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Can Live-Actor Patients in a Mass Casualty Incident Exercise Benefit as Exercise Players?

Wei-Kuo Chou MD[1], Wen-Chu Chiang MD, PhD[2], Ya-Wen Chen NP[2] and Ming-Tai Cheng MD, MPH[2]

[1]Department of Emergency Medicine, National Taiwan University Hospital, Taipei, Taiwan and [2]Department of Emergency Medicine, National Taiwan University Hospital Yunlin Branch, Yunlin, Taiwan

Original Research

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Corresponding author:
Ming-Tai Cheng;
Email: jengmt1976@gmail.com

Abstract

Objectives: In a mass casualty incident (MCI) exercise, live-actor patients (LAPs) simulated different scenarios in the exercise. This study compared the benefit to LAPs with that to exercise players (EPs) and nonparticipants (NPs).
Methods: An MCI exercise was conducted in 2018. Emergency department (ED) nurses were assigned as EPs, LAPs, or NPs and asked to attend a pre-exercise lecture. A pre-exercise survey evaluated all ED nurses' background, confidence level, and knowledge of MCI management. Knowledge assessment included disaster medicine knowledge (DMK) and on emergency operation plan familiarity (EOPF). The same survey was conducted again after the exercise. A paired t-test was used to analyze the difference before and after the exercise in the 3 groups.
Results: Twenty-nine ED nurses completed both surveys. Confidence improved significantly for both the EP and LAP groups. The DMK of the LAP group improved significantly. EOPF also improved significantly for all 3 groups. A comparison of the improvement levels showed no significant difference between the EP and LAP groups for confidence, DMK, and EOPF.
Conclusions: ED nurses can benefit from participating as LAPs in full-scale MCI exercises. Having ED nurses act as LAPs makes it possible to train more staff in 1 exercise.

A mass casualty incident (MCI) is a major threat to the hospital and emergency department (ED). Thus, to simulate an MCI, the exercise requires an adequate number of patients. These mock patients may be simulated by mannequins or live actors, each with different advantages.[1,2] The MCI simulation with live-actor patients (LAPs) has been used for over 50 years.[3] Some exercises have used laypeople or students as LAPs, while other exercises have used trained actors.[2,4,5] Actors with a medical background have also been used as LAPs in some exercises,[6] while in other training exercises, trainees have been used as LAPs.[7–9]

In hospital MCI exercises in Taiwan, hospital staff are commonly used as LAPs to reduce exercise costs. Because experience-based learning is an important component of disaster exercises, the experience of participating in an MCI exercise as an LAP may offer trainees another way of learning.[7] A previous study also revealed that acting as a standardized patient had educational value for medical students in clinical skills courses.[10] If an LAP can benefit as much as an exercise player (EP), we can train more hospital staff in 1 MCI exercise. This can make MCI exercises more effective tools for training purposes. However, no previous quantitative study has evaluated the exercise outcomes for LAPs. Therefore, this study compares the benefits of LAPs with those of EPs and nonparticipants (NPs).

Methods

MCI Exercise Design

A hospital MCI exercise was conducted in 2018. The scenario of this exercise was a major traffic accident resulting in 30 trauma patients being sent to the ED. The purposes of this exercise were to evaluate the hospital emergency operation plan (EOP) and to train hospital staff. This was a full-scale exercise that involved ED nurses and other hospital staff, including physicians, security guards, and administrative staff. The physicians, security guards, and administrative staff were all EPs, but ED nurses were assigned to 4 different roles based on their shifts, the supervisor's decision, and exercise needs. The ED nurses were assigned roles of EP, controller, facilitator, and LAP.

Nurses who were assigned the EP role were asked to be ED nurses in the exercise. Controllers were asked to manage the exercise, and facilitators assisted in the conduct of the exercise. LAPs were asked to present their symptoms and signs of injuries and had moulage applied to simulate wounds, blood, and dressings. They were also asked to observe the EPs' operations and give feedback during the post-exercise debriefing.

The exercise was conducted in the emergency room. ED nurses who did not participate in the MCI exercise were responsible for managing the actual ED patients. All ED nurses were asked to attend a lecture before the MCI exercise. The lecture contained information regarding the Hospital Incident Command System (HICS) and the Simple Triage and Rapid Treatment (START) algorithm. The Eps used the HICS and START triage methods in the MCI exercise.

LAPs were given instructions before the MCI exercise to increase the simulation fidelity. The exercise management team leader explained each role in the exercise, provided information about the simulation preparations and gave a short lecture to enable the LAPs to simulate the symptoms and signs of patients in an MCI. The exercise controller explained the purpose of the simulated injuries in the MCI exercise and answered the LAPs' questions.

