

Mortality in Spanish pediatric emergency departments: a 5-year multicenter survey

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Background Analysis of the causes of death in children in the pediatric emergency department (ED) may aid the development of management and prevention practices.

Objective To identify the causes of death in Spanish pediatric EDs and to analyze the management of these children in the prehospital and hospital settings.

Methods This was a retrospective descriptive multicenter survey including all patients whose death was certified in 18 Spanish pediatric EDs between 2008 and 2013.

Results During the study period, 3 542 426 episodes were registered in the EDs. Of these, 54 patients died (mortality rate: 1.5/100 000 visits). Data of 53 patients are analyzed (male 36, 67%, 31 younger than 2 years old and 43.3% nonpreviously healthy children). The main causes of death were related to their previous illnesses (24.5%), sudden infant death syndrome (20.7%), and traumatism (18.8%). Prehospital cardiopulmonary resuscitation (CPR)

was performed in 31 patients, and exclusively by health workers in 19 patients. In 35 patients, the parents witnessed the event and seven began CPR. Thirty children were transferred to the pediatric EDs by medical transport (56.6%) and all of them received prehospital CPR (vs. one patient out of 23 arrived in a nonmedical transportation). In 37 patients, CPR was performed in the pediatric EDs. Overall, CPR lasted 40 ± 23 min (range, 10–120 min). CPR was not performed in seven patients at any time.

Conclusion The main causes of death in Spanish pediatric EDs are related to previous illnesses, sudden infant death syndrome, and nonintentional lesions. Several actions have to be considered to improve the quality of care of these children in prehospital and emergency settings. *European Journal of Emergency Medicine* 24:392–397 Copyright © 2017 Wolters Kluwer Health, Inc. All rights reserved.

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Introduction

The presentation of children and adolescents to the pediatric emergency departments (EDs) has increased in recent years in developed countries [1–3]. This is a universal increase irrespective of hospital type and the circumstances of the community where it is located [2,4,5].

Most of these children do well, presentation of critically ill or injured children being very uncommon in the pediatric EDs of industrialized countries. The death of a child in an ED is a rare occurrence, but it has a significant impact on the family and staff involved [6]. The death of a child is one of the hardest situations for pediatric EDs and other staff to deal with and requires skill, sympathy, and composure. There are many factors that need to be taken into account when considering the termination of

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resuscitation efforts and the management of the death of a child in the ED. This is an event with emotional, cultural, procedural, and legal challenges and it is one of the most challenging problems that ED clinicians encounter [7].

Globally, the infant mortality rate has decreased in the last decades [8]. The infrequency of these events and the magnitude of the tragedy combine to make the death of a child in the ED one of the most challenging problems facing emergency healthcare providers [9]. Few clinicians will feel experienced in managing the death of a child [6]. Deciding when to terminate resuscitation efforts or not to initiate them at all or the family's presence ranks among the most difficult tasks that the pediatric emergency team faces when caring for a critically ill or injured infant or child [9].

Analysis of the causes of death of children in pediatric EDs and the quality of care provided to these children and their families is mandatory to design strategies to reduce this mortality and to provide adequate quality of care. However, there are no currently published data on how many children die in Spanish pediatric EDs.

The aim of this study is to determine the causes of death in Spanish pediatric EDs and to analyze the management of these children in the prehospital and hospital settings.

Methods

Study design

This is a retrospective descriptive multicenter survey including all patients whose death was certified in 18 Spanish pediatric EDs between January 2008 and December 2012. Secondary and tertiary EDs, pediatric and mixed pediatric and adults, rural and urban, and small and large EDs were included.

The cause of death was established after revising all the data of the episode including a complete autopsy of the patient.

The study was carried out under the scope of Research Network of the Spanish Society of Pediatric Emergency Medicine (RISEUP-SPERG), after approval was obtained in May 2013.

System of data collection

Eighteen Spanish pediatric EDs reported data, the number of total visits registered during the period of study, and the number of deaths registered.

