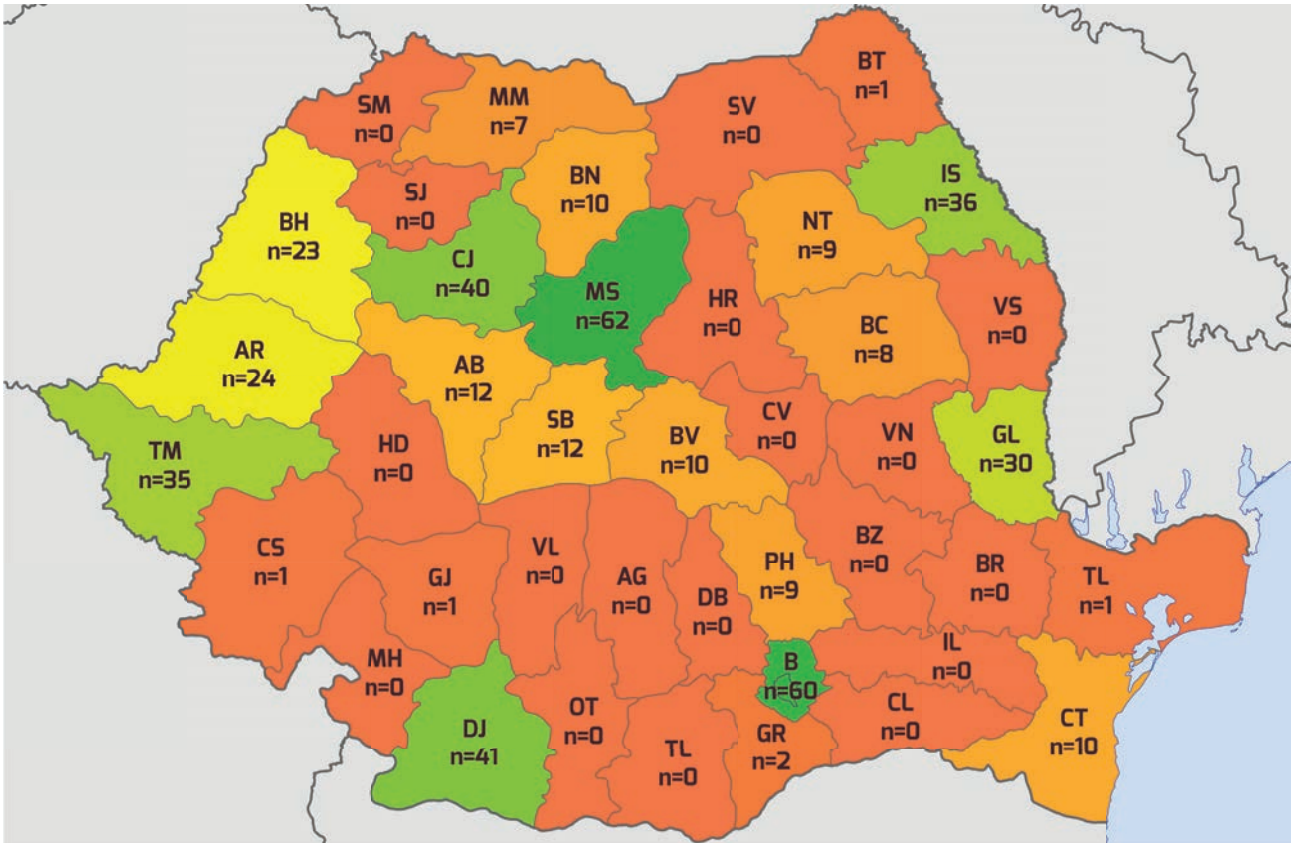

Fig. 1. Number of participants by county – also varying by county color as a scale from dark red to dark green