During the exercise, the EPs needed to take histories and perform physical examinations on the LAPs. The physicians of EPs could also arrange tests and provide treatment for LAPs in a safe way. LAPs could be discharged home or physically sent to the ward, intensive care unit, or operation room without entering it. In addition to presenting the symptoms and signs, LAPs also need to observe and informally evaluate the performance of EPs.

Study Design

ED nurses who were assigned to be EPs were defined as the EP group. ED nurses who played the role of MCI victims were defined as the LAP group. ED nurses who were not involved in the exercise were defined as the NP group. The pre-exercise survey was explained by the exercise management team leader and conducted with all ED nurses before the day of the exercise. The survey was used to evaluate the baseline MCI preparedness status of ED nurses, which included an informed consent section, demographic questionnaire, confidence level toward MCI management assessment, and knowledge assessment. The exercise management team leader collected the data. The demographic questionnaire included age, gender, working years, and previous disaster training experience (PDTE). PDTE was defined as the number of training sessions that ED nurses had completed before this MCI exercise.

The confidence level toward MCI management was self-assessed by all ED nurses using a 5-point Likert scale, where 1 = very unconfident and 5 = very confident. The knowledge assessment had 2 parts: disaster medicine knowledge (DMK) and emergency operation plan familiarity (EOPF). Each part included 10 multiple-choice questions. The correct answer was given 10 points, whereas the incorrect answer received 0 points.

The tests were designed and validity was assessed by experts in emergency and disaster medicine. The internal consistency and reliability of these 2 tests were assessed by a pilot sample of 37 nurses before the exercise, and Cronbach's alphas were 0.77 and 0.82 for the DMK and EOPF tests, respectively.

A debriefing was conducted immediately after the MCI exercise. Exercise evaluators discussed the strengths and areas for improvement with EPs, and the LAPs also shared their observations and opinions. A postexercise survey was conducted after the debriefing to evaluate training effectiveness. The postexercise survey was conducted with the same ED nurses, with the same content as the pre-exercise survey. The results collection was the same as the pre-exercise survey. ED nurses who completed both the pre- and postexercise surveys were included in the study.

Table 1. Demographic characteristics of the 3 groups

	EP (N=9)	LAP (N=11)	NP (N=9)
Male	N=0	N=1	N=0
Female	N=9	N=10	N=9
Age (y/o) (mean ± SD)	29.7±7.1	29.4±5.5	29.7±7.5
Working years (mean ± SD)	3.3±1.3	3.4±1.7	3.4±1.9
PDTE (mean ± SD)	1.89±1.6	2.2±1.6	2.1±1.8

Note: Abbreviations: EP, exercise player; LAP, live-actor patient; NP, nonparticipant; PDTE, previous disaster training experience; y/o, year old; yr, year.

Analysis

A paired t-test was used to analyze the differences in the mean scores of the 3 groups (EP, LAP, and NP) before and after the exercise. The measured data were described as mean ± standard deviation. An analysis of variance (ANOVA) and Fisher's least significant difference (LSD) were used to compare the levels of improvement among each group. A P-value of less than 0.05 was defined as statistically significant. Data were analyzed using SPSS 20.0 software (IBM Corp., Armonk, NY).

Results

Among the 49 ED nurses, 29 completed both the pre- and postexercise surveys and were included in the study. The EP group included 10 ED nurses, 9 of whom completed both surveys. The LAP group included 20 ED nurses, 11 of whom completed both surveys. The NP group included 19 ED nurses, 9 of whom completed both surveys. Table 1 shows the demographic characteristics of the 3 groups. None of the participants had actual experience in MCI management.

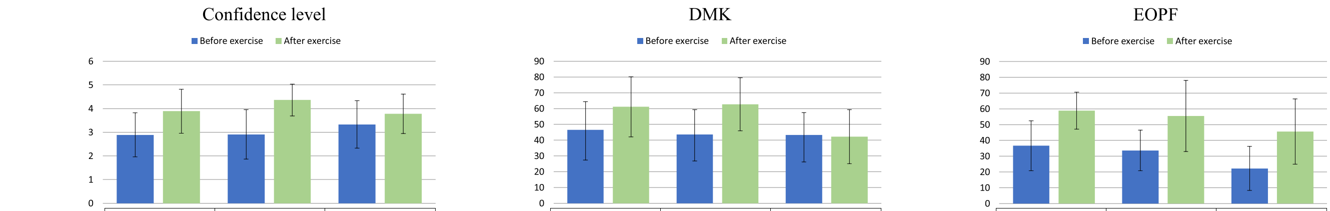
The scores of the pre- and postexercise confidence levels for MCI management and knowledge assessments are detailed in Figure 1. After the exercise, the confidence level toward MCI management increased significantly in both the EP and LAP groups (2.8 to 3.8 and 2.9 to 4.3, respectively). The confidence level in the NP group showed no significant change (3.3 to 3.7). Analysis of variance (ANOVA) showed a significant difference among the groups ($P = 0.003$). Fisher's LSD showed a significant difference in the confidence level increase between the LAP and NP groups ($P = 0.009$).