For all patients whose death was certified in the pediatric ED a specific electronic questionnaire was completed through Google Drive and sent to the principal investigator (E.L.), including sociodemographic, clinical data, results of tests performed, diagnosis, and information on legal-medical documents. We also collected data on the circumstances of the event, prehospital and hospital management, and a specific questionnaire for sudden infant death syndrome (SIDS).

We included all children younger than 18 years of age. However, some pediatric EDs included patients younger than 14 years, reflecting the variability that exists in the upper age limit of patients treated in different pediatric EDs. Organizational characteristics of the public health-care system at the level of the different regions account for differences in age-related thresholds for the provision of care in the pediatric EDs.

Ethical committee

This study was approved by the Ethical Committee of the Basque Country. Approval for the study and for data sharing with the coordinating institution and with the centralized data center was granted by the institutional review board at each participating institution. To maintain patient confidentiality, the forms did not include any data that would have enabled identification of any patients. As identities remained anonymous and no intervention was performed on patients, informed consent was not required.

The procedures performed in this study followed the ethical standards in the Helsinki Declaration of 1964, as revised in 2008, as well as the national law.

Statistical analysis

The variables were defined at the beginning of the study period to avoid changes in criteria later over time. Statistical analysis was carried out using the SPSS, version 22 (IBM Company, Chicago, Illinois, USA). Each variable was described using frequency distributions for categorical variables and statistical central tendency such as mean and median and variability as the SD or the range for continuous variables according to their distributional characteristics.

Results

During the study period, 3 542 426 episodes were registered in the 18 pediatric EDs included in the study. Of these, 54 patients died in the pediatric EDs (mortality rate: 1.5 dead patients/100 000 visits).

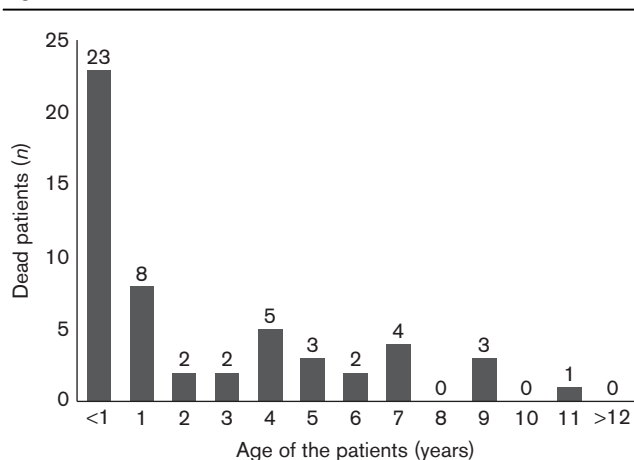
Data of 53 episodes were obtained and analyzed. Of these, 36 were male (67%). The median age was 17 months (interquartile range, 4.7–59 months). Age distribution is shown in Fig. 1.

Twenty-three were nonpreviously healthy children (43.3%), mainly because of neuromuscular (13 children) and congenital heart diseases (5 children).

Almost 50% of the deaths were certified between 8:00 and 16:00, showing no significant differences related to the day of the week and being more infrequent in summer months (8/53, 15.1%).

The causes of death recorded were mainly related to previous morbidity or SIDS (Table 1). Thirty-one episodes corresponded to patients younger than 2 years old. The causes of death in this group are listed in Table 2.

Fig. 1



Age distribution of the patients who died in Spanish pediatric emergency departments.

The characteristics of the 11 patients diagnosed with SIDS are shown in Table 3.

Prehospital management

The event occurred mainly at home (35, 66%). Other places were the street (5, 9.4%), school (4, 7.5%), and the nursery (2, 3.7%). Events were witnessed by the parents (accompanied or not by other individuals such as grandparents, teachers) in 35 cases (66%). In five cases, teachers were the only bystanders of the event.

Prehospital cardiopulmonary resuscitation (CPR) was initiated by bystanders and prehospital health workers in 31 patients (58.5%). Of these, CPR was exclusively performed by health workers in 19 patients (61.3%). In the other 12 patients, CPR was initiated immediately by family members (seven cases; 20% of those witnessed by them), teachers, police, or other bystanders and continued by health workers.