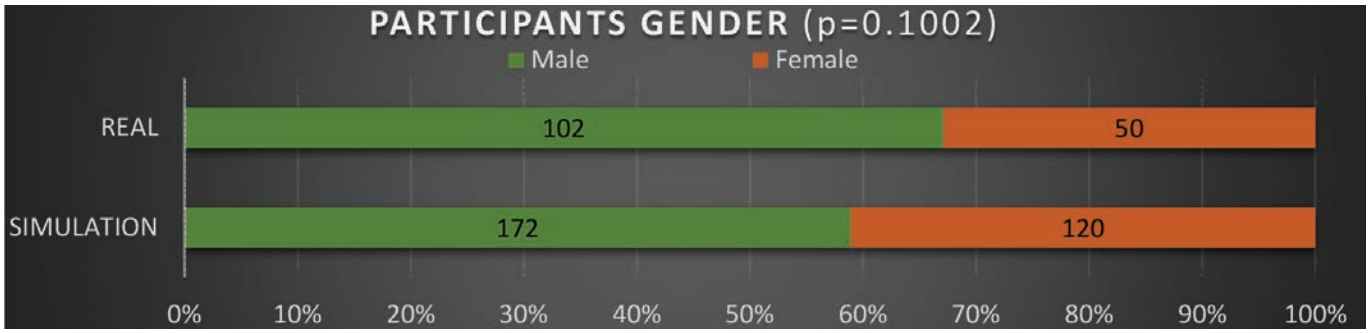

Fig. 2. Participants gender distribution for real and simulated events

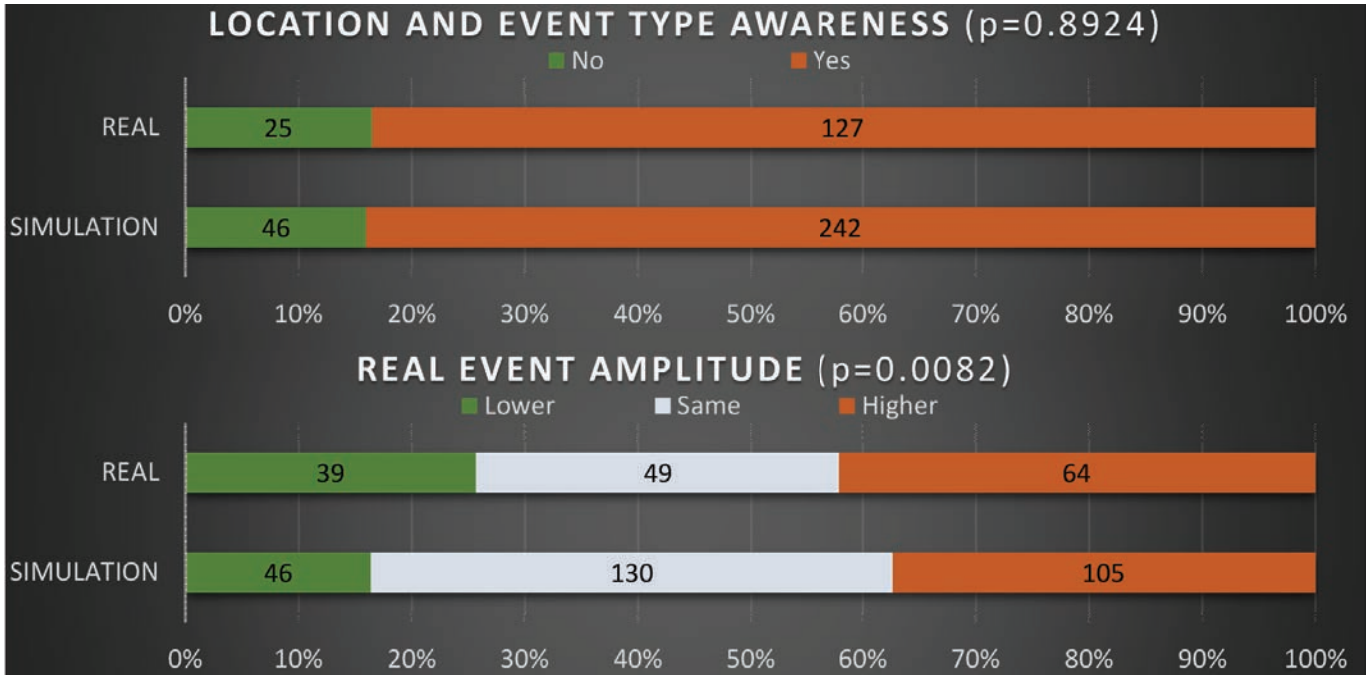

Fig. 3. Location and event type awareness and real event amplitude perception for real and simulated events

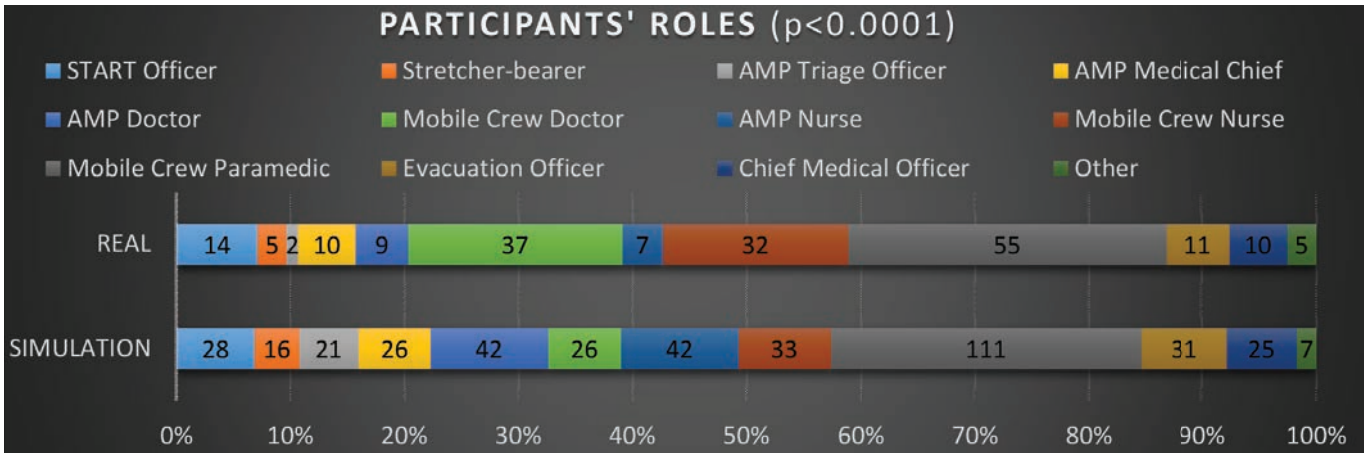

Fig. 4. Participants' roles distribution for both real and simulated events

statistically significant difference between the two groups (p=0.8619). However, 77.63% of real events participants and 76.76% of simulated event participants (p=0.9050) noted they repeated or requested the radio and phone communications being repeated during their actions. Also, 28.28% of real events participants and 24.91% of simulated events participants (p=0.4928) mentioned they misunderstood the information trafficked through radio and phone (*Figure 5*).

As for the course of operations, 45.39% (real events) and 48.41% (simulated events) of participants (p=0.6147) pointed out delays of their operations due to the encountered communication issues. As for their estimation of time being wasted due to miscommunication, 55.92% (real events) and 54.92% (simulated evens) of participants (p=0.9626) perceived the amount of wasted time was little (*Figure 6*).