The DMK scores of the LAP group improved significantly after the exercise (43.6-62.7; $P = 0.012$). The DMK scores of the EP group showed improvement without statistical significance (46.4-61.1; $P = 0.117$). The DMK score of the NP group showed a slight decrease (43.3-42.2) without statistical significance. ANOVA showed a significant difference among the groups ($P = 0.008$). Fisher's LSD showed a significant difference between the LAP and NP groups ($P = 0.002$).

The EOPF scores of all 3 groups improved significantly after the exercise (EP group: 36.6 to 58.8; $P = 0.003$; LAP group: 33.6 to 55.4; $P = 0.01$; NP group: 22.2 to 45.5; $P = 0.01$). ANOVA showed no significant difference among the groups ($P = 0.9$).

Discussion

Because disasters are events that occur suddenly and violently, it is imperative to prepare hospital staff to respond.[3] As proxies for actual disasters, exercises can offer hospital staff effective training



Confidence level	EP	LAP	NP
Before exercise (mean ± SD)	2.889 ± 0.928	2.909 ± 1.044	3.333± 1.000
After exercise (mean ± SD)	3.889 ± 0.928	4.363 ± 0.674	3.778 ± 0.833
P value	0.036	0.001	0.321

DMK	EP	LAP	NP
Before exercise (mean ± SD)	46.447 ± 18.028	43.636 ± 15.667	43.333 ± 14.142
After exercise (mean ± SD)	61.111 ± 19.002	62.727 ± 16.787	42.222 ± 17.159
P value	0.117	0.012	0.882

EOPF	EP	LAP	NP
Before exercise (mean ± SD)	36.667 ± 15.811	33.636 ± 12.863	22.222 ± 13.944
After exercise (mean ± SD)	58.889 ± 11.667	55.455 ± 22.522	45.556 ± 20.682
P value	0.004	0.011	0.012

Figure 1. The scores of the pre- and postexercise confidence levels for MCI management and knowledge assessments. DMK, disaster medicine knowledge; EOPF, emergency operation plan familiarity.

and an opportunity to practice.[11–13] However, designing and conducting such full-scale MCI exercises require significant time and resources.[1,14] Additionally, the number of EPs is usually limited in the exercise. To gain the most out of these exercises, 1 possibility is to create a greater learning effect from the exercises for participants other than EPs.[14] As the first quantitative research study regarding the benefits of participating as an LAP in a disaster exercise, this study indicated that acting as an LAP is effective for improving staff confidence and knowledge. Therefore, being an LAP in the exercise could provide an additional training method for hospital staff in the future. The lack of staff involvement in hospital disaster preparedness is a worldwide problem.[15] Our results indicated that being an LAP may solve this problem. Moreover, disasters do not occur frequently, and repeated training is necessary to maintain hospital staffs' ability to respond to disasters.[16] However, the repeated experience of being an EP may increase staff workload. Based on these study results, hospital staff can also benefit from being LAPs to increase the effectiveness of the training exercises.

The management of an MCI requires confidence and knowledge. However, previous research and our results indicated that hospital staff lack confidence in MCI management,[17] which may be due to a lack of training or MCI exercises.[17] Previous studies have indicated that the confidence of disaster exercise players increased after exercise participation.[16,18,19] Our results revealed that the level of confidence increased after the MCI exercise only for the EP and LAP groups. This result indicated that exercise participation, regardless of whether it is as a player or mock patient, can increase confidence. LAPs can become more confident by analyzing disaster management through, for example, being triaged and treated as mock patients[20]

In addition to confidence, hospital staff need adequate knowledge of disaster medicine and familiarity with the EOP to manage an MCI successfully. Our pre-exercise survey revealed a low score for DMK and EOPF for all 3 groups, which may indicate insufficient staff training, supporting the findings of another study.[17] Some studies have also pointed out the poor knowledge levels of hospital disaster plans and response protocols among hospital staff.[15,19] However, disaster exercises and pre-exercise preparation as educational opportunities can improve preparedness.[15,19] Our results also indicated that the LAPs' DMK improved significantly after the MCI exercise.

