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# Basic-SiM train-the-trainer: A resuscitation training module for cabin crew in Malaysia

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## Abstract

We tested the Basic-SiM train-the-trainer simulation-based resuscitation training module among airline instructors to train the cabin crew in Malaysia. Selected airline instructors were asked to attend a Train-The-Trainer course and then use the knowledge to test their airline cabin crews who were divided into 2 different groups (n=65) using different debriefing methods (customary vs *DIAMOND*) at both the baseline and at 6 weeks post-intervention on resuscitation knowledge and technical and non-technical skills through a MCQ test, TSTC, and CETAM. There were no significant differences in terms of the different debriefing methods on the improvement of all variables except for technical skills in both groups, $F(3,123) = 0.540$, $P=0.656$, and partial eta squared=0.013 despite retention for all variables. This module is an effective approach to develop trainers for simulated resuscitation training and was proven to be effective in improving the knowledge and skills of cabin crew in Malaysia.

**Keywords:** cabin crew, debriefing method, resuscitation training, simulation learning, Train-the-Trainer

## 1. Introduction

The development of the Malaysian aviation industry has occurred rapidly and directly encourages more people in Malaysia to choose to travel by commercial flights as shown in the increase of passengers to 2 million people per year compared to the much smaller numbers posted years ago. Statistics on airline activities around the world indicate that the increased travel by commercial flights in addition to the aging population contribute to an increase in in-flight medical emergency cases (http://www.transtats.bts.gov). In-flight emergency medical cases are a new phenomenon that still lacks attention (Amit & Shauna, 2013). Aside from the compact and small cabins with minimum space available to provide medical care, the low possibility of getting help from a medical doctor, nurse or medical assistant indirectly impacts and causes a variety of complications to passengers (Amit & Shauna, 2013).

The above issues can be overcome by having the airline crew trained in first aid in order to ensure that proper treatment is given timely and accurately. Every crew member on duty must undergo intensive training in order to be certified as a first aider. In the past, almost 3-quarters of in-flight emergency cases were handled by airline crew who

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were competent in carrying out their duties as a first aider (Dowdall, 2013). However, a study by Mahony (2008) which tested the airline crew's knowledge and performance of cardiopulmonary resuscitation (CPR) and the automated external defibrillator (AED) through a recurrent examination to renew the crew's safety and emergency licenses showed unsatisfactory results. The crew tested had failed on techniques such as proper hand positioning while performing CPR, use of the AED, as well as having a low level of knowledge and self-confidence. Low mastery of technical skills and knowledge retention in first aid amongst crew members have also been documented in several previous studies. These problems were attributed to several key factors including ineffective teaching and learning techniques, modular teaching, different learning methods according to each airline academy, and insufficient training duration (Mahony, 2008).

In addition to knowledge and technical skills, non-technical skills also play an important role in improving patient safety (Sevdalis, Hull, & Birnbach, 2012). In medical and health sciences education, professional training conducted by a faculty is more focused on technical knowledge and skills and not geared specifically to non-technical skills, such as communication, teamwork and leadership. However, in the present medical world, non-technical skills are the skills that should be mastered in full view as this skill is most important to be practiced in everyday work (Rasmussen *et al.*, 2012).

In developing a quality crew to provide medical care to patients, teaching and learning methods need to be extended and not focused on technical knowledge and skills alone due to the crew's lack of exposure to non-technical skills, in particular those that contribute significantly to errors in giving emergency treatment to passengers (Pronovost, 2013). Similarly, the lack of exposure to emergencies, insufficient training duration, and time constraints to engage with facilitators are additional factors leading to ineffective training which consequently, have an impact on the crews' quality and performance when giving emergency treatment to patients (Dreifuerst, 2009).

The train-the-trainer (TTT) module integrated with simulation-based learning is an instructional method that has been used successfully in both health sciences and medical education and has shown benefits in terms of development of clinical skills, knowledge on patients, and health management (Riley, Grauze, Chonnery, Horely, & Trewhella, 2003). The Institute of Medicine (http://www.nas.edu) claimed that this learning method is an innovation aimed to strengthen the learning process in the health sciences clusters through improvements in the skills of the students which will thereby reduce the risk of error to patients. The nursing field is also concerned about the importance of this learning method; therefore, trainers in this field should use this method as a teaching and learning methodology to generate specific clinical skills (Grantt & Webb, 2010).

