Role of Pediatricians in Advocating Life Support Training Courses for Parents and the Public

ABSTRACT. Available literature suggests a need for both initial cardiopulmonary resuscitation training and refresher courses. The establishment of a pediatric chain of survival for victims of cardiopulmonary arrest is the focus of this technical report and is advocated in the accompanying policy statement. Immediate bystander cardiopulmonary resuscitation for victims of cardiac arrest improves survival for out-of-hospital cardiac arrest. Pediatricians will improve the chance of survival of children and adults who experience cardiac arrest by advocating for basic life support training and participating in basic life support courses as participants and teachers. Pediatrics 2004;114:e761–e765. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2004-2021, basic life support training courses, cardiopulmonary resuscitation, CPR, cardiac arrest, community education, parents, school children, automated external defibrillator, chain of survival.

ABBREVIATIONS. SIDS, sudden infant death syndrome, CPR, cardiopulmonary resuscitation, AED, automated external defibrillator, EMT, emergency medical technician, AAP, American Academy of Pediatrics, HIV, human immunodeficiency virus.

INTRODUCTION

Pediatricians advocate for the health of children not only at local, state, and national levels but also with individual families and children. Pediatric basic life support training should include injury and cardiopulmonary arrest prevention information and be advocated the same way injury prevention and other preventive pediatric counseling are promoted. In fact, the “chain-of-survival” concept advocated in the Pediatric Advanced Life Support Course is a model in which each critical link in survival from prevention of trauma and cardiac arrest to rehabilitative and secondary preventative care of the survived arrest victim is optimized.1 Pediatric out-of-hospital cardiac arrest carries a poor prognosis, which seems to be improved only by on-scene application of basic life support.2 New information regarding sudden infant death syndrome (SIDS) and sudden cardiac death in children prompts careful attention to the role of the public in the chain of survival for an infant or child who experiences cardiac arrest.3–6 Ventricular fibrillation has been newly considered as an important cause of cardiac arrest in children and adolescents in several recent studies,3,7 which underscores the importance of basic life support training for the public, because cardiopulmonary resuscitation (CPR) before attempted defibrillation may improve the chances of successful defibrillation.8 Use of automated external defibrillators (AEDs) in children experiencing sudden cardiac arrest has been advocated by the American Heart Association. This recommendation includes children older than 1 year.9 All 50 states have now passed laws authorizing use of AEDs.10 Efficacy has been demonstrated by Atkins et al7 in children older than 8 years. These recent observations, along with the progressive improvement in survival of infants and children who undergo cardiac surgery for repair and palliation of congenital cardiac defects, suggest a need to promote pediatric basic life support training for people who could have an opportunity to save the life of a child who experiences sudden cardiac arrest.11 The epidemiology of sudden cardiac arrest in childhood suggests that pediatricians should advocate for pediatric basic life support training for parents, babysitters, child care providers, school personnel and coaches, and other youth leaders. Pediatricians can act as advocates and opinion leaders by serving as participants and instructors in CPR classes in medical settings and communities.12 Although survival rates from currently available studies after out-of-hospital pediatric CPR are discouraging, the survival rate for in-hospital CPR and for those who achieve return of spontaneous circulation before arrival in an emergency department should stimulate researchers and pediatricians to advocate strongly for pediatric basic life support training for the public to increase the available pool of at-the-scene responders to pediatric cardiopulmonary arrest. The need for establishment and maintenance of an adequate airway in a child cannot be overemphasized. The establishment of a pediatric chain of survival is advocated in the accompanying policy statement.13 The available information suggests that outcomes will improve for the newly apneic or fibrillating child who receives prompt CPR.2
Pediatric Cardiac and Respiratory Arrest: Success in Resuscitation

