Resuscitation Training for Schoolchildren Worldwide: Kids Save Lives

Hugo Van Aken, MD, PhD, Michael Hessler, MD, Peter Brinkrolf, MD, Andreas Bohn, MD, and Antje Gottschalk, MD, PhD

"You can learn much more from your children than they will ever learn from you."

— Friedrich Rückert (1788–1866)

Out of hospital cardiac arrest (OHCA) is a frequent event. In a recent study from Europe (EuReCa ONE), an incidence rate of 84 per 100,000 people was reported. The majority of OHCA (96.4%) occurred in a private residence. In 54.3% of cases, the collapse was witnessed by bystanders, and in 11.9% by the emergency medical service. In 47.7% of cases, a bystander initiated cardiopulmonary resuscitation (CPR). In all patients, where CPR was started, only 10% survived for at least 30 days after OHCA or to hospital discharge.[1] In 2015, the Institute of Medicine estimated that approximately 600,000 people per year experience OHCA in the United States. Survival rates were <6%.[2] Following sudden cardiac arrest, the brain can survive for only 3 to 5 minutes without oxygen—much less time than it usually takes for the emergency medical service to arrive on the scene.

CPR TRAINING AND SURVIVAL RATES

Which forms of treatment improve the survival rate for patients after cardiac arrest? Outcome has not been shown to improve through the administration of drugs such as tenecteplase,[3] epinephrine,[4,5] amiodarone, and lidocaine[6] during CPR. By contrast, the positive effects of bystander CPR on survival and on neurological outcome have repeatedly been demonstrated in recent studies, with survival increasing on average by a factor of 2 to 3.[7–11] In Denmark during 2001 to 2011, more than 75% of working-age 30-day survivors were able to return to work.[12]

In a recent publication, analyzing data from the Swedish Cardiac Arrest Registry, Hasselqvist-Ax et al[7] reported on experience with bystander CPR in Sweden. The study included more than 90% of all individuals who had an OHCA between January 1, 1990, and December 31, 2011, with a total of 30,381 witnessed OHCAs. In Sweden, with a population of 10 million, nearly 3 million citizens have been trained in CPR. When bystander CPR was initiated before the arrival of the emergency medical services, the patient survival rate more than doubled (odds ratio, 2.15 for a higher 30-day survival rate; 95% confidence interval, 1.88–2.45).[7] Notably, the increase in the rate of early bystander CPR correlated with the increase in the numbers of individuals who had received CPR training—with no sign of a plateau developing.

Some studies have shown contrasting results, with few effects of bystander CPR. These findings may be because of the multiple factors that influence survival after cardiac arrest. Studies that use multiple regression analysis with adjustment for confounding factors (eg, the proportion of witnessed cardiac arrests, age, sex, place of collapse) may therefore provide a more accurate estimate of the effects of bystander CPR.[7,13]

There are also dramatic differences between countries in the rates of bystander CPR, which range from 6% in Romania to more than 70% in the Netherlands.[14] Only 4.8% of bystanders who have no training in CPR initiate resuscitation in cases of cardiac arrest, in comparison with 35.1% of those with training in CPR.[15]

MOTIVATION

Motivating bystanders to perform CPR requires clear and simple instructions that take their fears and concerns into account. It must be clearly stated that laypeople can do little wrong—the only wrong thing would be to do nothing.[16] In the view of the authors, the potential for CPR-related injuries (such as fractures to the ribs or sternum, and mediastinal hemorrhage) is clearly outweighed by the importance of avoiding the alternative outcome, namely death, when the patient has actually suffered cardiac arrest.[17]

A straightforward and easy-to-implement approach has been developed for bystanders consisting of the "three Cs"—"**check, call, and compress**" by the European Patient Safety Foundation (www.kids-save-lives.eu). This is based on the European Resuscitation Council's current guidelines on resuscitation, published in 2015.[18,19] In accordance with the guidelines, the role of chest compressions in maintaining the circulation and transport of oxygen to the brain should be emphasized during CPR training. After cardiac arrest in adults, blood and oxygen circulating in the lungs serve as a reservoir that is only depleted after a few minutes, and various studies have shown that CPR with chest compression alone may be as effective as combined ventilation and compression in adults.[19,20] Occasional gasping and passive recoiling of the

From the Department of Anesthesiology, Intensive Care and Pain Therapy, Münster University Hospital, Münster, Germany.

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Address correspondence to Hugo K. Van Aken, MD, PhD, Department of Anesthesiology, Intensive Care and Pain Therapy, Münster University Hospital, Albert-Schweitzer-Campus 1, 48149 Münster, Germany. Address e-mail to hva@uni-muenster.de.