The principles of adult learning may explain this finding. The first assumption of adult learning is that participants need to know why they are learning.[21] In an MCI exercise, LAPs need to present clinical symptoms and signs to EPs. More importantly, LAPs need to understand the meaning of their role and why it is important in MCI exercises.[22] This need gives LAPs a reason for learning. The authentic nature of the MCI simulation differs from the passive reception of knowledge through a lecture, and the role of an LAP offers nurses a motivation to acquire knowledge actively. The MCI exercise thus provided an opportunity for these learners to reflect upon the material being learned and practice their knowledge in the exercise.[7,20,21] This may also suggest the importance of the motivation created by participation in the exercise.

Olsén et al. compared the learning effects of EPs and observers and found that both players and observers could learn from exercises.[14] In that study, the authors pointed out that EPs learn through experience and observers learn from an overview perspective.[14] Like exercise observers, LAPs can observe what EPs are doing during the exercise. Through observation, LAPs can learn from finding errors in aspects of the care that they receive and the disaster response of EPs.[4] Moreover, they can gain new insights when relating the performance of EPs to how they would have acted.[14] However, observers may perceive a decrease in the realism of the exercise due to a lack of participation.[23] In contrast to observers, LAPs can observe EPs while participating in an exercise. Therefore, LAPs may learn from the aspects of being both a player and an observer.

To participate in the disaster exercise, EPs need to review the EOP before the exercise. On the other hand, the nature of using LAPs in the exercise to test the disaster plan may motivate LAPs to review the EOP. Although the EOPF scores increased in all 3 groups in our results, the pre- and post-exercise scores of the NP group were lower than the scores of the other 2 groups. It can be assumed that MCI exercises can promote EOP reading and increase familiarity with the EOP for both participants and nonparticipants, but the effectiveness can be increased while participating in the exercise, regardless of the role.

Our pre-exercise survey was conducted after the role assignment. The assignment may provide motivation for learning to LAPs and NPs, because they need to know about disaster medicine and EOP. Due to the need to participate in the exercise, LAPs and NPs might feel less confident and try to read EOP and learn some disaster medicine before the exercise. This may explain the pre-exercise survey results. In addition, the role assignment and exercise participation may also cause LAPs and NPs to learn from the exercise. This may lead to the difference after the exercise.

In addition to the exercise itself, pre-exercise preparation programs are also important for LAPs to learn. In some cases, the programs include lectures or briefings for all exercise participants, including EPs and LAPs. The pre-exercise activity may contribute to learning by addressing the importance and relevance of the issues that learners must address during the exercise.[19] In addition,

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LAPs are trained before the exercise by experts in emergency and disaster medicine to portray disaster patients.[3] This pre-exercise training for LAPs may become another interactive format with specific educational goals.[10] Furthermore, a postexercise debriefing offers participants an opportunity to discuss what happened during the exercise and identify what lessons could be learnt from it. By participating in the debriefing, LAPs may reflect on what happened during the exercise, which may transform their experience into learning.[14] As LAPs in the current study participated in the pre-exercise lecture and post-exercise debriefing, this may explain the significant improvement in their knowledge and EOPF after the MCI exercise.

Limitations

This study has several limitations. The first limitation was the study participants. The group assignment was not random, and the demographic distribution of the 3 groups was different, which may have caused some degree of selection bias. Because the MCI exercise was held by the ED, all participants were from the same department and the number of participants was limited. The response rates of the LAP and NP groups were not high, which may have also influenced the results.

Second, the participants' subjective feelings about learning during the exercise were not evaluated. There was no evaluation of the possible factors that could have increased their confidence level in MCI management or improved their knowledge, which may have interfered with the analysis of learning effectiveness.

Third, we investigated only the effects of the MCI exercise. Disaster exercises are conducted in hospitals with different disasters, such as earthquakes or fires. Although disasters other than MCI may create many patients, our study only analyzed the effect of the MCI exercise. The learning effect of LAPs in exercises other than an MCI remains uncertain.

Finally, the LAPs in our study were asked to observe the EPs' operations informally. LAPs can be used to collect data during a disaster exercise and can even contribute to the exercise evaluation and after-action review.[24] If LAPs in an MCI exercise are asked to do more evaluation work, they might have more chances to learn and improve their knowledge.

Conclusions

In summary, participating as an LAP in an MCI exercise can increase confidence in MCI management and familiarity with hospital EOP as much as participating as an EP. Participating as an LAP can also improve knowledge of disaster medicine better than participating as an EP. More hospital staff can be trained during an MCI exercise by acting as an LAP.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/dmp.2023.97.

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