Health-care professional's theoretical knowledge of resuscitation guidelines decreases over time: A sample designed study.

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Abstract

Background: Many factors may affect survival rates after in-hospital cardiac arrest, including knowledge among health-care professionals. The aim of this study was to describe health-care professionals' theoretical knowledge of resuscitation guidelines five years after the introduction of a systematic standardized training program. An additional aim was to look at survival after in-hospital cardiac arrest.

Methods: This study was conducted at the county hospital in Västmanland, Sweden. The study was conducted using random sampling at two time points over two different years. In 2009, all health-care professionals were offered the opportunity to participate in a cardiopulmonary resuscitation (CPR) education program and answered a multiple-choice questionnaire regarding their knowledge of CPR guidelines. Five years later (in 2014), health-care professionals working at the same hospital answered the same questions. The results from the two tests were then compared using chi-squared tests.

Results: A total of 2,034 individuals participated in the study in 2009 and 1,519 participated in 2014. Overall, 19.6% of the health-care professionals achieved a correct response rate of at least 80% in 2009, whereas in 2014 only 7% did so.

Discussion: Many factors affect the survival rate, with education of hospital employees being only one. However, during the five years following the offered CPR education, and parallel with deterioration in hospital employees' theoretical knowledge of the guidelines, a sharp decrease in the 30-day survival rate was observed among patients with in-hospital cardiac arrest.

Conclusions: Long-term follow-up of an educational intervention among all employees in one hospital indicated a marked deterioration in knowledge of CPR. Five years after the intervention, only 7% of all health-care professionals showed adequate theoretical knowledge of the guidelines. Our results indicate that established guidelines for regular CPR training are not followed.

Key Questions

What is already known about this subject?

Many factors may affect survival rates after in-hospital cardiac arrest and guidelines recommend regular CPR training for health-care professionals.

What does this study add?

The level of knowledge is low when hospital employees´ answer a multiple-choicequestionnaire about CPR. Regular training guidelines are not followed.

How might this impact clinical practice?

Deterioration in theoretical knowledge of the guidelines may be associated with decreased 30-day survival rate among patients with in-hospital cardiac arrest. The impact on clinical practice however, needs to be interpreted with caution as many things affect the survival rate.

Introduction

Over past decades, patient safety issues have been heavily discussed. Despite this, medical or human errors account for about 10% of all in-hospital adverse events [1,2]. Furthermore, human errors are associated with decreased survival odds after cardiac arrest [3-5]. When patients receive care in an emergency department, adverse events may occur. One challenge is that some professionals are not trained in emergency care [6,7]. All health-care professionals should be able to perform cardiopulmonary resuscitation (CPR) with competence, which requires training [8]. The survival rate after cardiac arrest depends on the quality of CPR, the alarm response time, and the time to defibrillation. In Sweden (with

nearly 10 million inhabitants), there are 73 hospitals with emergency teams. Each year, these provide care and attempt resuscitation for about 3,000 patients experiencing in-hospital cardiac arrest (IHCA). The clear majority of these cases are reported to the Swedish National Quality Registry for Cardiopulmonary Resuscitation. The incidence of IHCA in Swedish hospitals during the 2006–2015 periods was estimated to be 1.7 per 1,000 hospital admissions (and personal communication J. Herlitz)[9].

In a cardiac arrest situation, adequate theoretical knowledge of the resuscitation guidelines is required. Accurate knowledge is associated with a better chest compression rate [10,11]. Previous studies have shown poor implementation of resuscitation guidelines [12,13]. Knowledge in CPR decreases with time and therefore the guidelines recommend regular refresher courses and clearly define how CPR is to be performed [9,14-16].

The communication of CPR guidelines in Sweden occurs through the Swedish Resuscitation Council's training program, which consists of communicating theory and practical training on a manikin [17,18]. The guidelines are, in principle, identical to the European Resuscitation Council guidelines. The training program recommends the administration of refresher courses at least once a year, to prevent a decline in CPR skills [10]. To do this, the managers on the wards need to take the initiative for training and make time and other resources available [19].

