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4 Trained first-responders with an automated external defibrillator: how do they perform in real resuscitation attempts?

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Abstract

Introduction: The quality of first-responder performance at the end of automated external defibrillator (AED) training may not predict the performance adequately during a real resuscitation attempt.

Methods: Between January and December 2000, we evaluated 67 resuscitation attempts in Amsterdam and surroundings, where police officers used an AED. We compared their performance with their assessment at the end of their ERC AED training course. One of the main goals of training was to deliver a shock within 90 s after switching the power on in the AED.

Results: We analysed 127 police officers working in 67 police-teams. The police officers had a mean age of 35 years (range 23–54 years), 73% was male. The interval between AED training and the first resuscitation attempt was a median of 4 months (range 1–13). 78% percent of the 67 teams consisted of two police officers who both were qualified as "competent" after the initial training. Successful completion of the course correlated well with good performance during a resuscitation attempt ($p = 0.009$). When measured switching the power on in the AED, 92% of the victims received a shock within 90 s.

Conclusions: Successful training correlates well with successful performance in the field. Competence of a team may be better than competence of two separate individuals.

Introduction

Early defibrillation is viewed as the single most important measure to increase survival of out-of-hospital cardiac arrest.[1–3] Currently, many automated external defibrillator (AED) projects incorporate traditional first-responders (police, fire brigade),[3,4] as well as non-traditional first responders (e.g., flight attendants).[5] The use of an AED by individuals with a duty to respond requires education, with lectures and training in skills of cardiopulmonary resuscitation (CPR) in conjunction with the device-operation.[4,6] Skills, such as BLS and AED techniques, can be learned best through simulated scenarios.[7–9] In these scenarios the students are confronted with a situation that could occur in real life. However, the circumstances in these scenarios are artificial with regard to the environment and the victim in cardiac arrest. Whether successful completion of training in the use of an AED is a guarantee for competence in a real resuscitation attempt is uncertain. It can be expected that skills acquired in training deteriorate quickly over time,[10–16] and that classroom performance, therefore, may not predict adequately the performance in a real resuscitation attempt.

This is already known from a study on training in CPR that only 55% of those who were trained in CPR delivered bystander CPR to the victims of cardiac arrest.[17] Of these victims 90% received a combination of chest-compression and ventilation, 8% received chest-compressions only, and 2% received ventilation only.
Using documented cases of real events, we studied whether the results of the end of AED course assessment of police officers was an indicator of the performance with an AED in real resuscitation attempts.

Methods
We evaluated performance of police officers in a randomised clinical study in the region of Amsterdam, The Netherlands, where police officers equipped with an AED served as first-responders.[18] Included in the current analysis were all cases of cardiac arrest where the police arrived first on the scene and used an AED between January and December 2000.

Training
In this region (0.9 million inhabitants), 945 police officers were trained in the use of an AED (LIFEPAK 500, Medtronic Physio-Control, Redmond WA). Each police officer was already trained in BLS skills, with retraining every year. Together with the introduction of the AED, they followed a slightly modified training course of the European Resuscitation Council. Officers were trained as a two-rescuer team, consisting of an AED provider and AED helper. One instructor trained four students with one manikin and one AED trainer in 3 h. At the end of the AED training, police officers were assessed by means of a scenario test. CPR and AED skills were tested with a simulated single shock scenario and were assessed on 13 aspects of performance (see Appendix A). An officer was considered competent and certified, when he met the criteria mentioned under 'competent' in the appendix, and delivered a shock within 90 s after switching on the AED. When an officer was assessed as 'not yet competent', this officer received re-training within 3 months. Only after being assessed as competent, an officer received a certificate allowing him/her to use the AED in resuscitation attempts.

Data collection during resuscitation attempts
During the study period, a dedicated data collector was sent to the scene, immediately after the dispatch of the ambulance and the first-responder.[19] Data collection took place at the scene during or immediately after the resuscitation attempt. Data were obtained on the estimated moment of collapse, witnesses and bystander CPR, by directly interviewing all persons involved. The continuous rhythm data from the AEDs and manual

defibrillators were downloaded into a laptop computer at the scene. Deviations of internal clocks were corrected by comparison with radio-controlled wristwatches. Time of call, dispatching and arrival on scene of first-responders and EMS were obtained from time corrected dispatch computers.
It was recorded which officer had served as AED provider and which one as AED helper. Their own assessment of performance and specific problems were obtained during an interview on scene immediately after the event.