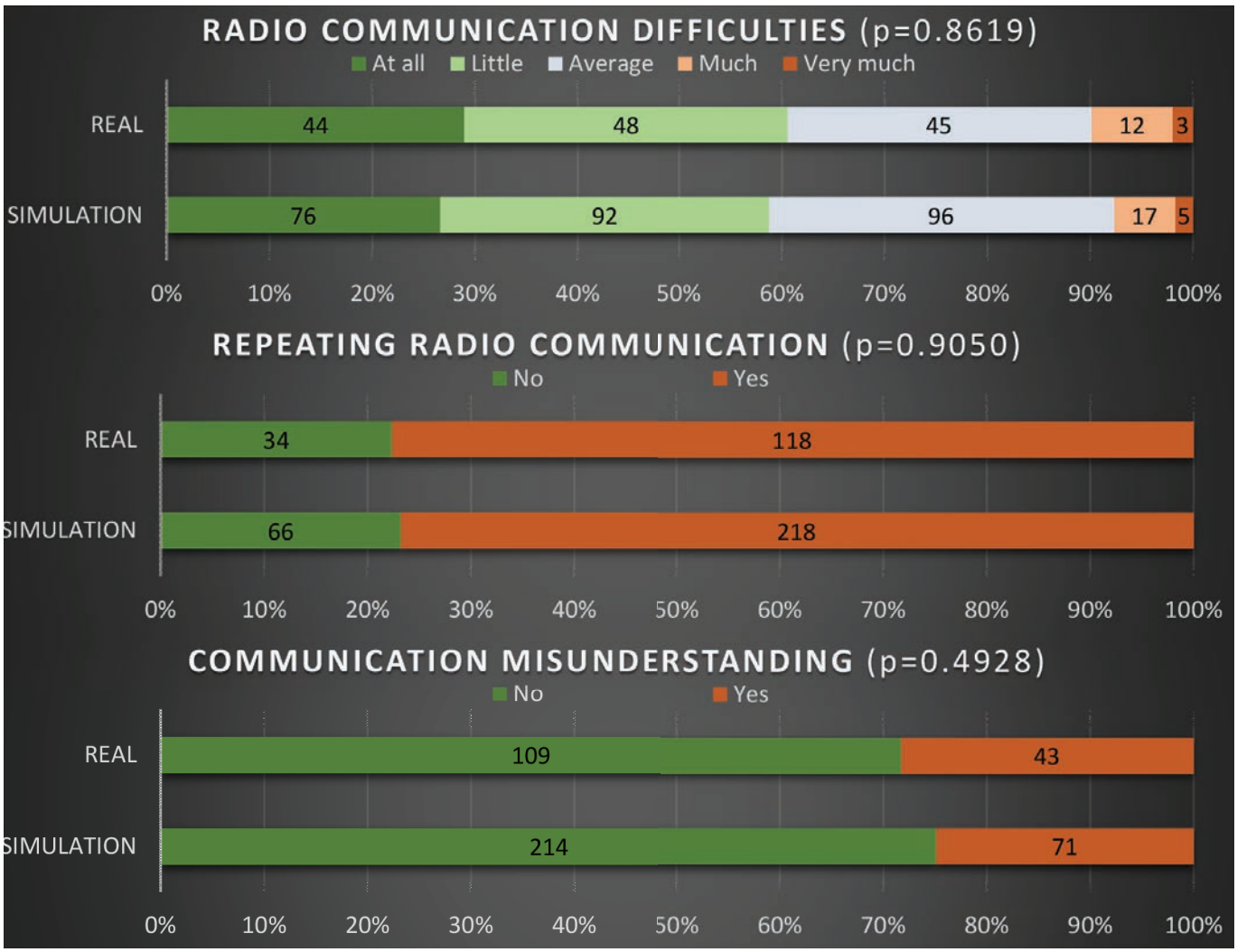

Fig. 5. General communication difficulties perception during real and simulated events

After the event had passed, 55.26% (real events) and 49.65% (simulated events) participants mentioned they could well recall the unfolding details of their actions and other participants' actions as well as patients' details, while 16.45% (real events) versus 27.46% (simulated events) participants felt like they had little or no recall of the event unfolding as opposed to 28.29% (real events) and 22.13% (simulated events) participants who mentioned a very strong recall, the differences being not quite statistically significant – p=0.0634 (*Figure 7*).