As such, we have sought a potentially sustainable solution to overcome the boundaries to education and training for airline academies through the introduction of the TTT module of resuscitation incorporated with basic simulation which uses first aid airline instructors as trainers to teach basic life support (BLS) to the cabin crew. The effectiveness of this module was assessed as statistically significant in the numerous components of resuscitation knowledge, skills, and non-technical skills among the cabin crew.

## 2. Materials and Methods

This project was developed by a team of health educators from Universiti Kebangsaan Malaysia (UKM) in collaboration with an airline company in Malaysia. Ethics approval was obtained from the Faculty of Health Sciences, Universiti Kebangsaan Malaysia (UKM) Research Committee (NN-2017-105) on Ethical Research in humans. According to the protocol, the research team described the details of the study and acquired written consent prior to the commencement of the intervention. This study was conducted at the airline academy of the airline company between August and December 2017. Our study population consisted of trainers who were participants in the Basic-SiM workshop and the cabin crew who attended the pre- and post-training assessment.

### 2.1 Phase 1: Training the trainers

The first section of the study involved training the trainers which consisted of 3 certified first aid trainers from the department of safety and emergency of the airline academy who each possessed different healthcare backgrounds (registered nurse & medical doctors). Each prospective trainer underwent a 1-day training session held from 0830 h to 1600 h.

The aim of the workshop was to ensure that each trainer was fully equipped with the knowledge and skills needed to conduct basic simulation learning through role-plays with case scenarios together with structured debriefing following a simulation. The two instructors responsible for the training session are simulation instructors certified by the Simulation Skill Lab of UKM Medical Centre.

The Basic-SiM Train–the-Trainer for Airline Instructor handbook that was used as the manual for this workshop is largely based upon the modified content of the Structure & Support Debriefing Instructor Training (American Heart Association) & SimPle Teach (Simulation Practice for Teaching & Learning) endorsed by the A & E Department of UKM Medical Centre.

The workshop began with a general introduction on the application of simulation learning in the healthcare industry, followed by specific content on the element of non-technical skills. The session continued with the identification of simulators and design of case scenario, followed by an introduction to the different models of debriefing and their application in different domains. The session was concluded with a practice workshop on how to conduct effective debriefing techniques based on the selected models given following a simulation learning session. The manual included a supplementary document on a relevant adult education theory which outlined the teaching goals that might aid in the delivery of the course content. The adult education theory and trainer training module within the manual were taken from the "Medical Education Theory & Practice".

## 2.2 Simulation based-first aid learning for cabin crew (phases 2 and 3 of the intervention)

The second and third phases required the "trained trainers" to conduct a simulation-based first aid learning course on a sample of cabin crew for 10 weeks. In this section, only two trainers were involved in delivering the simulation learning to 10–15 cabin crew members in line with the requirement of the session to keep a minimal ratio of 1 instructor to 10 individuals in all sessions. The participants consisted of experienced cabin crew from the airline company. The purpose of this session was to apply the simulation learning associated with BLS knowledge and skills to the cabin crew who were assumed to have no prior knowledge and experience in simulation learning. The point of interest of this learning was on the BLS knowledge, practical skills and non-technical skills that can be required and practiced by cabin crews in their working environment. The skills that were taught encompassed three approaches which were to maintain the patient's airway and breathing, provide effective CPR, and use the AED associated with non-technical skills including effective communication, teamwork among the crew members, decision making, and situational awareness.

The trainers carried out the simulation learning with the aid of training manikins and other supporting safety equipment on board the aircraft as well as learning materials, such as Power Point presentations and a wall chart to indicate the elements of technical and non-technical skills. Prior to the session, the baseline data of all participants were collected together with their consent forms. The learning session was divided into control and experimental groups. Each session was held from 0800 h to 1600 h and included general briefing, assessment, simulation via role-play, and debriefing sessions. The intervention started with a general briefing, followed by a pre-assessment on the cabin crew's knowledge on BLS using a 30 multiple-choice questions test which lasted for approximately one hour. Next, the participants were grouped into teams of five members for a flight simulation using the case scenario method. They were oriented to the role-play based on the case scenario given which covers the expected learning objective and skills (technical & non-technical) to be acquired based on the elements written on the wall chart.