Analysis
From the audio data transcripts were made. One reviewer checked these transcripts on content using the original audio data. The final transcripts were analysed by two reviewers.
If there was no agreement between the two reviewers, the interpretation by both reviewers was discussed and disagreement was resolved by consensus. The reviewers were blinded for the results of the assessment at the end of the AED course.
Assessment of the 13 criteria was done with the transcripts in conjunction with the information from the ECG tracing, the event recording of the AED and the interview at the scene.
Performance of the team was considered as not competent when one or more of the 13 items were not performed, or not performed in a competent way. Performance of the team was considered competent when all of the 13 aspects were performed correctly.
In the assessment of the team performance, the contribution of individual officers could not be separated clearly.
To compare the competence of teams during training and during real resuscitation attempts, we combined the assessment of individual officers during their training. A team was considered as not competent after training when at least one officer was without training or assessed after training as not competent. Data were analysed using descriptive statistics, with 95% confidence intervals around proportions. Time intervals were expressed as medians (range). Significance was tested by Fisher's exact test for proportions and the Mann–Whitney *U*-test for continuous variables. Significance was accepted when a two-sided p-value was <0.05 or confidence intervals did not include unity. All statistics were performed in SPSS® 11.0.1 for Windows.

Skills	Competence per skill of officers in training assessment *n* = 114 (%)	Competence per skill of officers in real resuscitation attempts *n* = 127 (%)	Competence per skill for "competent"[a] teams in real resuscitation attempts *n* = 58 (%)	Competence per skill for "incompetent"[b] teams in real resuscitation attempts *n* = 9 (%)
Safety	95	87	90	67
Workspace	95	90	91	78
Shout	93	100	90	89
Shake	88	97	88	78
Pulse check	100	100	90	89
AED position	100	100	100	100
CPR integration	94	82	78	78
Position of electrodes	95	100	100	100
Clearing during analyse	95	59	59	44
Clearing before shock	98	40	76	67
Shock in time	99	92	98	89
Pulse check	100	87	79	67
Check breathing	100	50	91	89

[a] A team consisting of two police officers who performed competed for all 13 skills during training assessment.

[b] A team consisting of two police officers of which at least one was untrained or one was incompetent for one or more of the 13 skills during training assessment.

Table 1.

Performance of the 13 skills during training assessment and real resuscitation attempts.

Results

In the study period of 11 months, 67 first-responders' resuscitation attempts were included in the analysis. These patients received CPR and were treated with an AED by 127 police officers. The police officers had a mean age of 35 years (range 23–54), 73% were male. Thirteen officers (10%) had not received AED training. Of the 127 officers, 30 officers were involved in two attempts, while seven officers were involved in three or more attempts. One untrained officer was involved in three cardiac arrests. The interval between the AED training and the first resuscitation attempt was a median of 4 months (range 1–13).

Performance at the end of AED training

Table 1 shows the score of performance at end-of-training.
Most difficult criteria to meet were shake and shout to establish unconsciousness in the beginning of the resuscitation attempt and CPR integration with the use of the device. Of the 114 trained police officers involved in a real resuscitation attempt, 87 officers (76%) had good marks for all 13 AED criteria at the end of course assessment.

Relation between end of course assessment and real resuscitation attempts

Eighty seven percent of the teams (58/67), who used the AED in real resuscitation attempts, consisted of two police officers who both were qualified as "competent" after the initial training. In 79% (46/58) of the teams, successful completion of the course was associated with good performance during a resuscitation attempt ($p = 0.009$, Table 2). In turn, of the nine "incompetent" teams in training, three performed competently during the resuscitation attempt.

	Assessment of training		Total
	Competent teams	Not competent teams	
Assessment of real resuscitation			
Competent teams	46	3	49
Not competent teams	12	6	18
Total	58	9	67

$p = 0.009$.

Table 2.

Cross tabulation of performance during training assessment and performance during resuscitation event per team.

Performance during real life resuscitation attempts

Table 1 also shows the performance of teams in real resuscitation attempts. Twenty-seven police officers (24%) were participating in a team when not (yet) considered competent, based on their end-of-training assessment. As the team always consisted of at least one competent officer, the team performance could be better than the performance of individual officers. Of the 67 patients, 27 (40%) had an initial shockable rhythm. Ninety-two percent of the patients with an initial shockable rhythm received a shock within the international recommended time of 90 s after the AED was switched on (Fig. 1). The time interval from AED switch-on to the first rhythm analysis was 64 s (range: 28–170 s). There was no difference in time from AED switch-on to shock between "competent" and "incompetent" teams. The time interval from arrival of the police vehicle (vehicle stop) to the first rhythm analysis was median 126 s (range 37–376 s).

Safety was scored lower in the not competent teams, not only during the start of the attempt, but also during clearing for analysis and shock.

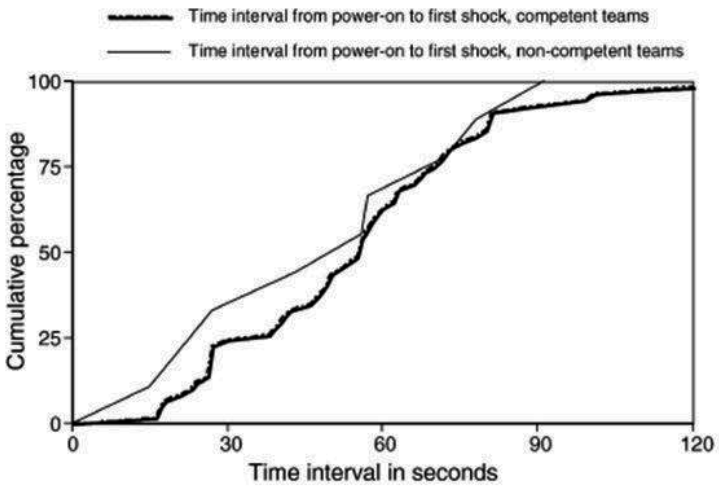

Figure 1.