Thirty children (56.6%) were transferred to the pediatric ED by medical transport (26 by medical ambulance and

Table 1 Causes of death in Spanish pediatric emergency departments

Cause of death	n (%)
Event related to their previous illness	13 (24.5), 56.5% of the nonpreviously healthy group
Sudden infant death syndrome	11 (20.7)
Traumatism	10 (18.8)
Polytraumatism	8
Head injury	2
Sepsis	5 (9.4)
Drowning	1 (1.8)
Asphyxia	1 (1.8)
Unknown	12 (22.6)
Previous neurologic pathology	6

Table 2 Causes of death in children younger than 2 years old in the Spanish pediatric emergency departments

Cause of death	n (%)
SIDS	11 (35.5)
Event related to their previous illness	8 (25)
Cardiologic	4
Neurologic	3
Digestive	1
Traumatism	2 (6.5)
Head injury	2
Sepsis	2 (6.5)
Unknown	8 (25)

SIDS, sudden infant death syndrome.

Table 3 Characteristics of infants with sudden infant death syndrome

Age (mean ± SD) (months)	4 ± 2.5
Place [n (%)]	
Home	7 (63.6)
Nursery	2 (18.2)
School	2 (18.2)
Site [n (%)]	
Bed	4 (36.4)
Cot	3 (27.3)
Sofa	1 (9.1)
Unknown	3 (27.3)
Position [n (%)]	
Supine	1 (9.1)
Lying prone	1 (9.1)
Unknown	9 (81.8)
Amounts of milk in the mouth [n (%)]	
Yes	1 (9.1)
No	8 (72.7)
Unknown	2 (18.2)
Covered by bedding [n (%)]	
Yes	0
No	5 (45.5)
Unknown	6 (54.5)
Color [n (%)]	
Pale	6 (54.5)
Cyanotic	4 (36.4)
Unknown	1 (9.1)
Temperature [n (%)]	
Cold	6 (54.5)
Warm	7 (58.3)
Normal	0
Unknown	5 (45.5)
Prehospital CPR [n (%)]	
Yes	9 (81.8)
No	2 (18.2)

CPR, cardiopulmonary resuscitation.

four by medical helicopter) and all of them received prehospital CPR (vs. one patient in the group of patients arriving in a nonmedical transport). Of the 53 patients, 27 (50.1%) arrived in the pediatric ED with assisted ventilation (bag-mask ventilation for 21 patients, mechanical ventilation for four patients, and noninvasive ventilation for two patients). Analyzing the data registered for these patients, it was found that all the patients transferred by an Emergency Medical Service received a vascular access: intraosseous access in 16 patients (62%), peripheral venous access in nine patients (34%), and central venous access in one patient (4%).

Management in the pediatric ED

On arriving at the pediatric ED, all patients showed an altered pediatric assessment triangle (37 patients with cardiorespiratory failure, 69.8%) and the Glasgow Coma Scale value was three in 46 patients (86.8%). Of the five patients diagnosed with sepsis, only two had a GCS 15 when they arrived at the ED.

In 37 children, CPR was performed in the pediatric ED (69.8%, including the insertion of an endotracheal tube in 20 children), having been previously initiated in 22 children. In the other 16 children (30%), no CRP maneuvers were performed on arrival to the pediatric ED (of these, no CPR maneuver was performed at any setting in seven children; this was because two children showed evident signs of death and the other two children were in the terminal stage of their illness). Overall, when used, CPR was performed for 40 ± 23 min (range, 10–120 min) and in six cases it lasted longer than an hour.

Certain differences related to the registered mortality rate and duration of CRP maneuvers were identified. Thus, in some hospitals, the mortality rate in the pediatric ED was higher (3.8 and 8/100 000 ED episodes). In these two pediatric EDs, the mean duration of CRP manoeuvres was also longer (45 and 70 min on average, respectively).