Eisenberg et al\textsuperscript{14} investigated 119 pediatric cases of out-of-hospital cardiac arrest in King County, Washington, spanning a period from 1976 to 1982. The most common cause of cardiac arrest was SIDS (32\%), followed by submersion (22\%). Six percent of patients with basic emergency medical technician (EMT) care and 7\% with EMT and paramedic care survived to hospital discharge. Of 103 patients for whom electrocardiogram rhythm strips were available, 9 (9\%) showed ventricular fibrillation. The majority of patients (77\%) showed asystole. Losek et al\textsuperscript{15} also investigated out-of-hospital pediatric cardiopulmonary arrest and found few neurologically intact survivors (9 of 114 [8\%]). In contrast, Innes and et al\textsuperscript{16} showed a 70\% success rate, with initial resuscitation of 41 children with inpatient pediatric cardiopulmonary arrest, 10 of whom (24\%) were neonates. At 12-month follow-up, 37\% were still alive. Attempts were initially successful in 82\% of primary respiratory arrest, compared with 36\% of cardiac arrests. These data from the inpatient setting suggest a marked improvement in survival with timely application of adequate CPR.

Sirbaugh et al\textsuperscript{17} reported on 300 children in Houston in 1999 who were apneic and pulseless outside the hospital. Eleven percent showed a return of pulse. Six patients survived to hospital discharge, 1 with intact neurologic status. Thirteen patients (4\%) showed ventricular fibrillation. Eleven percent of the total arrests were believed to result from cardiac causes, and 37\% were ascribed to SIDS. Basic CPR was performed by bystanders in 79 (26\%) cases. Twenty-two percent of children who arrested at home received bystander CPR, compared with 36\% of those who had a cardiac arrest at another location. Sixty-five patients had serious water submersions and were given bystander CPR. Of the 65, 41 (63\%) had return of spontaneous circulation before emergency medical services arrived and were not included in the 300 patients. Studies that analyze the outcomes of children who are pulseless and apneic on arrival of emergency medical services professionals and discard cases of successful bystander CPR may introduce a negative bias into the consideration of outcome of out-of-hospital child CPR by negating the bystander CPR. As an aside, in consideration of possible changes in the incidence of ventricular fibrillation and change in survival statistics, no new studies of etiology of cardiac arrest in children have been published, subsequent to the decrease in frequency of SIDS in association with the American Academy of Pediatrics (AAP) “Back to Sleep” campaign.\textsuperscript{18}

Gausche et al\textsuperscript{19} investigated 830 pediatric patients requiring airway management; 596 patients experienced cardiac arrest. The patients had been randomly assigned to receive bag-valve-mask ventilation or endotracheal intubation. Seventy-one percent and 72\% of the children experienced cardiopulmonary arrest in the 2 groups, respectively. Eight percent of subjects from each group survived the arrest. Etiology of the arrest and the number of children who experienced ventricular fibrillation (4\%) were provided in a recently published follow-up study.\textsuperscript{20}

Hickey et al\textsuperscript{21} investigated out-of-hospital cardiopulmonary arrest and found that 9 of 41 patients (22\%) who initially presented to the Columbus Children's Hospital emergency department with a documented cardiac rhythm showed ventricular fibrillation or ventricular tachycardia. Of 21 patients with documented rhythm who were secondarily transferred to the hospital, 5 (24\%) presented with ventricular tachycardia or fibrillation. These shockable rhythms are thought to have a higher likelihood of successful resuscitation compared with asystole. Of 23 patients who had cardiac arrest and return of spontaneous circulation in the field, 14 (61\%) survived to hospital discharge.