The afternoon session included the role-play session which lasted for 10–15 min. In this session, the trainer assisted the teams by providing instructions and prompts on the specific expected actions to be taken. Following this session, the trainer conducted a 30- to 45-minute debriefing session to reflect on the actions of the participants. The feedback consisted of both positive feedback and constructive criticism (Figure 1). The only difference between the two groups was the type of debriefing models used to conduct the debriefing session. A customary debriefing was conducted by the trainer who handled the control group, while the experiment group was debriefed using the *DIAMOND* structured model. Since the knowledge and skills of each participant were assessed before and after they went through the intervention, thus each role-play session was recorded for evaluation purposes by selected expert raters. At 6 weeks post-intervention, all participants had to go through an identical assessment as follow-up (Figure 2).

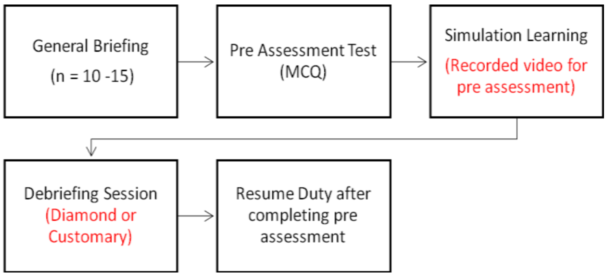


Figure 1. Flowchart showing the summary of a Phase 2 intervention.

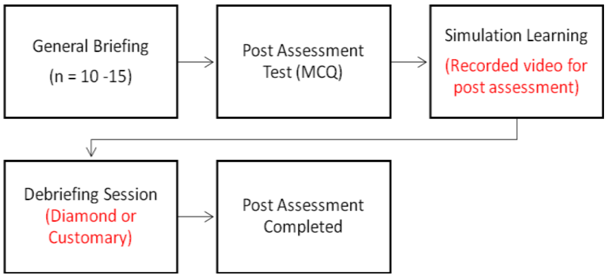


Figure 2. Flowchart showing the summary of the Phase 3 intervention.

## 2.3 Outcomes

The primary outcome was measured by the effectiveness of this simulation-based learning module to enhance the cabin crew's BLS knowledge and skills taught via the 'trained trainers'. Assessments were completed at pre-training and at 6 weeks post-training following the international guidelines which advocate the use of repeat assessments to ensure adequate retention of knowledge and skills following the training (Nolan *et al.*, 2010). The secondary endpoint of this study was the comparison between the structured and unstructured debriefing techniques used by each 'trained trainer' and its effectiveness following the simulation learning on the acquisition of non-technical skills and retention of knowledge and skills via the simulated case scenarios applied to the cabin crew.

## 2.4 Knowledge assessment: MCQ test

The MCQ test used was a modified version of the American Heart Association's BLS test validated by selected professionals. One point was awarded for each question answered correctly, and no penalty was given for neglected or incorrect answers. The participants were not informed of their test scores and they did not receive remarks on their answers.

## 2.5 Skills assessment: Technical and non-technical

A "simulated cabin interior" was established in the first aid room and the simulated passenger was a male manikin lying in the middle of the aircraft seat. Since the participants were given the scenario script during the morning session together with their respective roles, they were thus asked to locate their working positions in the actual cabin.

Throughout the scenario, they were given prompts by the 'trained trainer' such as:

*"Passenger is unconscious and not breathing, start CPR on this victim please" (technical skill)*

*"Incoming calls from the captain inquiring about the victim's status, please answer immediately" (non-technical skill)*

Video assessment of simulated scenarios is an established methodology in measuring the effectiveness of resuscitation training (Brennan, Braslow, Batcheller, & Kaye, 1996; Whitfield, Newcombe, & Woollard, 2003). The recorded simulated scenarios were marked by two different expert raters selected by the researcher. The observational checklist was adapted and modified from the *Technical Skills Testing Checklist* (Mahony, 2008) tool for the technical skills assessment component and the *Crew Emergency Teamwork Assessment Measure* (Cooper *et al.*, 2010; Guise *et al.*, 2008) tool for non-technical skills component. Each checklist was consistent with the *Safety and Emergency Procedure Manual for Cabin Crew* guidelines of the airline company. The videos of the participants were shown to each rater to be marked independently. These videos were not labelled pre- or post-. Technical skills were analyzed as binary outcomes (YES/NO), whereas non-technical skills were scored on a 1–10 Likert scale which indicated poor to excellent performance.