Discussion

Death in the Spanish pediatric EDs is very rare. Most of these events involve children younger than 2 years of age and almost 50% of the episodes were associated with their previous illness or SIDS. Both prehospital and ED management showed different chances of improvement.

Infant mortality remains one of the key health indicators. The rate and causes of mortality in children differ markedly depending on the country [8]. In Spain, the infant mortality rate has decreased significantly in recent decades and it is one of the countries with the lowest infant mortality rates in the European Union [8,10]. Overall, excluding perinatal illnesses, the main causes of child mortality in Spain are accidents, SIDS, neoplasms, and congenital diseases or malformations, with significant variations related to different age groups [10,11].

Nevertheless, very few data from the Spanish pediatric EDs are available. According to several studies, most of the incidences of out-of-hospital cardiorespiratory arrest (OHCRA) are because of accidents and heart diseases [11–13]. In our series, previous disease-related deaths accounted for a large number of cases, mostly related to neuromuscular and cardiac pathology, and accidents rank third in frequency.

Injuries are a leading cause of death and disability in children in the European Union, mainly among children aged 5–19 years. The main mechanisms of unintentional injury death are road traffic crashes (pedestrian, bicycle,

car occupant) drowning, poisoning, thermal injuries, and falls. It is possible to prevent or reduce the impact of injuries by improving legislation, product modification, environmental modification, education, and emergency medical care [14]. Use of bicycle helmets, child safety seats/restraints, use of seat belts, following of the speed limit in urban areas, child-proof packaging/pharmaceuticals, smoke detectors in homes, and barrier fencing in domestic swimming pools can help prevent unintentional injuries in children and young adolescents [15,16]. In this way, although the grade of child safety in Spain has been classified as good by the European Child Safety Alliance, different areas for improvement have been identified that deserve further attention, particularly with respect to road safety and water safety/drowning prevention [17,18].

On the basis of our data, SIDS is also a very relevant cause of death in Spanish pediatric EDs, being the second leading cause among all the cases and the first cause in the group younger than 2 years old. This is not surprising because, despite the decrease in SIDS in the last few years, it remains the leading cause of death among infants between 1 month and 1 year of age in the developed world. In a recent review of SIDS data from industrialized countries, in the majority of countries, there has been a major decrease in SIDS rates from 1990 to 2005, with the largest decreases occurring before 2000 [19]. These declines seem to be real and attributable, in large measure, to risk-reduction activities, especially placing infants to sleep in a supine position [20–23]. The rates of SIDS, however, varied considerably across countries for different reasons, such as differences in the age of inclusion and definitions and the use of death-scene investigation and autopsy protocols [19]. According to a study carried out by the Working Group of Perinatal and Infant Pathology of the Spanish Society of Forensic Pathology, up to 30% of sudden deaths in infants younger than 1 year were classified as SIDS [24]. In Spain, prevention campaigns on SIDS began in 1993 after an initiative of a group of pediatricians from the Basque Country and Navarre. The impact of placing newborns to sleep in a supine position during their stay in a maternity ward, besides the recommendation to parents to continue doing this at home, during the first 6 months of life was studied in Navarre, and it was found to significantly decrease the mortality rate because of SIDS [25].

Considering the setting where the event occurs, it is known that the mortality of children with an OHCRA is greater than if the event occurs in the hospital [26], underscoring the importance of adequate management of these children. If the event is witnessed and adequate and prompt CPR is initiated immediately, the prognosis is better [12,27,28]. Despite the small number of patients in our study, certain results are alarming. The low involvement of families in initiating CPR maneuvers has to be analyzed and, if possible, improved, as noted in other studies [12,27,29–31]. This may be related to deficiencies

in the training of the general population in first aid and CPR. Training programs in CPR involving the entire population are essential [32]. A significant number of cases in our study were patients with underlying disease and most of them probably did not suffer an irreversible situation. In those cases, it is especially important to train parents and caregivers in CPR. Furthermore, CPR education in school may be the best way to gain experience [33]. Both these strategies are not implemented in Spain. The latter, together with improved technical quality of CPR maneuvers, are two essential factors to improve survival of children with OHCA. In fact, in our study, a significant variability in the care provided was detected, which associated with the activation of the emergency medical services. In addition, the role of emergency medical dispatchers (EMD) is critical in OHCA. The EMD must help bystanders to identify cardiac arrest correctly [34]. EMDs can increase the rate of bystander CPR and can help improve resuscitation even among well-trained bystanders [35,36].