**BASIC LIFE SUPPORT TRAINING FOR PARENTS AND CAREGIVERS**

CPR training has been advocated for parents and caregivers of premature infants, ventilator- and tracheostomy-dependent infants, infants who have undergone cardiac surgery or arrhythmia treatment, and others.\textsuperscript{22} The AAP has recommended CPR training for parents and asked pediatricians to identify families with residential swimming pools beginning in the perinatal period for extra targeted counseling regarding drowning prevention.\textsuperscript{23} Efficacy of CPR training for parents has been demonstrated in a variety of ways. Moser et al\textsuperscript{24} showed that CPR training promoted a sense of control and reduced anxiety in parents of neonatal intensive care unit graduates. These authors studied 480 parents who were trained in CPR in 3 randomized groups: instructor-taught CPR, instructor-taught CPR plus social support, or a self-training video module.\textsuperscript{25} Sixty-three percent of subjects were able to demonstrate successful CPR after training. A larger proportion had received one of the instructor methods rather than the self-training video. Less-educated learners and those with better psychosocial adjustment to their child’s illness demonstrated slightly lower successful CPR performance rates.

Concerns about CPR training resulting in increased anxiety for parents are unsupported by scientific data.\textsuperscript{26-28} CPR training for parents of infants with congenital heart disease fostered a sense of empowerment in these parents and helped relieve anxiety.

**BASIC LIFE SUPPORT TRAINING FOR THE PUBLIC**

**Basic Life Support Training for School Children**

Basic life support training for children in schools has been investigated by several groups.\textsuperscript{29-31} Plotnikoff and Moore\textsuperscript{31} as well as Van Kerschaver et al\textsuperscript{32} showed CPR training to an acceptable level in their studies in children as young as 11 and 12 years of age. Plotnikoff and Moore demonstrated a marked decline in performance as early as 5 months after training. Decay of motor skills was more significant than that of cognitive knowledge. Poor performance at retest 5 months after training was felt to indicate
that a refresher course was needed at a shorter interval in this age group. The importance of retraining and the significance of diminution of skills and knowledge over time cannot be overemphasized. Children may especially benefit from an overtraining effect. CPR training in schools in Hampshire, England, was performed in children 7 to 16 years of age. Training was offered in 26% of schools and was provided by school staff in 50.9% of schools and by statutory ambulance services in 30.9% of schools. Other trainers were members of the Red Cross and the St John Ambulance Brigade. Peer-assisted training for boys from Cardiff, Wales, resulted in a lower percentage who reported willingness to provide CPR in an emergency, compared with boys trained by teachers or with girls trained by either method. Vanderschmidt et al demonstrated the need for skills practice and the importance of emphasis on discrete versus continuous skills (ie, teaching basic life support as a series of steps rather than a continuous action). Performance deterioration was noted at 3 months. Basic life support training in school has been recommended for high school students by the AAP.

**Basic Life Support Training for School Personnel and Youth Leaders**

Basic life support training for the public has been investigated in a variety of settings and by using a variety of methodologies. The AAP has also advocated basic life support training for lifeguards. These recommendations are based on the assessment that basic life support training can augment other injury-prevention strategies in saving lives.

**Basic Life Support Training Skills Retention**

Studies of pediatric basic life support skills retention in parents trained in preparation for discharge of high-risk infants show retention of skills 2 months after training in a study by Berden et al and 4 months after training in a study by Dracup et al. Deterioration of skills has been uniformly seen 6 and 12 months after training in these studies, respectively. Berden et al suggested a need for a training interval of at most 3 to 6 months for nurses. Hands-on practice by parents was shown to result in improved skills retention in a study by Komelasky and Bond. In this study, it was noted that a predominance of trainees were the infants’ mothers.

**Barriers to Basic Life Support Training and Implementation**

The study of Platz et al involved interviews of 100 family members of cardiac patients. Barriers to CPR included concern for risk of harm to the victim or lack of knowledge and skill to help. Forty-nine percent reported previous CPR training. Fifty-nine percent of people who underwent CPR training did so for a job requirement. Only 7% had trained within the past year. Only 2% recalled a recommendation from a health care professional that they obtain CPR training. An additional, frequently identified barrier to CPR is risk of contracting human immunodeficiency virus (HIV) infection. The lower rate of willingness to perform CPR in the boys trained in the peer-assisted program in Cardiff, Wales, pointed out the importance of how the potential barriers to CPR are presented and discussed in a training program.

