REVIEW

The use of classroom training and simulation in the training of medical responders for airport disaster

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There is a dire need to have complementary form of disaster training which is cost effective, relatively easy to conduct, comprehensive, effective and acceptable. This will complement field drills training. A classroom-based training and simulation module was built by combining multiple tools: Powerpoint lectures, simulations utilising the Kuala Lumpur International Airport (KLIA) schematic module into 'floortop' model and video show of previous disaster drill. 76 participants made up of medical responders, categorised as Level 1 (specialists and doctors), Level 2 (paramedics), Level 3 (assistant paramedics) and Level 4 (health attendants and drivers) were trained using this module. A pre-test with validated questions on current airport disaster plans was carried out before the training. At the end of training, participants answered similar questions as post-test. Participants also answered questionnaire for assessment of training's acceptance. There was a mean rise from 47.3 (18.8%) to 84.0 (18.7%) in post-test ($p<0.05$). For Levels 1, 2, 3 and 4 the scores were 94.8 (6.3)%, 90.1 (11)%, 80.3 (20.1)% and 65 (23.4)% respectively. Nevertheless Level 4 group gained most increase in knowledge rise from baseline pre-test score (51.4%). Feedback from the questionnaire showed that the training module was highly acceptable. A classroom-based training can be enhanced with favourable results. The use of classroom training and simulation effectively improves the knowledge of disaster plan significantly on the back of its low cost, relatively-easy to conduct, fun and holistic nature. All Levels of participants (from specialists to drivers) can be grouped together for training. Classroom training and simulation can overcome the problem of ''dead-document'' phenomenon or ''paper-plan syndrome''.

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Training responders for airport disaster is costly. Airport disaster trainings through field drills involve a lot of money, time and effort. Nevertheless, field exercises pose problems in terms of communication, coordination, assignment of responsibilities and postevent mitigation priorities. Tabletop drills provide additional benefits for these settings.[1]

Although it is generally agreed that field drills are something that no airports can do without, in order to increase preparedness for any airport disaster, a complementary form of training that is less costly and that solves issues not dealt with by field drill is needed. Issues such as ease of conduct, cost, extent of involvement of personnel, disruptions of routine operations of the airport and effectiveness are examples of limitations in field drills. Knowledge of disaster research findings will help planners avoid common disaster management pitfalls, thereby improving disaster response planning.[2]

Simulations are valuable because they serve as guide for improvement of disaster plans.[3] The classroom training and simulation should deal with all the weaknesses and limitations of a physical drill. It is emphasised that this form of training is never set out to replace the current regularly scheduled physical drills. It is on the other hand an attempt to complement and maximise responders' performance and make all the money spent in organising the physical drills worthwhile.[4]

OBJECTIVES

1. To produce a classroom-based modified tabletop exercise with multiple enhancements as a training instrument for disaster training module which has the following features:

a. Economic
b. Powerful in terms of producing much effect with limited time
c. Integrating all personnel
d. Enables reasonably good understanding of current disaster plan
e. Maximises the effectiveness of a training and drill conducted in a classroom
f. Maximises the benefit of real physical drill by having a clear understanding of each role before its conduct

2. To assess the understanding of the disaster plan before (as baseline) and after exercise
3. To assess the acceptability and participants' perspectives with regard to this method of training through questionnaires

METHODS

A classroom-based training module which incorporates multiple modes of training tools and simulation was developed. These included:

1. Lecture on disaster management principles and current airport, national and responding hospital's disaster plan. Triaging method using the Simple Triage And Rapid Transport method[5] and communication method were included.

2. Video-drill recording of past disaster drills.
3. Modified tabletop exercise for airport and hospital disaster plan exercise. The exercise was conducted on the floor for a holistic ''bird's eye'' view for participants. Photo 1 shows the ''floortop'' module that was produced.
4. Use of miniature ''patients'' to practise triage and initial management: these are in the form of ''man-shaped plastic toys'', with vital signs of respiratory rate, pulse, mental status and clinical conditions taped on them.
5. Integration of the ''Game Master'' and ''Role Hats'' concepts.
6. Assigned roles and seats for responders.