In addition, in our results, there was some variability related to CPR maneuvers in different pediatric EDs, such as the duration of CPR. We have also identified differences in mortality rates recorded in the different hospitals included. It is imperative to standardize the approach and management of these children in the ED in Spain.

However, the presence of the family is recommended during resuscitation maneuvers in the pediatric ED [7]. In our series, the presence of the family was documented for only two patients. According to the American Academy of Pediatrics and other societies, the option to be present with the child during all the procedures performed in the pediatric ED should be offered to the parents and guardians. Support should be offered before, during, and after the procedure [37–41].

Our study has certain limitations. First, the methods used to obtain information related to the episodes varied among hospitals. Some of them do not have electronic registries and it was more difficult to obtain all the information. In addition, the data were collected retrospectively. For instance, information on the response time of the emergency services or the elapsed time between the event and the initiation of CPR by witnesses was not collected for all the episodes, although it is a very important factor in the chain of survival [12,27,28]. Nevertheless, we believe that, overall, these episodes are well documented and the information obtained was enough to fulfill the objective of the study. However, the EDs involved in the study may not be truly representative of all Spanish pediatric EDs overall. However, the study included settings with different characteristics, such as rural, tertiary, secondary, and mixed pediatric and adult EDs. Therefore, it seems unlikely that self-selection would have significantly biased the results.

In summary, the certification of death in Spanish pediatric EDs is very uncommon. The main causes of death are related to previous illnesses, SIDS, and nonintentional lesions. Several improvements need to be considered in the management of these children both in prehospital and in emergency settings.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