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chest can also facilitate oxygen transport into the lungs, as long as the airway is open.[19] During CPR training, it therefore needs to be clearly stated that chest compressions are the crucial prerequisite for survival and for neurological outcome and that every bystander should start with compressions.[19]

As the study by Swor et al[15] shows, the reasons given by bystanders for not initiating CPR include panic (38.7%) and a fear of performing CPR incorrectly (10.8%). If the opportunity is taken during training events to address the feelings and concerns that bystanders tend to have, it can be expected to increase participants' willingness to take action.[15,21] Encouraging CPR with chest compression alone may make it easier for bystanders to start CPR when they are in panic or afraid of doing something wrong, and it could also avoid any reluctance to carry out mouth-to-mouth resuscitation, as a factor possibly preventing the initiation of CPR.[22]

The use of automatic external defibrillators (AED) by bystanders can also increase the survival rate after cardiac arrest in public places.[23] Today's AEDs are easy to use and can be employed after minimal training, or even without training.[19,24] However, bystanders should not move away from the victim to access an AED; instead, they should immediately start chest compressions.[19] Interrupting chest compressions to try to use an AED has detrimental effects on the neurological outcome.

CPR TRAINING IN SCHOOLS

As the example of Sweden shows,[7] survival after cardiac arrest crucially depends on the proportion of CPR-trained individuals in a population. One implication of this is that CPR training should be incorporated into the school curriculum, so that the proportion of CPR-trained individuals in the population gradually increases over time. In a few countries, it is already mandatory for CPR training to be provided for schoolchildren, and local, regional, and national campaigns have also been started in many countries.[9,12,25] In Denmark, the rate of bystander-initiated CPR increased from about 27% in 2005, when mandatory training in resuscitation was introduced into elementary schools, to 45% in 2010—almost double the figure.[11]

Lukas et al[26] recently published data from a prospective longitudinal study over 6 years in which the effectiveness of schoolteachers in providing CPR refresher courses to schoolchildren was compared with that of emergency physicians. The study included a total of 261 schoolchildren (starting from age 10) who were receiving resuscitation training. In one group, annual resuscitation training events stopped after 3 years; whereas, in a second group, they continued for 6 years. Overall, CPR training increased the schoolchildren's knowledge and practical skills. Although there were no differences with regard to chest compression rate, depth, ventilation volume, or "self-efficacy" at the end of the study, the schoolchildren achieved better results for knowledge (92.86% ± 8.38 vs 90.10% ± 8.63; $P = .04$) and ventilation rate (4.84/min ± 4.05 vs 3.76/min ± 2.37; $P = .04$) when they were trained by teachers than when they were trained by emergency physicians.[26] This study and others clearly show that it is not mandatory for CPR training to be provided by health care professionals, and this may make it easier to implement training events in schools.[26–28] Based on the available data, the optimal time for starting CPR training is at age 12, and a 2-hour course each year appears to be sufficient to maintain adequate performance.[28]

After 5 years of the public week of resuscitation in Germany, the incidence of bystander CPR increased from 17.7% in 2011 to 34% in 2016. However, in the City of Münster, where we started with our program "Kids Save Lives" in the schools, our incidence was 25% in 2011 and increased in 2016 to 45% (data from the German cardiac arrest registry). This large difference between Germany and Münster may be explained by the fact that we started in 2006 with education in the schools, and in 2013, we had the world record where 13,000 schoolchildren were simultaneously educated in resuscitation.[29]

CONCLUSIONS

Increased efforts therefore need to be made by anesthesiologists, and by the medical community in general, to promote bystander CPR through initiatives to provide training both for schoolchildren themselves and also for schoolteachers, who are equally effective in disseminating the necessary information. Including CPR training in the school curriculum, with just 2 hours of CPR teaching per year for all children over the age of 12, is an effective way of increasing the proportion of the population with CPR training and improving the rates of survival after sudden cardiac arrest. This has been recognized in the statement on "Kids Save Lives" published jointly by the European Patient Safety Foundation, the European Resuscitation Council, the International Liaison Committee on Resuscitation, and the World Federation of Societies of Anesthesiologists, and recently endorsed by the World Health Organization.[16]

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Name: Michael Hessler, MD.
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Name: Peter Brinkrolf, MD.
Contribution: This author helped analyze the data.
Name: Andreas Bohn, MD.
Contribution: This author helped analyze the data.
Name: Antje Gottschalk, MD, PhD.
Contribution: This author helped write the manuscript.
This manuscript was handled by: Angela Enright, MB, FRCPC.

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