Using the module produced (photo 1), simulations were done twice, at the beginning, before the training, and at the end, after participants received training. A pre-test with questions on current airport disaster plan validated by airport authorities was carried out before the training. At the end of training, participants answered similar questions in a post-test. The differences between pre-test and post-test were analysed. A questionnaire seeking feedback regarding the training module was administered after the training. The questionnaire's responses were based on the Likert Scale (strongly disagree, disagree, neutral, agree and strongly agree) towards statements relating to the training's acceptability.

THE TRAINING SEQUENCE

The training was conducted over a period of 4 h and conducted in sequential order as follows:

1. All participants were seated surrounding the ''floortop'' model. The chairs surrounding the floortop model were labelled according to responding groups: airport medical teams, responding hospitals , volunteers, Red Crescent and St John's ambulances, etc.
2. A pre-test containing general and specific questions regarding the airport disaster Plan and respective hospital's disaster plan was conducted. The questions were validated by the airport authorities and were in the form of multiple choice questions and fill-in-the-blanks of flow of medical response according to the local disaster plan.
3. A ''classroom pretraining simulation'' was started and participants responded according to whatever knowledge they had at baseline. Mistakes made were corrected and participants learnt about the disaster plan from the mistakes.
4. The lecture was delivered.
5. The video recording of previous airport disaster drills was shown so that the participants could to get a clear picture of the real situation on the field and at the airport disaster unit.
6. Post-training simulation was performed. By this time, the participants had a clear picture and a correct understanding of the whole process according to the disaster plan. The Game Master introduced situations to be solved and each responder (belonging to the respective unit— the airport personnel, hospital personnel or voluntary body) played his role.

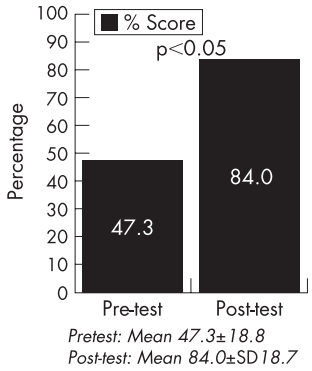

Figure 1 Overall results of responders' scores during pretest and post-test in the classroom training and simulation.

7. A post-test with similar questions as that of the pre-test was administered.
8. Questionnaires regarding the views and acceptability of this form of exercise were answered by participants.
9. A debriefing was done and the floor was opened to all participants to air their comments and views.

RESULTS

Population of participants

A total of 76 participants participated in the study. All 76 participants were divided into 4 levels (level 1 to level 4), each on the basis of their level of education and capability. The distribution of the participants was as follows:

- Level 1 (consisting of specialists and doctors): 18.3%
- Level 2 (consisting of staff nurses and paramedics): 43.3%
- Level 3 (consisting of assistant nurses and assistant paramedics): 19.7%
- Level 4 (consisting of ambulance drivers and health attendants): 19.7%

Comparison between pre-test and post-test performance

The results (fig 1) showed that the mean (standard deviation (SD)) post-test score for all groups was 84.0 (18.7%) as opposed to 47.3 (18.8%) in pre-test. Also, there was a significant change after the intervention in the form of this classroom-based training module, with $p<0.01$ using paired t test. The comparison of pre-test and post-test scores of each level showed marked improvement with the training (table 1).

Pre-test and post-test comparison of each level

Level 1 group had the highest score in both the pre-test and post-test when compared with other levels. In both pre-test and post-test performance, level 2 group had a score comparable to that of level 1 group. Level 4 group had the lowest score in both the pre-test and post-test when compared with other levels. Nevertheless, the level 4 group benefited the most in the sense that their rise of score was the highest (51.36%) compared with other levels (fig 2 and 3).