References

- 1 Derlet R, Richards J, Kravitz R. Frequent overcrowding in U.S. emergency departments. *Acad Emerg Med* 2001; **8**:151–155.
- 2 Schneider SM, Gallery ME, Schafermeyer R, Zwemer FL. Emergency department crowding: a point in time. *Ann Emerg Med* 2003; **42**:167–172.
- 3 Pou J, Benito J. Pediatric Emergencies: a new specialty. *An Esp Pediatr* 2002; **56**:1–4.
- 4 O'Neill KA, Molczan K. Pediatric triage: a 2-tier, 5-level system in the United States. *Pediatr Emerg Care* 2003; **19**:285–290.
- 5 Thomas DO. Special considerations for pediatric triage in the emergency department. *Nurs Clin North Am* 2002; **37**:145–159.
- 6 O'Meara M, Trethewie S. Managing paediatric death in the emergency department. *J Paediatr Child Health* 2015. [Epub ahead of print].
- 7 Davies F, Gaushe-Hill M, Chu S, Cheema B, Ang A, Caceres L, et al. *International standards of care for children in emergency departments*. West Melbourne, Australia: International Federation for Emergency Medicine; 2012.
- 8 Wang H, Liddell CA, Coates MM, Mooney MD, Levitz CE, Schumacher AE, et al. Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2014; **384**:957–979.
- 9 O'Malley PJ, Barata IA, Snow SK. American Academy of Pediatrics Committee on Pediatric Emergency Medicine; American College of Emergency Physicians Pediatric Emergency Medicine Committee; Emergency Nurses Association Pediatric Committee. Death of a child in the emergency department. *J Emerg Nurs* 2014; **40**:e83–e101.
- 10 Regidor E, Gutiérrez-Fisac JL. *Mortality patterns in Spain, 2010*. Madrid, Spain: Ministry of Health, Social Services and Equality; 2013.
- 11 López-Herce J, García C, Domínguez P, Carrillo A, Rodríguez-Núñez A, Calvo C, Delgado MA. Spanish Study Group of Cardiopulmonary Arrest in Children. Characteristics and outcome of cardiorespiratory arrest in children. *Resuscitation* 2004; **63**:311–320.
- 12 López-Herce J, García C, Domínguez P, Rodríguez-Núñez A, Carrillo A, Calvo C, Delgado MA. Spanish Study Group of Cardiopulmonary Arrest in Children. Outcome of out-of-hospital cardiorespiratory arrest in children. *Pediatr Emerg Care* 2005; **21**:807–815.
- 13 Bardai A, Berdowski J, van der Werf C, Blom MT, Ceelen M, van Langen IM, et al. Incidence, causes, and outcomes of out-of-hospital cardiac arrest in children. A comprehensive, prospective, population-based study in the Netherlands. *J Am Coll Cardiol* 2011; **57**:1822–1828.
- 14 Sethi D, Towner E, Vincenten J, Seguí-Gómez M, Racioppi F. *European report on child injury prevention*. Denmark: WHO Regional Office for Europe; 2008.
- 15 Towner E, Dowswell T, Mackereth C, Jarvis S. *What works in preventing unintentional injuries in children and young adolescents? An updated systematic review Technical Report*. London: Health Development Agency; 2001.
- 16 Towner E, Towner J. UNICEF's child injury league table. An analysis of legislation: more mixed messages. *Inj Prev* 2002; **8**:97–100.
- 17 European Child Safety Alliance. *Child safety report card, Spain 2012*. Spain; Birmingham: European Child Safety Alliance, Eurosafe; 2012.
- 18 Rubio B, Yagüe F, Benítez MT, Esparza MJ, González JC, Sánchez F, et al. Comité de Seguridad y Prevención de Lesiones No Intencionadas en la Infancia de la Asociación Española de Pediatría. Recommendations for the prevention of drowning. *An Pediatr (Barc)* 2015; **82**:e1–e5.
- 19 Hauck FR, Tanabe KO. International trends in sudden infant death syndrome: stabilization of rates requires further action. *Pediatrics* 2008; **122**:660–666.
- 20 Dwyer T, Ponsonby AL. The decline of SIDS: a success story for epidemiology. *Epidemiology* 1996; **7**:323–325.