Discussions

The focus of the current study is a general communications overview in mass casualty incidents and disasters, a rare topic of a discussion board. There is currently a true lack of information over this matter, although its importance of it is outlined by studies that stress the need for proper assessments and adjustments on scene and remotely [2]. At the same time, there are studies under way that evaluate new action models[3,4,5], real or simulated [6], without a proper reference point.

The current study used an electronic approach to obtain the participants' opinion, and since email is widely used for basically all purposes this may explain why, surprisingly, a lot of target users did not respond. Even if the survey link was sent repeatedly from an institutional email address, it is still possible for the emails to have been marked as spam or have fallen between daily commercial emails, making the invitation harder to be noticed.

One important downside of the study is the lack of personnel from every county. Even if the responders are spread country-wide, they generally come from the counties that have a medicine university and/or well-known developed emergency centers. The rest of the counties fall short of both study participants and their access to timely professional development. Currenty there is no way to evaluate what their impact would have been over the study results.

As for the results of the current study, more than 80% of mass casualty incidents and disasters participants are well aware of the event location and type, with no statistically significant difference between real or simulated events. However, the amplitude of a given event is generally well

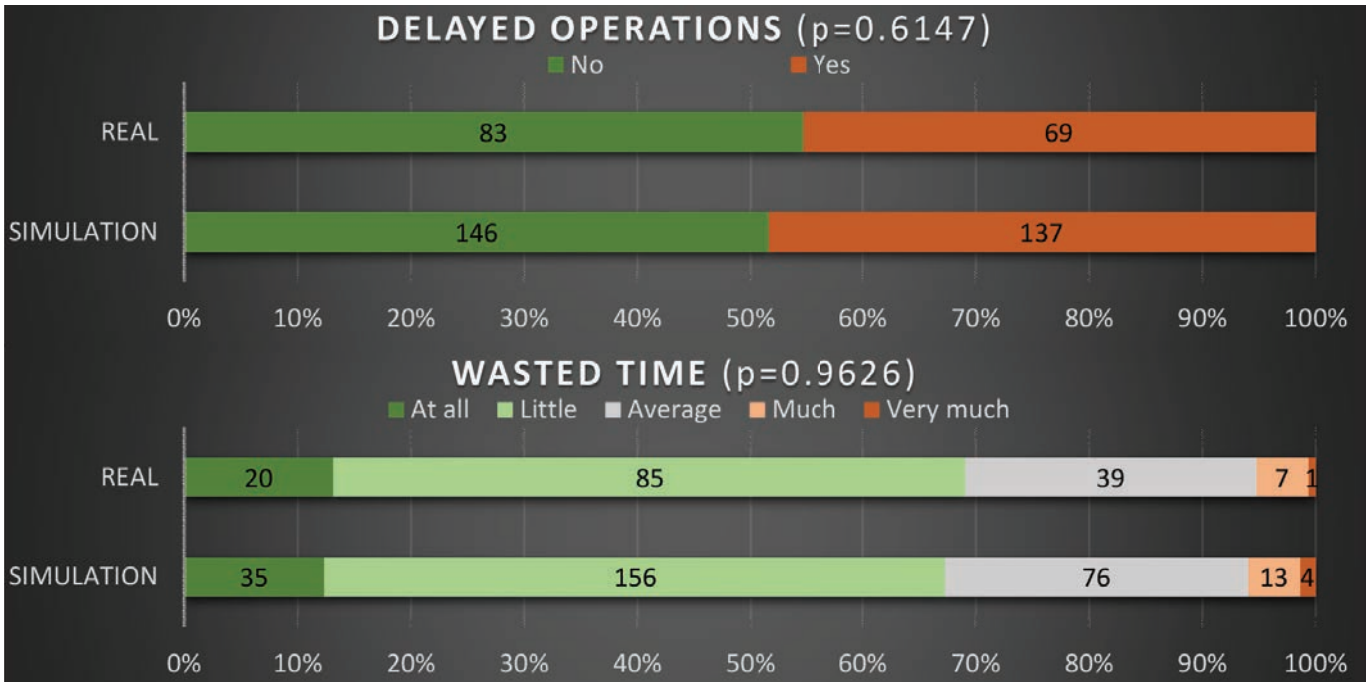

Fig. 6. Delayed operations and wasted time perception during real and simulated events

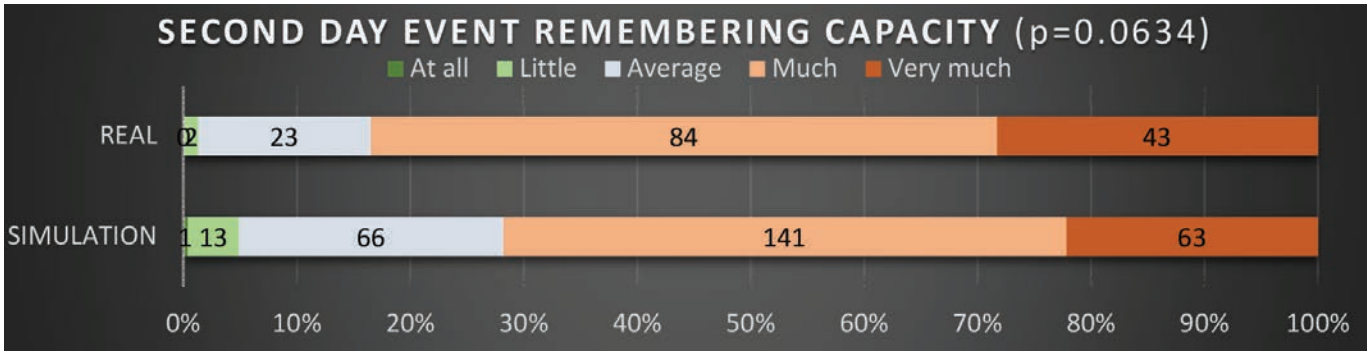

Fig. 7. Debriefing perception following real and simulated events

anticipated under simulation conditions as compared to real events where the amplitude tends to be higher rather than lower than expected.