### 2.6 Statistical analysis

The researcher estimated that a total of 128 participants were needed to provide greater than 80% power to detect any statistically significant difference between the groups at a significance level of 0.05 with a medium effect size using the *G* power software version 3.12. A final total of 150 participants were recruited which allowed for a 10–15% dropout rate. The mean MCQ test scores and the technical and non-technical skills scores were compared using a MANCOVA analysis. All pre-scores were used as a covariate to look for a change between the two groups (control and experimental) during the post-assessment. The statistical analysis was performed using IBM SPSS Version 22.

## 3. Results

A convenience purposive sample of 130 cabin crew members were chosen by the Human Resource Department of the airline company to enroll in this study following an internal review based on inclusion and exclusion criteria. The participants were equally assigned to either the control or experimental groups by the hosting facility. Each group consisted of 65 individuals. The researcher obtained a 100% response rate from the participating eligible cabin crew. The demographics of each participant were collected for both the control and experimental groups.

Sixty-nine flight stewards (53.1%) and 61 flight stewardesses (46.9%) were enrolled in this study. Other demographic characteristics, such as age distribution, education level, citizenship, working experience, experience in handling medical emergencies, and participation in simulation learning and debriefing sessions are presented in Table 1 below.

Table 1. Demographics and baseline characteristics of the study population.

| Demographics | Description | n | % |
|---|---|---|---|
| Sex | Male | 69 | 53.1 |
| | Female | 61 | 46.9 |
| Age | 18–22 | 9 | 6.9 |
| | 23–27 | 13 | 10 |
| | 28–32 | 20 | 15.4 |
| | 33–37 | 18 | 13.8 |
| | 38–42 | 18 | 13.8 |
| | 43–47 | 26 | 20 |
| | 48–52 | 17 | 13.1 |
| | >52 | 9 | 6.9 |
| Education | SPM | 75 | 57.7 |
| | STPM/Matriculation | 17 | 13.1 |
| | Diploma | 27 | 20.8 |
| | Bachelor's Degree | 9 | 6.9 |
| | Master's Degree | 2 | 1.5 |
| | PhD | 0 | 0 |
| Nationality | Malaysian | 130 | 100 |
| | Non-Malaysian | 0 | 0 |
| Working Experience (Year) | 1–5 | 24 | 18.5 |
| | 6–10 | 17 | 13.1 |
| | 11–15 | 24 | 18.5 |
| | 16–20 | 14 | 10.8 |
| | >21 | 51 | 39.2 |
| Medical Emergencies | Yes | 60 | 46.2 |
| | No | 70 | 53.8 |
| Exposed to Simulation Learning Activity | Yes | 0 | 0 |
| | No | 130 | 100 |
| Exposed to Debriefing Sessions | Yes | 0 | 0 |
| | No | 130 | 0 |

### 3.1 Knowledge and technical and non-technical skills assessment

The results for knowledge and non-technical skills showed improvements following the intervention. However, a reduction in technical skills was shown for both groups (Table 2). The mean MCQ scores for the knowledge assessment increased from 22.78 to 24.18 (control) and 21.89 to 24.37 (experimental), with better retention in the experimental group. A similar trend was recorded for the non-technical skills assessment with increases of mean scores from 8.45 to 8.54 (control) and 8.59 to 8.66 (experimental). However, both groups showed a decrease in the mean scores for technical skills from 11.85 to 10.75 (control) and 11.05 to 11.10 (experimental). To determine the presence of any significant change, a one-way MANCOVA analysis was performed to examine further the effectiveness of the training program.

The mean MCQ, technical & non-technical total scores (post-intervention) were analyzed using the MANCOVA analysis to assess the differences between both groups (DIAMOND debriefing vs. customary debriefing technique). Before carrying out the MANCOVA analysis, the data were tested using SPSS statistics to make sure that all of the underlying assumptions were met. Univariate normality

Table 2. Mean scores for knowledge, technical and non-technical skills assessment.

| Assessment | Group | Pre-intervention | Post-intervention |
|---|---|---|---|
| Knowledge | Control | 22.78 (3.25) | 24.18 (2.62) |
| | Experiment | 21.89 (3.69) | 24.37 (2.71) |
| Technical Skills | Control | 11.85 (3.2) | 10.75 (2.86) |
| | Experiment | 11.05 (3.2) | 11.10 (2.44) |
| Non-technical Skills | Control | 8.45 (.686) | 8.54 (.564) |
| | Experiment | 8.59 (.681) | 8.66 (.542) |

Data are presented as mean (SD).

was assessed using the Shapiro-Wilk test and boxplots, and can be assumed. Moreover, no multivariate outliers were discovered within the data, thus supporting the assumption of multivariate normality.

