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Research

Enhancing the quality of CPR performed by laypeople

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Abstract

Introduction
The prognosis of survival for a person suffering from cardiac arrest increases when a layperson performs cardiopulmonary resuscitation (CPR) on-site. In Sweden, providing CPR training to people working in public places is considered a social benefit.

Objective
The aim of this study was to investigate the effect of a 3-hour CPR intervention for electricians.

Methods
Data were collected through an intervention by means of simulation and consisted of a pre- and post-assessment of the participants' CPR performance.

Results
The results show a statistically significant improvement in ventilation (41%) and quality of compression (36%).

Conclusion
With short rehearsal training, the layperson can significantly improve the quality of CPR given. In a situation of cardiac arrest, this can be crucial for the patient's survival and continued quality of life.

Keywords:
CPR, intervention, layperson, simulation

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Introduction

The average survival rate for cardiac arrest outside the hospital setting in Sweden is just over 10% (1). If the cardiac arrest is witnessed and CPR initiated immediately by a layperson, the chance of survival increases (2). The shorter the time between cardiac arrest and the commencement of CPR and defibrillation, the greater the chance of survival (3). There are also differences in survival rates from different communities (4). To enhance the chances of survival in all communities, CPR education for laypeople is important.

Cardiopulmonary resuscitation refers to external chest compressions and ventilation of the lungs, possibly in combination with defibrillation (5). Well-performed CPR comprises of good quality chest compressions containing adherence to rate, depth, full recoil and fraction. Chest compressions are performed at a depth of 5–6 cm, at a rate of 100–120 compressions per minute. The ventilation involves inflating of the patient's lungs with sufficient air volume for 1 second. Ventilation of the patient is conducted using a mouth-to-mouth or mouth-to-pocket mask. The chest compressions to ventilation ratios are 30:2 (6). Cardiopulmonary resuscitation aims at restoring spontaneous circulation and respiratory function in a person who has had a cardiac arrest. In some cases, the cardiac function can be reset immediately only by means of defibrillation; in other cases, intensive care treatment after CPR may be required (5).

The quality of the CPR affects both the short- and long-term survival of the patient (6). CPR can be considered successful when a patient suffering from cardiac arrest recovers spontaneous breathing and circulation, and can continue to live a good quality life. At the same time, there is a risk that the patient's survival will mean a continued life with different degrees of cerebral and cardiac muscle impairment due to oxygen deficiency. When circulation stops, the risk of injury increases proportionately to the duration of the cardiac arrest (5). In some cases, CPR can result in patient survival but with a life of low quality or to die in a manner that neither the patient nor his family would have chosen (7).

In Sweden, all employers must ensure that employees have preparedness for first aid and CPR (8). Electricians working in factories or industries are therefore regularly trained to perform CPR and provide immediate resuscitation. All larger workplaces in Sweden are equipped with defibrillators and basic medical equipment. Examples of CPR that the electricians may perform include traumatic or non-traumatic cardiorespiratory arrest and electrocutions with muscular paralysis (9). Whatever the reason for the cardiac arrest, it is difficult to perform high-quality CPR. Studies show low quality in pre-hospital CPR performed by professionals (10,11). Both professionals and laypeople therefore need regular CPR training (12,13).

A short period of time between the cardiac arrest and the commencement of high-quality CPR increases the patient's chance of survival. It also reduces the risk of cellular damage caused by oxygen deficiency. The aim of this study was to investigate the effect of a 3-hour CPR intervention by electricians.

Methods

This study had a quantitative approach. Data was collected through an intervention by means of simulation and consisted of a pre- and post-assessment of the participants' CPR performance.

Participants

Participants consisted of 27 electricians, all men, with an age range of 23–64 years (mean 50 years, median 57 years). The time since latest CPR training was 3 years, for all participants. One participant had previously performed CPR on a human. Inclusion criteria were participation in a CPR education intervention. All participants received oral information about the study and were asked to participate voluntarily.

Intervention and data collection

The study was carried out in three steps. Step one was to assess the participants' CPR performance. Participants performed CPR for 2 minutes on a Resusci Anne QCPR (Laerdal®). Each of the participants performed chest compressions and ventilations according to European Resuscitation Council Guidelines for Adult Basic Life Support (2). The mechanical spring simulating the thoracic resistance required 30 kg chest compressions to achieve correct compressions depth of 5–6 cm. The ventilation required 400–700 mL/breath. Data were collected on the percentage of correct ventilation and the percentage of correct compression depth, rate, hand placement and recoil.

In step two, the group participated in a 3-hour education session divided into a theoretical part regarding anatomy and pathophysiology and a hands-on part consisting of CPR.

The intervention was completed with step three. Step three was to re-assess the participants' CPR performance for 2 minutes. No feedback about the CPR performances was given during the step one or step three assessments. All results were read from a SimPad Skillreporter.

Data analysis

The descriptive and analytic analysis was conducted using IBM Statistical Package for the Social Sciences (SPSS) 24.0. Descriptive analysis (central tendency and distribution) was used to describe the data. Analytic statistics (related-sample Wilcoxon signed rank test) were used to compare the pre- and post-assessment.

