ARTICLE

Transition From a Traditional Code Team to a Medical Emergency Team and Categorization of Cardiopulmonary Arrests in a Children's Center

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Objectives: To study the effect of an intervention on prevention of respiratory arrest and cardiopulmonary arrest (CPA) and to characterize ward CPAs by preceding signs and symptoms and initial cardiac rhythm.

Design: A before-and-after interventional trial (12 months preintervention and 12 months postintervention).

Setting: A tertiary care, academic children's hospital.

Participants: Admitted patients who subsequently had either the code team or pediatric medical emergency team (PMET) called or who had a respiratory arrest or CPA on the wards.

Intervention: Transition from a traditional code team to a PMET that responds to clinically deteriorating children in noncritical care areas.

Outcome Measures: Combined rate of respiratory arrests and CPAs, rate of CPAs, and rate of respiratory arrests on the wards and agreement between independent reviewers on categorization of CPAs.

Results: There was no change in the rate of CPAs on the wards. However, there was a 73% decrease in the incidence of respiratory arrests (0.23 respiratory arrests/1000 patient-days pre-PMET vs 0.06 post-PMET, $P=.03$). There was 100% agreement between reviewers on categorization of CPAs.

Conclusions: Transition to a PMET was not associated with a change in CPAs but was associated with a significant decrease in the incidence of ward respiratory arrests. We also describe children who may have benefited from the PMET but whose data were not captured by current outcome measures. Finally, we present a new method for categorization of ward CPAs based on preceding signs and symptoms and initial cardiac rhythm.

Arch Pediatr Adolesc Med. 2008;162(2):117-122

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CHILDREN WHO HAVE IN-hospital cardiopulmonary arrests (CPAs) have only a 15% to 34% 1-year survival rate.[1-4] Despite the advent of organized code teams, the survival rate has not significantly improved. Similarly, the literature has not noted any improvement in the adult survival rate of in-hospital CPAs during the past 4 decades.[5] Most adults who ultimately have CPAs on the wards have signs of decompensation prior to their actual CPAs.[6] In an observational study of pediatric in-hospital CPAs, Reis et al[1] noted that most participants had signs of either respiratory compromise or shock preceding their events.

In the adult population, recognition that patients have signs and symptoms prior to CPA has led to the introduction of response teams being called when vital signs or symptoms associated with an increased likelihood of decompensation appear. These teams, named medical emergency teams when they are physician led or rapid response teams when they are nurse led, are meant to be called before a patient has a CPA in hopes of improving outcomes.[7] Several observational studies in adults have reported a decreased incidence of CPAs after the introduction of a medical emergency team; whereas a large, cluster-randomized controlled trial performed in Australia did not show a significant reduction in CPA incidence.[8-12] Although most agree that it is essential to identify decompensation early, not all researchers agree that medical emergency teams have been proven to improve patient outcomes and have called for further studies.[13,14] In addition, little is known about whether medical emergency teams are effective in children, as there are few reports to date. However, 2 recent publications have demonstrated encouraging reductions in the incidence of pe-

Table 1. Definition and Categorization of In-Hospital Pediatric CPA Type (n=12)