Correlations between the dependent variables were not excessive, which indicated that multicollinearity was not a problem. Moreover, the relations that exist among the dependent variables were more or less linear. Subsequently, box's M was not significant at $\alpha$=0.001 which indicated homogeneity of the variance-covariance matrices. As all of the underlying assumptions were supported by the data, a MANCOVA analysis was then performed. The findings confirmed no significant effect from the different debriefing methods (*DIAMOND* debriefing vs. customary debriefing) on the combined dependent variables, $F (3,123)=0.540$, $P=0.656$, partial eta squared=0.013 (Table 3).

Despite the lack of significant effect on the use of different types of debriefing methods, there were several noted improvements, though no significant differences were observed for any variable. The most prominent improvements were in terms of level of knowledge where both groups had shown improvement after the training intervention, followed by non-technical skills. However, a decrease of mean scores was observed for both groups following the intervention with the control group showing the most decrease in technical skills (Table 4).

## 4. Discussion

Simulation-based learning has emerged as a well-known innovative teaching method which promotes active participation and offers experience by applying realistic skills in addition to the development of cognitive skills. With such a platform, the opportunity for individuals to function more independently can be accomplished with minimum risk of harm or mistakes. Aside from that, debriefing has been identified as the key element to an effective simulation experience as it reinforces the teachable moments which happened during the simulation scenario. Even though past research studies measured the advantage of various educational interventions in enhancing the BLS outcomes in medical settings, the key difference in this study was its focus on the use of the Train-the-Trainer (TTT) module on the effectiveness of the simulation and the enrollment of a non-medical community together with non-expert medical professionals in a confined resource setting. In addition, the researcher tested the objective and validated the endpoints of the resuscitation knowledge and skills directly following the training intervention. Evidence from the study suggested that the participants (cabin crew) were capable of acquiring and effectively retaining cognitive and psychomotor skills following the simulation learning as indicated by better scores compared to their baseline scores, except in terms of technical skills. Improvements in most of the domains and data taken from each group were discovered. Furthermore, the improvements seen in those metrics were similar to reports on comparable endpoints from training interventions delivered in high resource clinical environments (Mpotos *et al.,* 2011; Perkins *et al.,* 2006, 2007).

The effectiveness of different debriefing models on promoting the retention of skills and knowledge at 6 weeks post-intervention was a secondary endpoint in this study and the results showed that the post-mean scores for knowledge and non-technical skills were elevated in comparison to the covariate baseline scores. However, no improvement was sustained at 6 weeks post-intervention in terms of technical skills, with a higher rate of deterioration by the control group.

Table 3. Multivariate test.

| | Effect | Value | F | Hipotesis df | Error df | Sig | Partial eta squared |
|---|---|---|---|---|---|---|---|
| Group | Pillai's Trace | .013 | .540 | 3 | 123 | .656 | .013 |
| | Wilks' Lambda | .987 | .540 | 3 | 123 | .656 | .013 |
| | Hotelling's Trace | .013 | .540 | 3 | 123 | .656 | .013 |
| | Roy's Largest Root | .013 | .540 | 3 | 123 | .656 | .013 |

Table 4. Estimated marginal means.

| Variables | Group | Mean (Co-variate) | Mean | SD | 95% Confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower bound | Upper bound |
| Knowledge | Control | 22.34 | 24.13 | .307 | 23.528 | 24.744 |
| | Experiment | | 24.41 | .307 | 23.810 | 25.026 |
| Technical Skills | Control | 11.68 | 10.76 | .274 | 10.221 | 11.304 |
| | Experiment | | 11.09 | .274 | 10.557 | 11.640 |
| Non-technical skills | Control | 8.51 | 8.58 | .073 | 8.443 | 8.731 |
| | Experiment | | 8.64 | .073 | 8.501 | 8.789 |

This indicated that the debriefing session that was carried out following the simulation learning did not impose any effects on maintaining the skills of the participants beyond the intervention assessment. The fact that both the knowledge and non-technical skills showed an improvement following the intervention made the researchers anticipate identical trends for technical skills. Nonetheless, the rate of decay of technical skills accelerated quicker compared to the other variables, thus leading to the search for a doable clarification on several possibilities.