Ethical considerations

The study followed the ethical principles regarding anonymity and integrity in accordance with the World Medical Association (14). Ethical approval was not needed according to Swedish law (15). Informed consent was obtained from each participant.

Results

On average, the group improved on both ventilation and compressions (Figure 1). Related-sample Wilcoxon signed rank test shows that the p-value for both ventilation and compressions is significant (p<0.001). For ventilation, the average increased by 41%, and for compression, the average increased by 36% (Table 1).

Discussion

The aim of this study was to investigate the effect of a 3-hour CPR intervention for electricians. The results reveal that both the compression and ventilation quality is statistically significantly improved by the intervention. This specific group of electricians had all conducted CPR training 3 years earlier. Previous research has shown that knowledge deteriorates 3–6 months after CPR training (16–19). Therefore repeated training is required at intervals of 3–6 months in order to maintain a high degree of quality performing CPR and thus give patients a better outcome (13). The repetition or training can be done with a short video presentation to a large group of people (20). Training in any form is necessary as a CPR trained layperson performs better quality CPR compared to laypeople without CPR training, following dispatcher-assisted CPR (21,22).

Table 1. Mean and median of compressions and ventilations percentage divided in pre- and post-groups

Item	Pre-group	Post-group	Related sample Wilcoxon signed rank test	Mean % increase
Ventilation mean Median Min-max	17% 23% 0-50%	58% 56% 25-72%	p<0.001	41%
Compression mean Median Min-max	34% 31% 5-77%	70% 73% 31-79%	p<0.001	36%

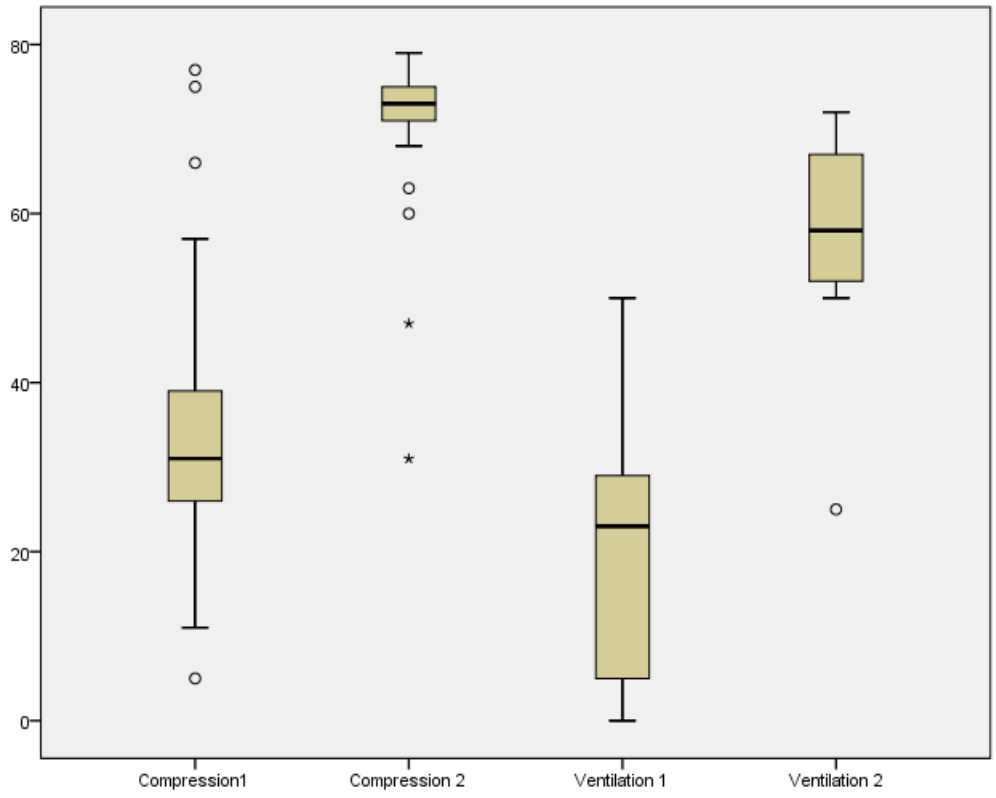

Figure 1. Compression and ventilation for pre- and post-groups in percent

Training also means that the layperson feels safe in performing CPR (23). Previous studies have shown how performing CPR can affect the rescuer in a negative way (24,25). When the outcome is negative, the rescuer can experience both physical and emotional outcomes such as self-blame, anxiety, sadness and nightmares. This was alleviated by the rescuers having a degree of education and being confident with their knowledge of CPR (26).

Limitations

The ventilation score included the ventilation-rate and the number of ventilations. The compression score included depth, rate, hand-placement and recoil. These figures have not been presented separately but as an overall score.

Conclusion

Cardiopulmonary resuscitation provided by laypeople is of the greatest importance for patients suffering a cardiac arrest because it improves the patient's chance of survival. Through a 3-hour intervention, the participants' CPR knowledge improved by 30–40%. In the event of a cardiac arrest, CPR intervention can be crucial for a patient's survival and continued quality of life.

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Conflict of interest

The authors declare they have no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.

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