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TRAINING AND EDUCATION PAPER

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Retention of Knowledge and Skills in First Aid and Resuscitation by Airline Cabin Crew

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Abstract
The study was conducted to investigate the retention of CPR and AED skills, first aid knowledge and perceived levels of confidence for a sample of 35 cabin crew twelve months after recurrent training. The 35 cabin crew undertook a mock resuscitation scenario using the AED and bag-valve-mask carried in the medical kit. Of the 35 subjects, 33 subjects failed to use the bag-mask correctly, 18 performed chest compressions at the incorrect site, only 13 achieved the correct compression depth, only 20 placed the AED pads correctly, and the average time to first shock was 110 seconds after commencement of the resuscitation. While theoretical first aid knowledge was high, the participants held low levels of self confidence in their CPR and AED skills. The results of this study indicate that cabin crew may not have sufficiently high levels of skill to manage a cardiac arrest adequately. This suggests that existing approaches to training of cabin crew require further investigation and modification.

Introduction

Background to passenger medical incidents

The International Air Transport Association predicts that by 2012 there will be 3 billion passengers travelling by air per year [1]. Between 1/14,000 to 1/50,000 passengers will experience acute
medical problems (passenger medical incidents) [2], resulting from the exacerbation of existing medical conditions such as asthma and cardiovascular disease [3]. Exposure to the stresses of flight [4] increases the risk of cardiac arrest, although its overall incidence is less than one percent of all reported passenger medical incidents [5].

Many airlines have recognised that survival of cardiac arrest is dependant on the early access to Cardio Pulmonary Resuscitation (CPR) and defibrillation with the placement of Automated External Defibrillators (AEDs) on board long-haul aircraft [6,7]. The Federal Aviation Administration has ruled that Automated External Defibrillators (AEDs) are mandatory equipment for all airlines flying into the United States [8].

Responsibilities of Cabin Crew

Cabin crew are expected to be competent in the recognition and initial management of medical emergencies including the provision of CPR and the operation of the AED, as well as how to elicit assistance from persons with medical training [9]. There are currently no agreed international standards for cabin crew training [10] and there is wide variation in its duration and content [11].

The aircraft environment

In the event of a passenger medical incident, there can be delays of more than 20 minutes to several hours before expert assistance is available [12] and the availability of medically trained persons on board cannot be entirely relied upon [13]. It is therefore important that cabin crew be trained to an
appropriate level of proficiency in first aid and resuscitation skills. The competency of cabin crew in these skills has not been studied previously.

This study was undertaken to assess the level of CPR and AED skill within cabin crew of one international airline twelve months after they undertook recurrent first aid training. The airline used the standards for first aid, CPR and AED operation as stipulated by the New Zealand Resuscitation Council Guidelines for 2006 [14].

Methods

Selection of research participants

Approval was granted by the University of Otago Human Research and Ethics Committee and the executive of the participating Oceania-based international airline. Cabin crew were difficult to access as potential research participants due to the operational requirements of the airline. For this reason, a sample was obtained from the cabin crew who were already allocated to compulsory annual two day recurrent emergency procedures training session. Over a 6 week period, these cabin crew each received invitations to participate as research participants.

All the cabin crew attending the two day recurrent session had completed training in CPR and use of the AED and supplemental oxygen therapy 12 months prior to participating in this study. The training syllabus was based on the New Zealand Resuscitation Council Guidelines and had consisted of a 1 hour review of knowledge components of first aid including CPR, followed by classroom-based demonstration and brief practice of CPR. The airline discouraged the use of expired air resuscitation.
Study Protocol

A similar approach was taken to a study of the CPR and AED skills of laypersons [15] with the following modifications. The Little Anne Skill Reporter manikin was placed in a simulated aircraft aisle at a cross-over location (where two aisles intersect), which is one location in the aircraft used for resuscitation. An aviation oxygen cylinder and aviation medical kit were placed nearby. Cabin crew had also undertaken training in the use of a silicone resuscitator (bag-valve-mask device). The test scenario included ventricular fibrillation followed by pulseless electrical activity. The data was collected electronically directly from the resuscitation manikin; an approach previously reported as reliable [16].

Use of the test scenario

Each of the research participants were asked to manage the situation as instructed in previous training without any assistance from other cabin crew, and using only the equipment provided. The cabin crew were not prompted or encouraged to use any equipment or undertake any first aid activities and the scenario lasted 10 minutes.