### 4.1 Cognitive load and rate of decay in technical skills

In the context of this study, technical skills were reported to decay at a faster rate in both groups following the intervention. This can be explained by the level of exposure and participation in dealing with actual medical emergencies on a daily basis (Einspruch, Lynch, Aufderheide, Nichol, & Becker, 2007; Kaye *et al.,* 1995; Reder, Cummings, & Quan, 2006). The research team had specifically designed resus-citation case scenarios based on actual emergencies that occurred on-board which involved the management of airway and breathing, high quality of chest compression, and use of the AED. All of these elements are linked to one another and simultaneously require an excellent grasp of the theoretical knowledge, technical and non-technical skills in order to solve emergency medical problems. The use of simulation modalities which reproduce real-life situations in a simulated workplace environment to produce a better transfer of learning is now debatable (Norman, Dore, & Grierson, 2012). For instance, in this research, the participants who were also known as novices have limited exposure to medical emergencies. Therefore, unfamiliar learning environments can potentially be distracting rather than add meaning to a learning task (Van Merrienboer & Sweller, 2010).

According to the cognitive load theory, learning is restricted via the finite capability of the learner's working memory which could preserve seven to nine newly-obtained items; however, the working memory only actively processes three of such items at any given time (Sweller, Van Merrienboer, & Paas, 1998; Van Merrienboer & Sweller, 2010; Young, Van Merrienboer, Durning, & Ten Cate, 2014). The demand on the working memory resources imposed through a learning task is known as cognitive load which can be divided into intrinsic, extraneous, and germane. While intrinsic cognitive load is associated with the complexity of what is learned, extraneous cognitive load is commonly a result of bad instructional design and is considered counterproductive to learning. The germane cognitive load refers to the working memory resources committed to the development and storage of schemata into long term memory and for this reason is directly connected to learning (Kirschner, 2002; Sweller, 2010).

In this study, the researchers chose to study the element of interactivity which refers to the degree to which each element to be discovered requires reference to other elements which might be learned or learned additionally. This element is a key determinant of intrinsic cognitive load (Young *et al.,* 2014). As such, the high-fidelity simulation of medical emergencies developed by the research team through the re-creation of information, skills and non-technical skills essential in real life offers a form of complicated learning with a very high element of interactivity (Van Merrionboer & Sweller, 2005). The researchers suspect that the cognitive load of medical emergency management used in the case scenarios probably surpasses the potential working memory of the participants, particularly in individuals who have not acquired any knowledge and skills prior to the simulation as these components help in their overall performance by means of freeing up more working memory to cope with the imposed cognitive load (Riem, Boet, Bould, Tavares, & Naik, 2010).

It is also important to note that providers from different disciplines or specialties (medical vs. non-medical community) may experience different rates of decay in their knowledge and skills due to differences in type and frequency of clinical exposure (Jensen *et al.*, 2009). This is supported by the fact that cabin crew rarely have to confront medical emergencies in their workplace. Thus, the differences above explain the higher rate of decline even after 6 weeks post-intervention of successful intervention. To amend this situation, the Department of Civil Aviation (DCA) has instructed airline companies to send their cabin crew for refresher courses once a year as a mandatory requirement prior to renewing their safety licenses. The long duration prior to the refresher course added to the lack of exposure in dealing with medical emergencies directly affects the decay rate among cabin crews compared to healthcare professionals (Jensen *et al.,* 2009; Lewis, Kee, & Minick, 1993; Young & King, 2000).

### 4.2 Study limitations

Since this study was measured up to 6 weeks post-intervention following the intervention, there is a potential limitation in understanding the rate of retention, particularly on all of the included variables. Second, it is plausible that independent learning could possibly occur following the intervention and prior to the post-assessment. This may have affected the post-assessment performance in terms of knowledge and non-technical skills among the cabin crew. Third, the use of the same MCQ test and case scenario for the pre- and post-assessment imposed a potential limitation as it is possible that repeated testing may have contributed in part to the elevated overall performance. Additionally, the teaching techniques imposed by the selected facilitators also limited the study. It is important to note that the effectiveness of intervention between the groups which used different debriefing methods may be highly influenced by the teaching skills of the individual facilitators.