Table 1 Comparison between individual group's performances in the classroom simulation and training pre-test and post-test

Levels	Level 1		Level 2		Level 3		Level 4	
Test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pretest	Post-test
Mean (SD) score	54.4 (17.7)	94.8 (6.3)	52.5 (18.5)	90.1 (11)	41.7 (16.9)	80.3 (20.1)	13.6 (7)	65 (23.4)

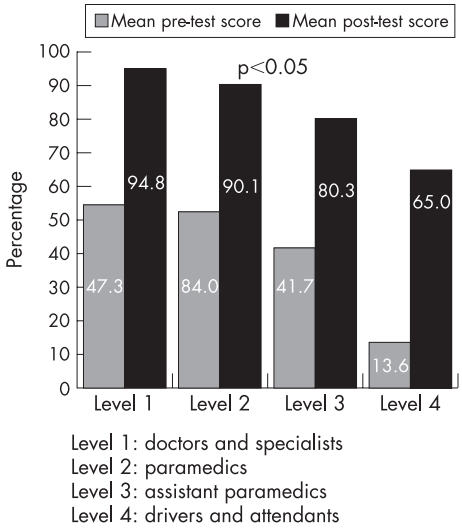

Figure 2 Comparison between individual group's scores in the classroom simulation and training pre-test and post-test.

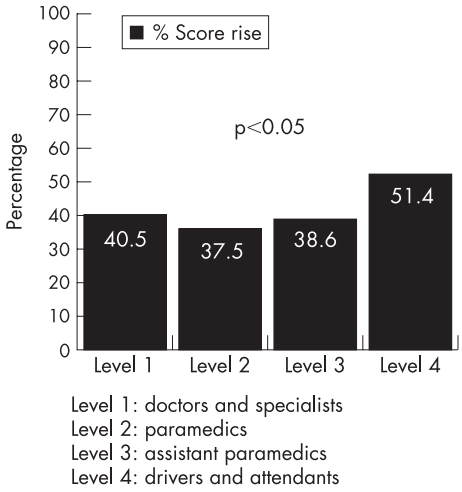

Figure 3 Percentage of score rise in levels of participants

The graph in fig 3 shows the rise of percentage score among participants in each group. It can be seen that level 4 participants, despite scoring less in the post-test, gained the most from the training.

Responses to the questionairre

In past studies, tabletop exercises were found to be a feasible and well-accepted modality for training in hospital preparedness. Hospital employees, including doctors and nurses, ranked this method as highly useful for guiding preplanning activities.[6] Most participants found that the training: provided a clear understanding, was useful, should be extended to all, was easy to accept, fun, and easy to conduct, exposed the weaknesses in the current plan and increased mental preparedness for disaster whereas the video show provided a clear picture of an airport disaster situation. The responses were generally either ''strongly agree or agree'' (these two opinion groups in combination ranged between 78.9% and 100%) to all these statements, with χ^2 tests showing a p value <0.05 for each response. The training module was clearly well received by the participants.

DISCUSSIONS

This study has shown that the responders' overall baseline knowledge on their local airport disaster plan was only 47.26% (18.8%). There was clearly a need to improve this knowledge among the responders. The classroom training and simulation had been able to improve drastically medical responders' understanding of the existing airport disaster plan. The mean rise from 47.26% (18.8%) to 84% (18.7%) as shown in fig 1 was a significant rise (p value <0.05). This classroom training and simulation was clearly beneficial in increasing the theoretical knowledge of candidates. Sarpy *et al*[7] also showed the effectiveness of this kind of tabletop exercise in increasing participants' competency-related knowledge and skills. Therefore, it makes much sense that disaster trainings incorporate tabletop exercises for its strength in this respect.[8]

All groups (level 1–4) benefited from the training, with significant increase in post-test performance for each group ($p<0.05$). As shown in table 1, doctors and specialists were clearly the best candidates in this training. Staff nurses and paramedics also performed quite well, next best to the level 1 group. Level 3 candidates (assistant nurses and assistant paramedics) with a mean (SD) score of 80.3% (20.1%) performed reasonably well, whereas level 4 candidates (drivers and attendants) scored the lowest marks, with a mean (SD) score of 65% (23.4%). Participants of level 1, level 2 and level 3 were capable of scoring up to a maximum of 100% as highest

Photo 1 Layout of the floortop model in the classroom simulation and training.