Video recordings were not permitted due to industry security policy, so a modified validated visual check list was used [17].
Cabin crew completed a self-assessment of performance and a knowledge quiz consisting of the following three questions which were based on the content of recurrent training.

For each of the situations below describe your first aid management in detail. Please assume the aircraft has reached cruising altitude.

1. A 24 year old female passenger complains of shortness of breath, wheeze and is very distressed. She is fully conscious, pulse 100, breathing 25 breaths per minute. Her asthma inhaler is empty.

2. A 30 year old male passenger stands up after a meal service and is seen to collapse into the aisle. He is pale, unconscious, breathing at 10 breaths per minute, pulse 60.

3. A 55 year old male passenger complains of a heavy feeling in his chest and a pain down his left arm. He is pale, sweaty and fully conscious.

The answers were compared to the expected management listed in the airline first aid manual.

The crew were asked to rate their perceptions of self confidence in CPR skills, using the AED, first aid knowledge and first aid skills using a 5 point Likert scale. The results of these scores were compared to the performance of each cabin crew member in the CPR and AED assessment and the quiz.

Data Analysis
Data were subjected to descriptive statistical analysis and for correlation (Pearson r) using SPSS (version 14.0 of SPSS, Chicago, IL, USA). The data met the assumptions of linearity, normality and homoscedascity.

Results:

The demographics of the 42 research participants are presented in Table 1. A total of 42 cabin crew were allocated by airline management to recurrent emergency procedures training and 35 agreed to participate in the research. The seven who did not participate stated that they declined because of exam anxiety relating to the emergency procedures training. None of the participants had a health care background, 12 possessed current first aid certificates and the reminder had allowed their first aid certificates to lapse.

Approach to the Patient

All of the participants demonstrated some components of initial assessment (safety, responsiveness, airway opening manoeuvres, breathing and circulation) (Table 2) before moving on to CPR but only 18 participants performed all components in the correct sequence.

Airway, Breathing and Circulation
Table 3 describes performance in CPR. One participant commenced CPR without delivering initial ventilations. The majority of participants had difficulty operating the silicone resuscitator. Most were unable to create an air seal around the face mask, and after several attempts resorted to mouth to mouth ventilation.

Some participants (31 of the 35) attempted to locate the carotid pulse and 2 sought the radial pulse, despite this having been removed from the training curriculum.

Chest Compressions

Chest compressions were delivered by all participants. Some participants experienced difficulties delivering initial ventilations and this delayed the start of chest compressions. Many participants had difficulty in finding the correct hand position for chest compressions and with the exception of one participant, all had corrected this after the first cycle, delivering compressions at the midline of the lowest third of the sternum.

There was no measurable decline in chest compression depth over the course of the scenario. The majority of participants demonstrated some improvement in compression depth, and rate with each cycle of CPR delivered during the 10 minute scenario.

Use of AED

The majority of subjects did not operate the AED safely (Table 4) because of failure to demonstrate the "stand clear" command. In more than half of the cases there were time delays prior to delivery of the first shock, because some participants chose to provide CPR before using the AED.
All participants placed the sternal AED electrode in the correct location but 15 participants placed the apical electrode on the left side of the upper abdomen. All subjects responded appropriately to the PEA (Pulseless Electrical Activity) component of the scenario by following the AED voice prompts, demonstrating an appropriate assessment and commencing CPR.

Theoretical Knowledge

The answers provided by 20 of the 35 participants included additional information beyond the scope of the curriculum. Three out of 35 gave answers indicating potentially hazardous misunderstandings of first aid procedures.

Self-rated confidence and competence.

None of the participants rated their confidence in first aid knowledge as high, with the majority designating 'low confidence' (26 of the 35).

Only 2 participants believed they were confident in their CPR skills.

There were no relationships demonstrated between self-rated variables or between years of service and performance in the knowledge test, CPR skills, AED skills or first aid skills.
Discussion

A decline in CPR and AED skills following training has been demonstrated in laypersons and medically trained persons [18,19], and has been associated with the types of instructional techniques employed [20], variations in program delivery [21] and the time interval between training and re-assessment [22,23]. Although we did not measure the skills of these participants at the last recurrent training, and therefore could not measure any change in skills performance over the following 12 months, it was clear that the majority cabin crew in this study did not perform at the level required by the training curriculum. This may have been due to the time interval or other factors and should be further explored.