The aim of this study was to describe health-care professionals' theoretical knowledge of resuscitation guidelines five years after the introduction of a systematic standardized training program. Also look at survival after in-hospital cardiac arrest.

Methods

This five-year follow-up was part of an intervention study of health-care professionals at the Västerås county hospital in Västmanland, Sweden. The study was conducted using random sampling at two time points, one in 2009 and the other in 2014. In 2009, all study participants (health-care professionals) took part in a CPR education program. One to three months after the program, the participants answered a questionnaire designed to test their theoretical CPR knowledge. In 2014, health-care professionals at the same hospital (comprising both individuals who participated five years previously and new employees who had started working at the hospital since then) answered the same questionnaire. However, at this time, only 14% of the participants had undergone CPR training in the 1−3 months before the test. Healthcare professionals should have undergone CPR training once a year according to national guidelines, but that was not the case. The results from the two tests were then compared. In the study, we used the Swedish Resuscitation Guidelines 2011 [18]. These guidelines changed between 2009 and 2014, as described below under the title questionnaire. The questionnaire results were analyzed in accordance with the guidelines that were applicable at the time the participants answered the questionnaire.

Participants

All health-care professionals available at the hospital were invited to participate in the study. To be eligible, prospective participants had to be actively working at the time (i.e., those on maternity or sick leave was excluded). The participants were health-care professionals from different professions including physicians (n=222), nurses (n=636), other university-educated staff (such as physiotherapists, occupational therapists, social welfare officers, psychologists, and biomedical analysts) (n=187), assistant nurses (including keepers) (n=434), and other occupational groups, such as secretaries and kitchen and service staff (when these groups were involved in active patient care) (n=78). The mix of participants was the same at the two measurements and they answered the questionnaire anonymously. The staff turnover rate was 8.2% per year.

Questionnaire

The multiple-choice questionnaire used in this study has previously been validated and used in Sweden [20,12]. The questionnaire includes nine questions about resuscitation guidelines covering the following areas:

Evaluation of an unconscious patient

Evaluation of a suspected cardiac arrest

What first aid equipment to prioritize

Indications for defibrillation

The practical defibrillation procedure

The consecutive times of practical defibrillation procedure

The time frame for optimal defibrillation

Mouth-to-mouth ventilation and

Chest compressions

Each question has four possible answers, of which only one is correct. Respondents also have the option to answer, "I do not know". The questionnaire answer alternatives were designed in the same way in 2009 and 2014, but the correct answers to questions 1 (evaluation of an unconscious patient) and 9 (chest compressions) were changed, because the guidelines had been modified. For question 1, the correct answer in 2009 was to check for response, breathing, and pulse, and the correct answer in 2014 was to check for response and breathing only. For question 9, the correct answer in 2009 was a chest compression rate of 100/min, whereas in 2014 it was a compression rate of 100–120/min.

Ethics

The study was approved by the Uppsala Regional Ethics Committee (Dnr 2006/201), and (Dnr 2006/201/2). No individual approval or written consent was mandatory, according to the Ethics Committee decision.

Statistical analyses

The answers to the nine questions were dichotomized as either right or wrong in the analyses. Chi-squared tests were used to compare the results from 2009 and 2014 for each question. Due to multiple comparisons, Bonferroni correction was used to compensate for the increased likelihood of committing a Type I error. An adjusted alpha level was calculated based on the number of analyses (21). The corrected p-value was thus p=.002 (.05/26). As the questionnaire was repeated at the same hospital, some of the health-care participants answered the questionnaire in both 2009 and 2014. Next, we compared the results of all participants in 2009 with those who had undergone training within 1−3 months of the test in 2014 (n=212). Data are presented as number of correct answers, corresponding percentage correct, and p-values. All statistical analyses were conducted using SPSS version 24.0.