Table 2 Responses to questionairre statements

	Questionnaire statements: This training ……	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	χ^2 p value
1	Is useful	0	0	0	26.3	73.7	<0.05
2	Provides a clear understanding of the disaster plan	0	0	3.9	43.4	52.6	<0.05
3	Should be extended to all medical staff	0	0	2.6	36.8	60.5	<0.05
4	Is easy to accept	0	1.3	9.2	43.4	46.1	<0.05
5	Is fun	0	0	13.2	36.1	40.8	<0.05
6	Is easy to conduct	0	1.3	19.7	42.1	36.8	<0.05
7	Exposes the weaknesses in the current disaster plan	1.3	1.3	5.3	55.3	36.8	<0.05
8	Increases mental preparedness for disaster	0	1.3	5.3	46.1	47.4	<0.05
9	Provides a clear picture of the disaster situation and management with the video show of previous field drills	0	1.3	14.5	53.9	30.3	<0.05

mark. Participants of level 4 were capable of scoring up to a maximum of 95.35%. This means that this classroom training and simulation can be effective for participants from all levels of academic qualifications. The most remarkable thing to note from this study was that level 4 participants made up of drivers and health attendants had the highest rise of knowledge from the baseline. Their knowledge of the disaster plan jumped by 51.4% at the end of the training (fig 3). Clearly, the lowest level of health responders can be grouped together with doctors and paramedics for the disaster training.

Concepts that support the success of this training

As shown in table 4, most participants found that the training was very acceptable. Although every effort was made to search for certain concepts and ideas to make the training of this nature successful, it was found that the existing evidences in this respect are not many. A systematic, evidence-based process evaluating different methods of disaster training for hospital staff showed that most methods were characterised by significant limitations in design and evaluation. The strength of evidence in other training methods was insufficient to draw valid recommendations, whereas current evidences on the effectiveness of mass casualty incidence training for hospital staff is limited.[9] Nevertheless, certain concepts introduced in this training were noted to have made this training effective and successful. These included the following

1. The ''game master'' concept: This concept was introduced to give only one person the ''power'' to control the simulation. He is the only one who can put up scenarios and navigate the simulation. At the beginning of the simulation this role was spelled out clearly and was to be agreed on by all participants. The game master would control the flow of the game and avoid wasting of time while the training was being conducted. The concept allowed effective control of the simulation and avoided unnecessary disruption of flow or deviation from the core issues during the exercise.

2. ''Toy patients'' These were in the form of miniature plastic men, used to train responders to perform triaging. On each of these toy patients, the respiratory rate, capillary refill time/pulse and mental status, blood pressure and injury information were specified on a piece of paper glued to the body. This allowed the application of Simple Triage And Rapid Transport method concept in triaging the patients during the simulation. The toy patients were necessary as triaging would be the essence in initial management of any disaster. The participants became very involved as they triaged the patients and this boosted their confidence in performing triaging.

3. Vests and hats for different roles: Differently labelled vests and hats were used to identify role players according to the local incident command system. These roles included the police, fire and medical commanders at strategic or other tactical and operational roles under their command. This was done to give the sense of belonging to the roles played by participants. Participants would feel the need to give their best in performing while playing out these roles.

4. The pretraining simulation: This simulation was powerful as it provided immediate impact to kick-start the feel of being in a disaster right at the start of the training. Responders did not feel embarrassed to make mistakes, and with each mistakes corrected they learnt much even before the training was started. Having gone through the mistakes, they performed in a spectacular manner in the post-training simulation.

5. The floortop concept: Floortop is a much more ergonomic position compared with tabletop. This position allowed more comfort and longer span of attention to all participants. The advantage of bird's eye view was that it enabled all participants to see every aspect of the sequence and roles played in the exercise, thus benefiting them maximally.

All these concepts had helped make this training a success. It is recommended that tabletop exercises include concepts such as this to make them more effective.

The classroom training and simulation also dealt with the following problems:

1. *Cost*: cheaper than field drill (It cost only US$205 to prepare the module)
2. *Narrowness of scope of those involved*: every activity of participants could be witnessed by all participants
3. *Limited number of people involved*: the number of people involved could be expanded as the exercise could be repeated as often as required because it is cheap and easy to organise
4. *Limited exposure*: participants get to see what others are doing and thus understand the role of others (This will enable a holistic understanding of the disaster plan.)
5. *Ease of conduct*: the simulation can be conducted as frequently as desired because there is zero disruption of airport operation (A classroom is all that is needed as venue of training.)