Concern for the risk of HIV infection is considered a barrier to bystander CPR performance in many recent studies. However, in a study from Sweden, the bystander CPR rate was higher in public places (53%) than for cardiac arrest in the home (23%). Overall, bystander CPR was attempted for 36% of cardiac arrests, resulting in a 2.5 times increased likelihood of survival if bystander CPR was provided (95% confidence interval: 1.9–3.1). Concern for risk of spread of disease from mouth-to-mouth resuscitation is a major issue even for prehospital emergency care providers. In their evaluation of willingness to perform mouth-to-mouth resuscitation by New York City emergency medical services professionals, Hew et al found that 57% of 77 EMTs and 100% of 27 paramedics said that they would refuse to perform mouth-to-mouth resuscitation. The study suggested a need for education regarding risks of infection along with CPR training and a need for strategic placement of barrier masks for mouth-to-mouth resuscitation. The risk of infection with HIV is low with contact during CPR: 0.09% for health care workers with mucous-membrane contact with HIV-positive persons. Fear of harming the person who requires CPR rescue has resulted in concern for application of bystander CPR. Adverse effects of CPR on people surviving CPR to hospital admission were no different for people rescued by bystanders versus advanced life support providers in a review of chest radiographs.

Good Samaritan laws protect any layperson or professional who renders first aid to victims of injury. These state statutes provide immunity to health care professionals except in the case of gross negligence. Health care professionals are not covered in the normal conduct of their jobs. Laws in Louisiana, Minnesota, and Vermont termed “failure-to-act statutes” compel all citizens to aid a victim in need. None of these state laws compel a layperson or health care professional to render emergency aid that could result in their own personal danger. The American College of Emergency Physicians has endorsed statutory protection for Good Samaritan acts, including actions of emergency physicians who respond to in-hospital emergencies.

Concern for the cost and outcome of resuscitation in children may decrease health care professionals’ enthusiasm for CPR training programs. Ronco et al reported a 10% survival to hospital discharge for out-of-hospital arrest victims who received CPR. They noted an average cost of $100000 for each survivor and $10000 for each nonsurvivor. Cost-effectiveness of CPR was not investigated, nor was cost of ongoing care of survivors. They did not consider years of potential life lost of nonsurvivors. An overall cost analysis has not been attempted for pediatric out-of-hospital arrest victims. Health care professionals should be reminded that the Hickey et al study and others suggest that the best out-
comes are obtained for children who respond to basic life support interventions.

SUMMARY

Basic life support training should be advocated for anyone who has a chance to provide a link in the chain of survival for a victim of cardiac arrest. Pediatric out-of-hospital arrest victims do less well than similar adult patients and less well than in-hospital pediatric patients. The disparity between the different cardiac arrest survival rates suggests a need to stress application of CPR by any available individual to cardiac arrest survival rates suggests a need to stress application of CPR by any available individual in the pediatric setting.2,12,15 The poor outcomes for stress application of CPR by any available individual ent cardiac arrest survival rates suggests a need to stress application of CPR by any available individual in the pediatric setting.2,12,15 The poor outcomes for children who achieve return of spontaneous circulation only after application of advanced life support interventions demands increased emphasis on basic life support training for anyone who has more than casual contact with children.15,17,20,21 Pediatricians can improve overall community health by advocating for basic life support training for resuscitation of child and adult cardiac arrest victims and by participating in basic life support courses as students and teachers. The best outcomes will still be obtained through prevention of cardiac arrest. To this end, additional investigations to identify children who are at imminent risk of respiratory arrest as well as those with heart rhythm and structural abnormalities are needed, along with investigations to prevent injury, if we are to improve the lives of children and families.

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Pediatrics 2004;114;e761
DOI: 10.1542/peds.2004-2021

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