Results

A total of 2,034 individuals participated in the study in 2009 and 1,571 participated in 2014. The response rate was 84% in 2009 and 67% in 2014. The mean number of years of work experience of the employees at the hospital was 17.6 (standard deviation, 11.5) in 2009 and 17.8 (standard deviation, 12.2) in 2014. Nurses and assistant nurses were the largest occupational groups. In 2009, all participants who responded to the survey had participated in CPR education within 1−3 months of the study. In 2014, a total of 212 (13.8%) participants received training in resuscitation within 1−3 months of the study. This indicates that regular training guidelines are not followed. The percentage of missing answers in the study questionnaires for the two time periods varied between 0.1% and 3.4%.

Main findings

Overall, 19.6% of the health-care professionals achieved a correct response rate of at least 80% in 2009, whereas 7% did so in 2014.

Knowledge of the guidelines was significantly reduced for three of the nine questions in 2014 compared with 2009, including questions about "how long time in seconds you should spend inspecting a patient", "at what frequency chest compressions should be performed" and the question asking, "What you should do, according to the existing guidelines, if you see a person collapse?" Performance on the 2014 questionnaire was superior to 2009 for the question "what first aid equipment to prioritize?" In two of the nine questions results did not change: "where the defibrillator electrodes should be placed"; "how you know that the ventilation is effective".

There was a high level of guideline knowledge among all health-care professionals that the defibrillator should be prioritized over other first-aid equipment (86% in 2009 vs. 92% in 2014, p<.001). Knowledge of the guideline regarding the number of consecutive times one can defibrillate declined (71% in 2009 vs. 66% in 2014, p<.001).

Comparing the proportion of correct answers for all participants undertaking training in 2009 and for participants who had undertaken training within 1−3 months in 2014, knowledge about "the first thing to do if you see a person collapse in the waiting room" decreased (94% in 2009 vs. 48% in 2014, p<.001).

Survival after in-hospital cardiac arrest

At Västerås Hospital, the 30-day survival rate decreased from 36.6% in 2009 to 14.9% in 2014 (OR=0.28; 95% CI, 0.12−0.66; p=.002). From 2009 to 2011, 22 lives were saved annually in Västmanland, compared with 13 per year from 2012 to 2014.

Discussion

Main findings

In this five-year follow-up study of theoretical knowledge of resuscitation guidelines among employees at a hospital in Sweden, regarding what to do in the case of in-hospital cardiac arrest it was found that theoretical knowledge was markedly reduced after five years, compared with a time point close to CPR education. Knowledge was greater for those who had undergone CPR education within the three months prior to the new knowledge test.

The clinical relevance of our findings could be subject to debate. According to national guidelines, health-care professionals should participate in a CPR course once or twice a year [18]. Skills have been shown to deteriorate 3−6 months after training [21, 22]. In reality, the recommendations for regular education in CPR are not respected, and this is probably a problem in many hospitals around the world. The consequences of not following the guidelines for regular CPR training include impaired theoretical knowledge and impaired adherence to guidelines. Other studies have shown that the retention of theoretical knowledge does not last more than two years after the successful completion of resuscitation training courses [22,23]. The results of the current study are consistent with those of previous works. At Västerås Hospital, 60 instructors actively participated in CPR meetings in 2009, but this dropped to 55 in 2014. Fewer employees underwent CPR training in 2014. The region's learning management system was replaced between 2009 and 2014, meaning that only descriptive activity reports were available. The activity reports for the two years show that in 2009, most of the departments had 80−100% of staff trained, while in 2014, only 50% of the departments trained their employees [24,25].

Structured CPR recertification courses are important for providing the best CPR to patients, following updated guidelines. We can only speculate about the reasons for not regularly refreshing CPR training. One reason might be that CPR courses take hospital employees away from their ordinary work. Limited financial resources may be another contributing factor. Moreover, the implementation of new guidelines takes time [16]. The results from this study should be kept in mind

when planning and prioritizing different education programs in health care, for patient safety.