Written plans are important, but they do not assure preparedness by themselves. Emergency plans become an illusion if they are not known and accepted by participants, if they are not based on valid assumptions on human behaviour, if they do not incorporate an interorganisational perspective, if they are not tied to resources and if they are not tied to training programmes. This illusion, called the ''paper plan syndrome'',[10] needs solution and the classroom training may be of great use to treat this syndrome. This training will also bring alive ''dead'' documents and refresh the knowledge of the plan to all participants. A classroom-based training and simulation will also enable decision makers or policy makers to sit around and watch and anticipate the problems of the current disaster plan and recommend changes.[11] The exercise format can also be

effective in increasing healthcare administrators' capabilities related to disaster management and response.[12] A national centre for disaster teaching and research will be a wonderful idea for disaster training.[13] In view of this idea, the classroom training and simulation, in view of its acceptability, may be incorporated in an institution like this as part of the training component.

CONCLUSIONS

The classroom training and simulation module provides a complementary method of training for airport disaster. It could solve problems and weaknesses incurred in field drills. The use of classroom training and simulation clearly improves the knowledge of disaster plan significantly on the back of its low-cost, relatively easy to conduct, fun and holistic nature. All levels of participants (from specialists to drivers) could be grouped together for classroom training and simulation. They scored differing marks but each gained a considerable increase of knowledge. This form of training was well received by all the participants. The classroom training and simulation can overcome the problems of ''dead-document'' phenomenon or ''paper-plan syndrome'' for which disaster plans remain on paper and are not frequently practised. It is also beneficial for planners and decision makers who need to see the overall flow of the disaster plan and its weaknesses and subsequently make necessary changes for improvement.

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REFERENCES

1 **Chi CH**, Chao WH, Chuang CC, *et al*. Emergency medical technicians' disaster training by tabletop exercise. *Am J Emerg Med* 2001;**19**:433–6.
2 **Auf der Heide E**. The importance of evidence-based disaster planning. *Ann Emerg Med* 2006;**47**:34–49.
3 **Henning KJ**, Brennan PJ, Hoegg C, *et al*. Health system preparedness for bioterrorism: bringing the tabletop to the hospital. *Infect Control Hosp Epidemiol* 2004;**25**:146–55.
4 **Levi L**, Bregman D, Geva H, *et al*. Hospital disaster management simulation system. *Prehospital Disaster Med* 1998;**13**:29–34.
5 **START triage plan for disaster scenarios**. *ED Manag* 1996;**8**(Suppl 1):103–4.
6 **Henning KJ**, Brennan PJ, Hoegg C, *et al*. Health system preparedness for bioterrorism: bringing the tabletop to the hospital. *Infect Control Hosp Epidemiol* 2004;**25**:146–55.
7 **Sarpy SA**, Warren CR, Kaplan S, *et al*. Simulating public health response to a severe acute respiratory syndrome (SARS) event: a comprehensive and systematic approach to designing, implementing, and evaluating a tabletop exercise. *J Public Health Manag Pract* 2005;**11**(6) (Suppl):S75–82.
8 **Advanced Life Support Group**. *Major incident medical management and support; the practical approach*. London: BMJ Publishing Group, 1995.
9 **Hsu EB**, Jenckes MW, Catlett CL, *et al*. Effectiveness of hospital staff mass-casualty incident training methods: a systematic literature review. *Prehospital Disaster Med* 2004;**19**:191–9.
10 **Auf der Heide E**. Disaster response—principles of preparation and coordination. Online Edition. http://orgmail2.coe-dmha.org/dr/DisasterResponse.nsf/section/B9BAA72900B166890A25691A006604F9?opendocument&home=flash.
11 **Lee WH**, Kuan JT, Shiau YW, *et al*. Designation of a new training model of a local disaster medical system with tabletop exercises. *Chang Gung Med J* 2003;**26**:879–88.
12 **Pryor E**, Heck E, Norman L, *et al*. Integrated decision-making in response to weapons of mass destruction incidents: development and initial evaluation of a course for healthcare professionals. *Prehosp Disaster Med* 2006;**21**:24–30.
13 **Rutherford WH**. The place of exercises in disaster management, injury. 1990;**21**:58–60, discussion 63–4.