One specific area of poor skill performance was the use of the silicone resuscitator which raises questions over the appropriateness of relying on this device in a first aid context. The use of this device introduced delays in the commencement of ventilation and external chest compressions which could have implications for survival of passengers. The cabin crew showed similar problems in performance as reported in junior doctors of whom only 40% could operate a manual resuscitator and achieve acceptable tidal volumes on apnoeic patients [24] because of difficulty creating an air seal and problems with single handed bagging [25,26]. The cabin crew whilst not meeting the ILCOR standards for ventilation, did provide some tidal volume which could have been useful [27,28] but was delivered at the cost of a time delay to commencing CPR. It is for these reasons that although many airlines have a silicone resuscitator in the medical kit, the cabin crew training focuses on the use of expired air resuscitation using the Laerdal Pocket Mask which is available in the aircraft cabin.
Most cabin crew failed to deliver CPR correctly, showing wide variations in hand position, compression depth and rate, which are all critical for survival of cardiac arrest [29]. The poor performance of cabin crew in the delivery of CPR, despite gradual improvement during the course of the scenario, means that if reproduced in an actual cardiac arrest could adversely affect passenger survival. This was in clear contrast to the operation of the oxygen therapy equipment and operation of the AED, which was generally safe despite variations in electrode placement.

The study suggests that for this occupational group the possession of a high level of first aid knowledge and some experience in CPR and AED use, is not matched by an acceptable level of skill retention. There may be implications for passenger survival if this decline in skill performance is representative of the cabin crew occupational group across the airline industry.

The level of training delivered and the training techniques employed are important factors in the retention of CPR and AED skills and this has not been examined in this study, or indeed at all in the context of cabin crew. The economic pressures on the airline industry have lead in some cases to the outsourcing of first aid training to providers who may have little or no experience of the flight environment. Although there is anecdotal evidence from cabin crew that the delivery and content of outsourced training is less than adequate, this has not been the subject of any previous studies. Even where training is conducted in house, concern has been expressed by cabin crew that there is less emphasis placed on first aid than other aspects of emergency procedures training.

The testimony by Hancke [30] supports this view and by Klinect [31] who found that cabin crew perceive the chance of a medical emergency in flight is greater than other types of aircraft emergencies, and the first aid training they receive to be inadequate. This may have contributed to the low self confidence scores reported by participants and warrants further investigation.
The use of frequent brief skill reviews using a range of training technologies that provide immediate skill performance feedback to students can improve retention of skills [32]. This may be one possible option and should be explored as an inclusion to pre-flight briefings. The use of real-time automated feedback devices as part of CPR training and also in the aircraft cabin could be considered as a way of improving CPR performance [33]."

The lack of consistent standards in first aid training between airlines, and the extreme time pressures placed on first aid instructors in aviation warrant an international evidence based approach to the training of cabin crew in first aid.

A larger study is currently in the planning stage and is anticipated to be of use to airline first aid instructors in determining then optimum frequency of recurrent training in CPR and AED use.

Limitations of the study

Access to cabin crew to take part in research is a major problem and is affected by crew being only available during narrow time slots during allocated training days. Cabin crew attending these training days are under pressure from their instructors to complete all the allocated activities. The requirements made by the airline for cabin crew to pass all components of training, may have lead to perceptions of undue stress.

The study was limited by not running the scenario in an actual aircraft cabin and so may have influenced the behaviour of the cabin crew. It is also possible that we influenced the behaviours of cabin crew by asking them to perform resuscitation without any assistance from other crew members. The sample size, whilst being representative of the cabin crew population in the airline in
terms of demographics, may not have been representative of the skill and knowledge decline in the larger body of cabin crew and should be investigated.

Conclusions and recommendations

Cabin crew serve an essential role in aviation safety and require appropriate recurrent training at frequencies more than once every 12 months. The study suggests that for this sample of cabin crew who had extensive industry experience, their performance in CPR and AED skills was less than adequate, compared to their retention of acceptable to extensive first aid knowledge and compared to lay person first aider performance. The precise frequency and type of recurrent training that can maintain skills and knowledge at an appropriate level needs to be quantified for this occupational group.

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