Almost 50% of the health-care professionals performed significantly worse in 2014 than in 2009 on the question "What is the first thing you should do if you see a person collapse in the waiting room of the hospital where you work?" (Question 1). One reason for this finding may be that health-care professionals take part in many other educational programs and knowledge updates. The ABCDE (Airway, Breathing, Circulation, Disability, and Exposure) concept is not recommended during cardiac arrest situations because examining the pulse is time-consuming, and it is important to start CPR quickly [26]. Previous guidelines have recommended the examination of consciousness, breathing, and pulse control, but current guidelines do not recommend checking the pulse. The everyday clinical work in which health-care professionals check patients' vital parameters includes pulse control monitoring. This could lead to habitual checking of the pulse rate in a suspected case of cardiac arrest, even though it is not included in the guidelines [16].

CPR education in relation to patient survival after in-hospital cardiac arrest

Ultimately, the major challenge to adopting training is to show that a difference is being made to real clinical outcomes.

The rate of survival to discharge after cardiac arrest is on average 32% in Swedish hospitals [9]. In the Västerås Hospital, Västmanland, Sweden, the 30-day survival rate decreased from 36.6% in 2009 to 14.9% in 2014 (Figure 1). Meantime, in the rest of Sweden, there was an increase in the 30-day survival rate during this period, from 24.9% in 2009 to 31.9% in 2014 (OR=1.42; 95% CI, 1.23–1.63; p<.001; p for interaction=.003).
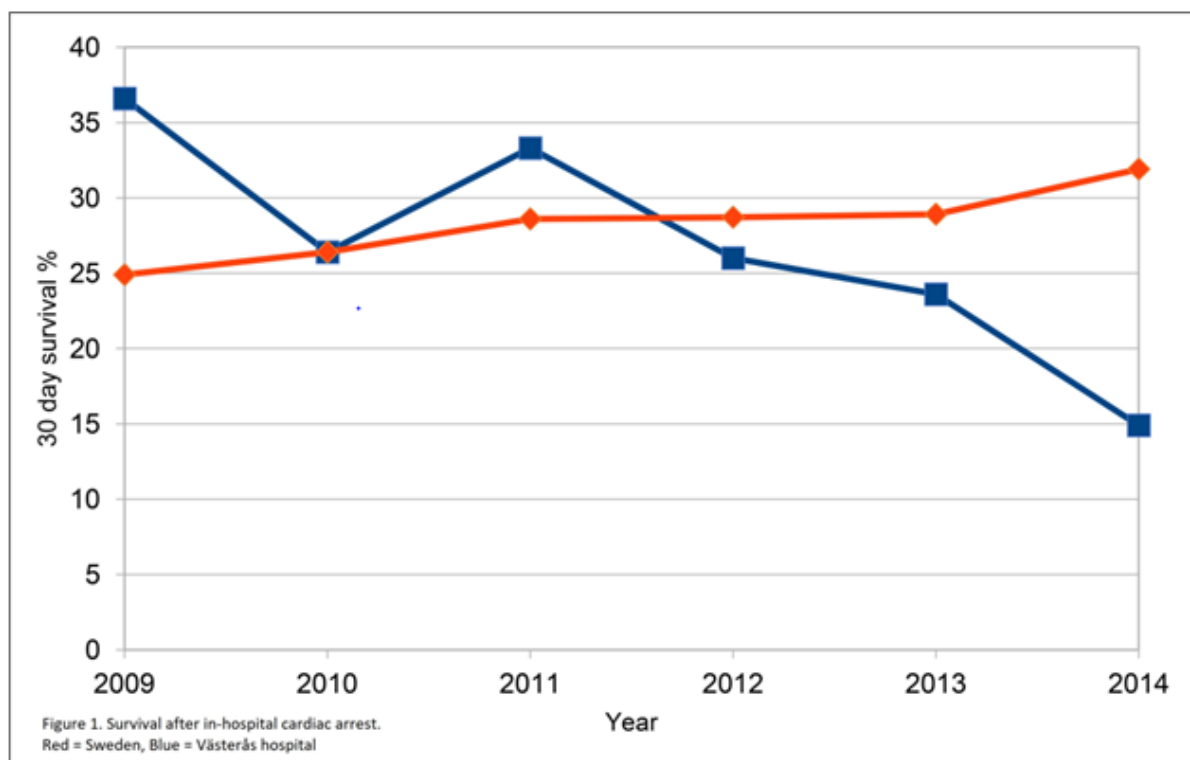