### 4.3 Future research directions

There are some aspects that can be improved when conducting the research in the future. First, it is important to ensure an adequate sample size is successfully obtained to avoid any attrition during the study. Second, this research only investigated the effectiveness of the structured debriefing method compared to the customary debriefing method. In conducting the debriefing sessions, the researchers noticed that the participants faced difficulties in reflecting on their actions which might have impaired the discussion, thus the use of a video during the debriefing session is highly suggested. Besides, there is still a wide knowledge gap in the use of video assisted debriefing when coupled with several structured models of debriefing, which in this study was the *DIAMOND* debriefing model. Third, technical errors that occurred in this study should be addressed accordingly. Since the method used to assess the skills of the participant was a recorded video analysis, the camera played a role in developing high quality images which directly helped the raters provide better ratings. The researchers also suggest that the devices and manikins used for the interventions be upgraded or replaced to ensure that technical difficulties will not be encountered while simulations are conducted as these difficulties are known to affect the performance of the participants. Finally, it is crucial to notice that the debriefing effectiveness can be affected by the instructor's debriefing skill. Only two instructors were involved in the study due to the limited number of instructors available at the airline academy. Fewer instructors may be more suitable in minimizing the personal style variations employed in carrying out the intervention.

## 5. Conclusions

The research team discovered that the Train-the-Trainer module of resuscitation education incorporated with simulation learning was effective in improving and retaining the resuscitation knowledge and non-technical skills among the cabin crew in Malaysia. Moreover, both knowledge and non-technical skills showed improvements which were sustained for up to 6 weeks post-intervention. Regardless of the decayed technical skills reported, further research to investigate the components of the training course may lead to improved knowledge and technical and non-technical skills. Furthermore, multiple opportunities for experience could be of benefit in developing effective resuscitation simulation programs for all Malaysian cabin crew.

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## References

Bureau of Transportation (2016) Airline activity: National summary (US flights). Retrieved from http://www. transtats.bts.gov

Amit, C., & Shauna, C. (2013). In flight medical emergencies. *Western Journal of Emergency Medicine, 14*(5), 499-504

Brennan, R. T., Braslow, A., Batcheller, A., & Kaye, W. (1996). A reliable and valid method for evaluating cardiopulmonary resuscitation outcomes. *Journal of Resuscitation, 32*(2), 85-93

Cooper, S., Cant, R., Porter, J., Sellick, K., Somers, G., Kinsman, L., & Nestel, D. (2010). Rating medical emergency teamwork performance: Development of the Team Emergency Assessment Measure (TEAM). *Journal of Resuscitation, 81*(4), 446–452

Dowdall, N. (2013). Is there a doctor on the aircraft? Top 10 in-flight medical emergencies. *British Medical Journal, 321*(7272), 1336-1337

Dreifuerst, K. T. (2009). The essentials of debriefing for meaningful learning to foster development of clinical reasoning in simulation. *Journal of Nursing Education, 51*(6), 326-333.

Einspruch, E. L., Lynch, B., Aufderheide, T. P., Nichol, G., & Becker, L. (2007). Retention of CPR skills learned in a traditional AHA Heartsaver course versus 30-min video self-training: A controlled randomized study. *Journal of Resuscitation, 74*(3), 476-86.

Guise, J. M., Deering, S. H., Kanki, B. G., Osterweil, P., Li, H., Mori, M., & Lowe, N. K. (2008). Validation of a tool to measure and promote clinical teamwork. *Journal of Simulation in Healthcare, 3*(4), 217–223

Grantt, L. T., & Webb, C. R. (2010). Using simulation to teach patient safety behaviours in undergraduate nursing education. *Journal of Nursing Education, 49*(1), 48-51

The National Academies of Science, Engineering, and Medicine (2016), Institute of Medicine to err is human: Building a safer health system in 1999. Retrieved from http://www.nas.edu

Jensen, A. R., Wright, A. S., Levy, A. E., McIntyre, L. K., Anastakis, D. J. (2009). Acquiring basic surgical skills: is a faculty mentor really needed? *American Journal of Surgery,197*(1), 82–88

Kaye, W., Rallis, S. F., Mancini, M. E., Linhares, K. C., Donovan, D. S. (1995). The problem of poor retention of cardiopulmonary resuscitation skills may lie with the instructor, not the learner or the curriculum. *Journal of Resuscitation, 21*(1), 67-87

Kirschner, P. A. (2002). Cognitive load theory: Implications of cognitive load theory on the design of learning. *Journal of Learning and Instruction, 12*(1), 1–10