Type of CPA	No. of CPAs (%)	Definition	Clinical Case Example
I	2 (17)	Patient with signs and/or symptoms prior to CPA for > 15 min that, if heeded, may have either prevented arrest or allowed transfer to the PICU to enhance management of the event.	A 9-month-old infant admitted with respiratory distress had "abrupt asystolic arrest" prompting a call for the PMET. Review of records reveals the infant had only ¼ L per minute of oxygen flow but an RR of 80-90/min for 24 h preceding the event. There were multiple calls to the physician, a final nursing note of RR 110-120/min, and a call to the physician 20 min prior to event, followed by a rapid drop in RR from 120/min to near apnea and an HR from 168/min to 54/min requiring compressions with rapid progression to asystole.
II	3 (25)	Patient with new onset signs and/or symptoms prompting rapid and appropriate call for PMET. Despite arrival of PMET, patient progresses to CPA. Progression from symptoms to CPA in < 15 min.	A 13-year-old adolescent with oncologic disease and history of pulmonary *Aspergillus* infection and treatment with 3 L per minute of oxygen flow. After walking to the bathroom, the patient had sudden-onset respiratory distress prompting a call for the PMET. On arrival, the patient was tachypneic and tachycardic and oxygen saturation was 93% on 100% NRB and dropping. A BVM was used and while the patient was prepared for intubation, asymmetric breath sounds developed. It became clear that the adolescent had developed spontaneous PTX. Needle decompression was performed but the patient progressed to PEA and asystole with immediate management by PMET. Review of the records revealed no remarkable signs or symptoms in the preceding 24 h.
III	3 (25)	Patient with no remarkable signs or symptoms, when sudden hypoxic episode or vagal stimuli (eg, episode of reflux, placement of nasogastric tube) triggers bradycardic event to HR < 60/min and poor perfusion requiring compressions in < 5 min.	A 1-year-old child with cardiomyopathy had a large bowel movement, then, in the nurse's arms, a rapid bradycardia that led to asystole. Ward staff started CPR and called the PMET. Review of the records revealed no remarkable signs or symptoms in the preceding 24 h.
IV	4 (33)	Patient with no remarkable signs or symptoms when sudden pulseless event occurs: PVT/VF/PEA/asystole.	A 19-year-old patient with ESRD and BOOP who had had a renal transplant was recovering on the wards with nighttime BiPAP. The patient's CRM alarmed for sudden tachycardia, the patient pulled off the BiPAP mask then became unresponsive. Ward staff started CPR and called the PMET. The pediatric resident successfully defibrillated the patient for VF. Review of the records revealed no remarkable signs or symptoms in the preceding 24 h. However, new EKGs revealed acquired long QT_c as the probable inciting event.

Abbreviations: BiPAP, bilevel positive airway pressure; BOOP, bronchiolitis obliterans with organizing pneumonia; BVM, bag valve mask ventilation; CPA, cardiopulmonary arrest; CPR, cardiopulmonary resuscitation; CRM, cardiorespiratory monitor; EKG, electrocardiogram; ESRD, end-stage renal disease; HR, heart rate; NRB, nonrebreather; PEA, pulseless electrical activity; PICU, pediatric intensive care unit; PMET, pediatric medical emergency team; PTX, pneumothorax; PVT, pulseless ventricular tachycardia; QT_c, corrected QT interval; RR, respiratory rate; VF, ventricular fibrillation.

diatric CPAs preceded by warning signs and symptoms that had gone unheeded after introduction of a pediatric medical emergency team (PMET).[15,16] The specific aims of this study were to evaluate whether a PMET would be associated with a decrease in the rate of respiratory arrests and CPAs and whether eliminating CPAs with preceding signs and symptoms would be equivalent to eliminating all pediatric ward CPAs.

METHODS

This is a before-and-after interventional study evaluating the effect of a transition from a traditional code team to a PMET at the Johns Hopkins Children's Medical and Surgical Center (JHCMSC), a tertiary care, academic medical center. Our primary outcome measure was the combined rate of respiratory arrests that required intubation and CPAs that required compressions and/or defibrillation at the JHCMSC (per 1000 patient-days and per 1000 patient discharges). Secondary measures included rate of respiratory arrests, the rate of CPAs, survival rates, and categorization of all ward CPAs into type (as defined in **Table 1**) based on the kind of CPA and whether or not there were any preceding signs or symptoms.

Prior to our intervention, the code team responded to regular-care beds and intermediate medical–care beds when the staff summoned them for a CPA or other critical situation. Under that system, ward nurses and physicians managed cases until the code team arrived, at which point care was generally transferred. The code team consisted of the following members: a pediatric intensive care unit (PICU) fellow, a PICU nurse, a PICU respiratory therapist, a nursing shift coordinator (senior nurse who supervises bed management and triage in JHCMSC), a senior assistant resident, a junior assistant resident, and an intern. The Johns Hopkins School of Medicine institutional review board reviewed and approved the study protocol.

NEW JOB DESCRIPTIONS AND REVISION OF CODE TEAM MEMBERSHIP

Preliminary studies revealed that our ward nurses were expected to perform too many tasks during a medical emergency and did not always perform first-responder tasks.[17] Therefore, we clarified the role of ward nurses during medical emergencies and formally delegated some of their previous roles to new members of the team. The goal was to ensure that ward nurses could concentrate on assessing and treating airway, breathing, and circulation. A pediatric pharmacist was added to the team with the key responsibility of preparing arrest medications. Similarly, a security officer and the hospital chaplain were added to the team to further decrease the nursing workload.