Figure 1. Survival after in-hospital cardiac arrest.
Red = Sweden, Blue = Västerås hospital

Figure 1. *Survival after in-hospital cardiac arrest. A Comparison of survival in Sweden and Västerås hospital.*

Many factors affect the survival rate, with education of hospital employees being only one. However, during the five years following the intervention, and parallel with a deterioration in hospital employees' theoretical knowledge of the guidelines, a sharp decrease in the 30-day survival rate was observed among patients with in-hospital cardiac arrest. Also, the annual refresher courses decreased at the county hospital, which may have affected the survival rate. Another factor affecting survival is whether the initial cardiac rhythm is Ventricular Fibrillation (VF) or not. During the five years, the percentage of cardiac arrest with VF decreased. We can therefore identify two other factors, besides the deterioration in theoretical knowledge, which probably contributed to the marked decrease in survival rate after cardiac arrest in our county.

General discussion

The strengths of the current study include the large sample of different hospital employee categories from a single hospital in Sweden. However, the overall level of knowledge was low, indicating an urgent need for refresher courses in CPR. For patient safety, annual CPR education should be mandatory. Many hospitals agree with the recommendations to conduct annual CPR courses for health-care professionals, but, in the reality, it is not feasible. The intervention study from 2009 showed that theoretical knowledge of and adherence to guidelines increased after the intervention [12]. Here we have identified a decrease in knowledge over time for health-care professionals not taking part in CPR education. Furthermore,

the subgroup who received CPR education in the months prior to answering the questionnaire did not reduce their knowledge. This finding suggests that the deterioration of theoretical knowledge is related to the absence of regular refresher courses in CPR, and this might be one important factor underlying the deterioration observed in the 30-day survival rate. Regular training sessions for professionals and simulations, with a focus on leadership/followership, teamwork, and communication, should be prioritized [26,27]. The management teams of hospitals need to understand the importance of a structured educational regime. Some of the health-care professionals might be new or temporary staff and have deficient knowledge regarding the care of cardiac arrest, which may affect the survival odds of their patients. Successful factors include the implementation of team training as a part of enhancing safety in the organization. This includes learning goals for each team training program related to the organizational goals and getting the leadership to support team training initiatives [16,28].

Single-instance efforts, such as CPR education without repetition, have short-term effects, and the results of our study show that there is a need to prioritize continuous CPR education, and to ensure all staff undertake CPR training and repetition training. The current overload of clinical work and reduced financial resources in the health-care system may affect opportunities for staff to attend CPR refresher courses. This will ultimately affect the patient's right to quality care in conjunction with resuscitation care.

Limitations

As the questionnaire was distributed via internal mail in paper format, we do not know whether some of the hospital employees checked the guidelines, or received help from each other, while answering the questionnaire. The importance of a reduced proportion of patients with VF may affect in-hospital cardiac arrest survival, and the effect of health-care professionals' reduction in participation in annual refresher courses may affect the results.

The survey was anonymous; however, this creates limitations when choosing a statistical method. One might argue that bootstrapping would be one way to solve such a problem. However, with larger sample sizes, violations of distributional assumptions become less of an issue and the benefits of bootstrapping are thus limited. The response rate decreased from 84% in 2009 to 67% in 2014, which might be explained by an increase in workload in more recent years.

Conclusion

Health-care professionals' knowledge in resuscitation has decreased dramatically over time. Our results highlight the urgent need for strong efforts in refresher and continuous training, to maintain hospital employees' knowledge of how to perform CPR after in-hospital cardiac arrest, something that the patient takes as a given when visiting the hospital.

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