(A) Delivering first shock; (B) cumulative time interval from power-on of the AED to first shock separate for competent (n = 58) and not competent (n = 9) teams during training assessment.

Discussion

We investigated whether successful completion of an AED course is related to good performance during a real resuscitation attempt. Results show that in 79% of the cases successful completion of the course was associated with good performance during a resuscitation attempt. In turn, a course not successfully completed is still compatible with a good performance.

Ten percent of the officers who were not trained at all were involved in resuscitation attempts with an AED. Together with the officers who were not trained to the level of a satisfactory mark for all 13 skill criteria, 31% (40/127) of the officers were not, or not sufficiently, trained. However, with most of the police officers trained and operating in teams of two, there is a high likelihood that at least one of the team members is trained and assessed competent. Indeed, there were no teams where both members were untrained.

Of concern were problems such as the delay to the start of CPR after a pulse check despite prompts from the AED. It is our impression that those police officers were not confident or needed more time to recollect their basic skills of CPR.

Another important problem was the delay in time to defibrillation. Nearly 10% of the first shocks were delivered with a delay longer than 90 s after switching AED the power-on.

This delay was caused by hesitation of the police officers or difficulties in connecting electrodes and discussion on the correct position of the electrodes as derived from the audio recording. This points to a lack of skills-routine, which may be addressed by improving practice and training. It is remarkable that three out of the nine teams with one police officer who failed the post training assessment, performed well in a real resuscitation attempt.

Limitations

Except for the time to shock, AED skills in the classroom and during a real life resuscitation attempt are assessed subjectively.

With the current training devices, objective assessment of AED related skills is not possible during classroom training. Similarly, there is no objective way to assess performance during a real resuscitation attempt. This assessment has partly to rely on post-hoc interviews, with the possibility of receiving socially desirable answers. However, the reliability of our data was improved by collecting the data from multiple sources (AED sound recordings, ECG and critical event recordings, and the interview). Data available from multiple sources allows for data triangulation, which improves the validity and reliability of the data.[20]

Assessing the interval between arrival on scene and the first shock is an

important objective component of AED skill assessment. However, the signal and time stamp of “vehicle stop” frequently is given too early or forgotten by police officers.
As the interval from vehicle stop to shock also included the walking distance from the car to the patients’ side, this is of limited value in the assessment. The interval between switching the power on in the AED to shock delivery seems more reliable, but sometimes the AED was switched on after connecting the electrodes. Many newer AEDs combine removal of the electrodes from the cover with power-on, allowing a more reliable assessment of their performance.

Conclusion

The successful completion of an AED course is an indicator of good performance in the field, but is far from being a guarantee. Delays in initiating CPR and administration of the first shock may occur through stress and lack of self-confidence.
Not following AED training or failing to meet the assessment criteria of a successful training does not mean that these first-responders cannot save patients, as long as they are skilled in BLS and work in teams with a colleague competent in AED use.

Acknowledgement

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Appendix A. The 13 aspects of assessment

1. Safety: making sure that there is no continuing danger either to the first-responders, bystander or the victim.
   Being aware of hazards from electricity, gas, traffic, masonry, etc.
2. Workspace: creating space to work, by moving a victim from a soft bed to the floor and keeping bystanders at a distance.
3. Shout: checking response by loudly asking, like “Are you all right?”
4. Shake: assessing whether or not the victim is conscious by carefully shaking his shoulders.
5. Pulse check: checking for signs of a circulation for not more than 10 s to decide if the AED is necessary.
6. AED position: positioning the AED next to the head of the victim.
7. CPR integration: CPR performed before attaching the electrodes and resumed immediately after the prompt of the AED to start CPR after assessment of signs of a circulation.

8. Position of electrodes: positioning one electrode below the right clavicle, next to the breast bone, the other electrode below and left from the left nipple, in the midaxillary line.
9. Clearing during analysis: demanding and controlling for distance by the first-responders and bystanders.
10. Clearing before shock: demanding and controlling for distance by the first-responders and bystanders.
11. Shock delivered in time: delivering a shock within 90 s after power-on.
12. Pulse check: checking for signs of a circulation for not more than 10 s after the voice prompt of the AED.
13. Check breathing: checking whether the victim is breathing by looking for chest movement, listening at the mouth for breath sounds and feeling for breath on the cheek for not more than 10 s.

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