- 21 Markestad T, Skadberg B, Hordvik E, Morild I, Irgens LM. Sleeping position and sudden infant death syndrome (SIDS): effect of an intervention programme to avoid prone sleeping. *Acta Paediatr* 1995; **84**:375–378.
- 22 Dwyer T, Ponsonby AL, Blizzard L, Newman NM, Cochrane JA. The contribution of changes in the prevalence of prone sleeping position to the decline in sudden infant death syndrome in Tasmania. *JAMA* 1995; **273**:783–789.
- 23 Mitchell EA, Ford RP, Taylor BJ, Stewart AW, Becroft DM, Scragg R, *et al.* Further evidence supporting a causal relationship between prone sleeping position and SIDS. *J Paediatr Child Health* 1992; **28** (Suppl 1):S9–S12.
- 24 Suárez MP, Aguilera B, Hernández AI, Molina P, Morentin B. Causes of sudden infant death in Spain after the forensic autopsies. In: Izquierdo MI, editor. *White Paper on sudden infant death*. 3th ed. Majadahonda (Madrid): Ediciones Ergon; 2013. pp. 215–226.
- 25 Olivera JE, Sánchez F, Zabalza A, Berrade S, Olivera A, Viguria D, *et al.* Change of posture and decrease the mortality rate of sudden infant death in Navarre. *An Esp Pediatr* 1996; **45**:161–166.
- 26 Moler FW, Meert K, Donaldson AE, Nadkarni V, Brilli RJ, Dalton HJ, *et al.* In-hospital versus out-of-hospital pediatric cardiac arrest: a multicenter cohort study. *Crit Care Med* 2009; **37**:2259–2267.
- 27 Kitamura T, Iwami T, Kawamura T, Nagao K, Tanaka H, Nadkarni VM, *et al.* Conventional and chest-compression-only cardiopulmonary resuscitation by bystanders for children who have out-of-hospital cardiac arrests: a prospective, nationwide, population-based cohort study. *Lancet* 2010; **375**:1347–1354.
- 28 Sasson C, Rogers MA, Dahl J, Kellermann AL. Predictors of survival from out-of-hospital cardiac arrest: a systematic review and meta-analysis. *Circ Cardiovasc Qual Outcomes* 2010; **3**:63–81.
- 29 Atkins DL, Everson-Stewart S, Sears GK, Daya M, Osmond MH, Warden CR, Berg RA. Resuscitation Outcomes Consortium Investigators. Epidemiology and outcomes from out-of-hospital cardiac arrest in children: the Resuscitation Outcomes Consortium Epistry-Cardiac Arrest. *Circulation* 2009; **119**:1484–1491.
- 30 Donoghue AJ, Nadkarni V, Berg RA, Osmond MH, Wells G, Nesbitt L, Stiell IG. CanAm Pediatric Cardiac Arrest Investigators. Out-of-hospital pediatric cardiac arrest: an epidemiologic review and assessment of current knowledge. *Ann Emerg Med* 2005; **46**:512–522.
- 31 Park CB, Shin SD, Suh GJ, Ahn KO, Cha WC, Song KJ, *et al.* Pediatric out-of-hospital cardiac arrest in Korea: a nationwide population-based study. *Resuscitation* 2010; **81**:512–517.
- 32 Strömsöe A, Andersson B, Ekström L, Herlitz J, Axelsson A, Göransson KE, *et al.* Education in cardiopulmonary resuscitation in Sweden and its clinical consequences. *Resuscitation* 2010; **81**:211–216.
- 33 Cave DM, Aufderheide TP, Beeson J, Ellison A, Gregory A, Hazinski MF, *et al.* Importance and implementation of training in cardiopulmonary resuscitation and automated external defibrillation in schools: a science advisory from the American Heart Association. *Circulation* 2011; **123**:691–706.
- 34 Vaillancourt C, Charette ML, Bohm K, Dunford J, Castrén M. In out-of-hospital cardiac arrest patients, does the description of any specific symptoms to the emergency medical dispatcher improve the accuracy of the diagnosis of cardiac arrest: a systematic review of the literature. *Resuscitation* 2011; **82**:1483–1489.
- 35 Akahane M, Ogawa T, Tanabe S, Koike S, Horiguchi H, Yasunaga H, Imamura T. Impact of telephone dispatcher assistance on the outcomes of pediatric out-of-hospital cardiac arrest. *Crit Care Med* 2012; **40**:1410–1416.
- 36 Bradley SM, Rea TD. Improving bystander cardiopulmonary resuscitation. *Curr Opin Crit Care* 2011; **17**:219–224.
- 37 Knapp J, Mulligan-Smith D. American Academy of Pediatrics Committee on Pediatric Emergency Medicine. Death of a child in the emergency department. *Pediatrics* 2005; **115**:1432–1437.
- 38 American Academy of Pediatrics, Committee on Hospital Care. Family-centered care and the pediatrician's role. *Pediatrics* 2003; **112** (Pt 1): 691–697.
- 39 Emergency Nurses Association, Department of Nursing Resources. *Presenting the option for family presence*. Dallas, TX: Emergency Nurses Association; 1995.
- 40 American Heart Association. Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 2: ethical aspects of CPR and ECC. *Circulation* 2000; **102** (Suppl):I12–I21.
- 41 O'Malley P, Barata I, Snow S, Shook JE, Ackerman AD, Chun TH, *et al.* American Academy of Pediatrics Committee on Pediatric Emergency Medicine, American College of Emergency Physicians Pediatric Emergency Medicine Committee and Emergency Nurses Association Pediatric Committee. Death of a child in the emergency department. *Pediatrics* 2014; **134**:198–201.