Lewis, F. H., Kee, C. C., & Minick, M. P. (1993). Revisiting CPR knowledge and skills among registered nurses. *Journal of Continuing Education in Nursing, 24*(1), 174-179

Mahony, P. H. (2008). Retention of knowledge and skills in first aid and resuscitation by airline cabin crew. *Journal of European Resuscitation Council, 76*(3), 413-418

Mpotos, N., Lemoyne, S., Calle, P. A., Deschepper, E., Valcke, M., & Monsieurs, K. G. (2011). Combining video instruction followed by voice feedback in a self-learning station for acquisition of Basic-Life Support skills: a randomised non-inferiority trial. *Journal of Resuscitation, 82*(1), 896-901

Nolan, J. P., Hazinski, M. F., Billi, J. E., Boettiger, B. W., Bossart, L., Zideman, D. (2010). Executive summary: 2010 International consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommenddation. *Journal of Resuscitation, 81*(1), e1-25

Norman, G., Dore, K., & Grierson, L. (2012). The minimal relationship between simulation fidelity and transfer of learning. *Journal of Medical Education, 46*(7), 636–647

Perkins, G. D., Boyle, W., Bridgestock, H., Davies, S., Oliver, Z., Cooke, M. W. (2007). Quality of CPR during advanced resuscitation training. *Journal of Resuscitation, 77*(1), 69-74.

Perkins, G. D., Smith, C. M., Augre, C., Allan, M., Rogers, H., Stephenson, B., & Thickett, D. R. (2006). Effects of a blackboard, bed height and operator position on compression depth during simulated resuscitation. *Journal of Intensive Care Medicine, 32*(10), 1632-1635

Pronovost, P. (2013). Teamwork matters. Developing and enhancing teamwork in organizations: Evidence-based best practices and guidelines (pp 11-12). San Francisco, CA: Jossey-Bass

Rasmussen, M. B., Dieckmann, P., Isenberg, S., Ostegard, D., Seroide., E., & Ringsted, C. V. (2012). Long term intended and unintended experiences after advanced life support training. *Journal of Resuscitation, 84*(3), 373-377

Reder, S., Cummings, P., & Quan, L. (2006). Comparison of three instructional methods for teaching cardio-pulmonary resuscitation and use of an automatic external defibrillator to high school students. *Journal of Resuscitation, 69*(3), 443–453

Riley, R. H., Grauze, A. M., Chonnery, C., Horely, R. A., & Trewhella, N. H. (2003). Three years of CASMS: the world's busiest medical simulation centre. *Medical Journal of Australia, 179*(11-12), 626-630

Riem, N., Boet, S., Bould, M., Tavares, W., & Naik, V. (2012). Do technical skills correlate with non-technical skills in crisis resource management: a simulation study. *British Journal of Anaesthesia, 109*(5), 723-728

Sevdalis, N., Hull, I., & Birnbach, D. J. (2012). Improving patient safety in the operating theatre and peri-operative care: Obstacles, interventions, and priorities for accelerating progress. *British Journal of Anaesthesia, 109*(1), i3-i16

Sweller, J., Van Merrienboer, J. J., & Paas, F. G. W. C. (1998). Cognitive architecture and instructional design. *Journal of Educational Psychology Review, 10*(3), 251–296

Sweller, J. (2010). Element interactivity and intrinsic, extraneous, and germane cognitive load. *Journal of Educational Psychology Review, 22*(2), 123–138

Van Merrienboer, J. J., & Sweller, J. (2010). Cognitive load theory in health professional education: Design principles and strategies. *Journal of Medical Education, 44*(1), 85–93

Van Merrienboer, J. J., & Sweller, J. (2005). Cognitive load theory and complex learning: Recent developments and future directions. *Journal of Educational Psychology Review, 17*(2), 147–177

Whitfield, R. H., Newcombe, R. G., & Woollard, M. (2003). Reliability of the Cardiff test of basic life support and automated external defibrillation. *Journal of Resuscitation, 59*(3), 291–314.

Young, J. Q., Van Merrienboer, J., Durning, S., & Ten Cate, O. (2014). Cognitive load theory: Implications for medical education: AMEE Guide No. 86. *Journal of Medical Teacher, 36*(5), 371–384

Young, R., & King, L. (2000). An evaluation of knowledge and skill retention following an in-house advanced life support course. *Journal of Nursing Critical Care, 5*(1), 7-14