TRANSITION FROM TRADITIONAL CODE TEAM TO PMET

A fundamental change in mission of the team was undertaken: to respond to children before they had a respiratory arrest or CPA. We highlighted this goal with a new title, the pediatric rapid response team. Although the literature refers to a physician-led team as a medical emergency team, for institutional reasons, our team is called a pediatric rapid response team. To be consistent with the literature, however, in this article, we will refer to our team as a PMET.[7]

The next step was to define new triggers or illness categories for activating the PMET. We deliberately created broad criteria to encourage calls and described categories of illness rather than using specific vital sign parameters, because the wards had children of varying ages and no single set of vital sign parameters would be appropriate (**Table 2**).

The third step was to educate the following staff about our new goals: those caring for patients who might need to call the team, those notified that the team had been called (specifically, physician faculty), responding members of the PMET, and those facilitating the call (ward clerks and telephone operators). The key components of the education were (1) to change the staff's understanding of triggers for calling the PMET, (2) to encourage the staff to listen to their instincts and call when worried, and to clarify that there is no need for a physician's approval to call the PMET, (3) to educate PMET members not to say anything disparaging to front-line staff about appropriateness of a call, (4) to empower staff to circumvent established hierarchies to call the PMET if needed, (5) to encourage that the PMET be called if one group of staff needs assistance even if others are comfortable with the situation, and (6) to emphasize that if a parent expresses any concerns or fears about his or her child's clinical status, then the PMET should be called. This educational effort was initiated 2 months before implementation of the PMET and continued during staff debriefings of PMET calls.

In October of 2004, the code team officially transitioned to a PMET. For the year pre- and post-PMET, the principal investigator and another author (E.A.H. and C.G., respectively) recorded all calls to the JHCMSC code team and the PMET. Calls were captured through 1 of 2 mechanisms: (1) authors carried code pagers so they knew when each call was made and (2) a monthly record of all calls to the code team was maintained by the telephone operators. After each call, the PICU fellow, as leader of the PMET, was contacted for a brief summary of the event, which focused on whether the case involved a respiratory arrest that required intubation or a CPA, and issued the required mediation. The time and date of all events were recorded in an electronic database and CPAs and respiratory arrests on the wards were noted and confirmed through retrospective chart reviews. Survival data of patients who had a respiratory arrest or CPA was assembled through retrospective examination of electronic medical records. Patient-days and discharge data were obtained through the JHCMSC administrative database. Analysis of severity of illness indices during those periods were conducted using the *All Patient Refined Diagnosis Related Group, version 20, weighted* (*APDRG*).[18] The *APRDRG* classifies each hospital discharge into a group based on the diagnoses and procedures associated with the discharge.[18] Each discharge is also assigned a complexity and mortality risk score within the *APRDRG* category. Relative values or weights are then assigned based on the *APRDRG* and the complexity score. When looking at a group of discharges, each weight is averaged together to make the case mix index. For analytic purposes, incidence rate ratios were compared using Stata, version 8.0, with 2-tailed α tests (Stata Corp, College Station, Texas).

Table 2. Triggers for Calling the Pediatric Medical Emergency Team

Respiratory distress/compromise
Abnormal or worsening respiratory symptoms
Decrease in saturations despite first-line interventions
Seizures with apnea
Progressive lethargy
Circulatory compromise/acute shock syndrome
Supraventricular tachycardia/other dysrhythmias
Acute change in neurologic/mental status
Respiratory arrest
Cardiac arrest
Worried staff
Worried family member

In addition, we reviewed the medical records of all CPAs that occurred on the pediatric wards during the 30-month period after implementation of the PMET to determine if (1) there were any preceding signs and symptoms that if heeded may have theoretically prevented the CPA and (2) whether or not the PMET had been activated prior to onset of apnea and loss of pulse. This information was used to categorize the CPAs as type I through IV (ranging from theoretically preventable with clear signs and symptoms preceding the event to unavoidable, ie, no preceding signs or symptoms) (Table 1). Owing to the low incidence of pediatric ward CPAs, we included 30 months of postimplementation CPAs for this part of our data set to have more data for analysis. The categorization scheme was reviewed by a group of pediatric intensivists to ensure each category was clearly defined and would further our understanding of the types of children having CPAs on the wards. Two pediatric intensivists independently reviewed and categorized each event and percent agreement was calculated.