There is also a significant difference in the design of simulations, with a switch between on-scene and on-route medical personnel, for both doctors and nurses. Simulations focus on the proper operation of the Advanced Medical Point, so that the roles therein are favored, even if under real circumstances the accent falls on medical mobile crews personnel.

The general opinion is that no significant communication issues are encountered, although: more than three quarters of participants repeated or demanded repeating the information trafficked through mobile radios, almost a quarter misinterpreted the information, almost a half reported delayed operations due to miscommunication, but also more than a half mentioned the wasted time is limited. There is no significant difference between real and simulated events over these matters. The discrepancy between the apparent lack of significant problems and the specific reported issues may be due to the lack of alternative: an event finally ends and there's no way to tell what the end result and performance would have been if communication was better. Also, since there's no visual real time evidence available for the participants, it is likely some of them resort to redundant radio practices in order to prevent errors.

Real events may have a more pronounced fingerprint on the memory of the participants, since there's no safety net of the unfolding. Real events are likely to be more vivid, so when debriefing is done later after the event ended, participants tend to have a stronger memory of the details and sequence of unfolding than simulations participants have.

Conclusion

Simulations are a proper method of communication evaluation for mass casualty incidents and disasters, but it may be useful to have a well documented thorrough country-wide evaluation and simulation personnel restructuring. Also, having a precise reference point over current communication issues opens the door for novel intervention models that may be properly evaluated in terms of efficency and relevance.

Acknowledgement

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