RESULTS

The volume of patients treated in the hospital during the 2 periods was similar. From October 1, 2003, to September 30, 2004, there were 48 393 patient-days and 7504 discharges and from October 1, 2004, to September 30, 2005, there were 49 588 patient-days and 7503 discharges. The mean (SD) monthly hospital case mix severity index was similar across the 2 time periods: 2.02 (0.21) vs 2.05 (0.14). This indicates that the patients' illness severities were comparable the year before and after transition to the PMET. Transition to the PMET was associated with an increase in the rate of calls for the team: 1.1 calls per 1000 patient-days, or 6.8 calls per 1000 patient discharges pre-PMET, vs 1.8 calls per 1000 patient-days, or 11.9 calls per 1000 patient discharges post-PMET (incidence rate ratio, 1.68; 95% confidence interval, 1.18-2.43). This indicates that after the educational intervention, the ward staff was 68% more likely to call the whole team for assistance.

The combined rate of respiratory arrests and CPAs on the wards decreased 51% after transition to the PMET, but not significantly: 0.33 arrests per 1000 patient-days and 2.1 arrests per 1000 patient discharges pre-PMET vs

Table 3. Data for the Code Team vs the Pediatric Medical Emergency Team[a]

Outcome Variable	Code Team[b]	Pediatric Medical Emergency Team[c]	IRR (95% CI)	*P* Value
Annual No. of discharges	7504	7503	NA	
Annual patient-days	48 393	49 588	NA	
Mean monthly *APDRG* case mix severity (SD)[b,c]	2.02 (0.21)	2.05 (0.14)	NA	
Calls for team				
Annual total, No.	51	88	1.68 (1.18-2.43)	
No./1000 discharges	6.8	11.7		.002
No./1000 patient-days	1.1	1.8		.003
Combined ward arrests[d]				
Annual total, No.	16	8	0.49 (0.18-1.20)	
No./1000 discharges	2.1	1.1		.10
No./1000 patient-days	0.33	0.16		.10
Ward respiratory arrests				
Annual total, No.	11	3	0.27 (0.05-1.01)	
No./1000 discharges	1.46	0.40		.04
No./1000 patient-days	0.23	0.06		.03
Ward cardiopulmonary arrests				
Annual total, No.	5	5	0.98 (0.22-4.24)	
No./1000 discharges	0.67	0.67		>.99
No./1000 patient-days	0.10	0.10		.97

Abbreviations: *APDRG*, *All Payer Refined Diagnosis Related Group, version 20, weighted*[18]; CI, confidence interval; IRR, incidence rate ratio; NA, not applicable.
[a] Johns Hopkins Children's Center, Baltimore, Maryland.
[b] Data collected October 2003 through September 2004.
[c] Data collected October 2004 through September 2005.
[d] Respiratory events that required intubation and cardiopulmonary arrests on the wards.

Table 4. Types of Arrests and Survival in the Code Team vs the Pediatric Medical Emergency Team[a]

Type of Arrests and Survival Outcome	No. (%) Code Team[b]	No. (%) Pediatric Medical Emergency Team[c]	*P* Value
Combined No. of annual respiratory and cardiac arrests[d]	16	8	NA
Respiratory arrests	11 (69)	3 (38)	NA
Cardiopulmonary arrests	5 (31)	5 (62)	NA
Survival			
24 h	11 (69)	8 (100)	.10
PICU discharge	9 (56)	6 (75)	.66
Hospital discharge	8 (50)	6 (75)	.39
6 mo	5 (31)	5 (58)	.20

Abbreviations: NA, not applicable; PICU, pediatric intensive care unit.
[a] Johns Hopkins Children's Center, Baltimore, Maryland.
[b] Data collected October 2003 through September 2004.
[c] Data collected October 2004 through September 2005.
[d] Respiratory events that required intubation and cardiopulmonary arrests on the wards.

0.16 arrests per 1000 patient-days and 1.1 arrests per 1000 patient discharges post-PMET (incidence rate ratio 0.49; 95% confidence interval, 0.18-1.20). Closer analysis reveals there was no change in the rate of CPAs (**Table 3**). However, the incidence of respiratory arrests decreased 73% after implementation of the PMET (incidence rate ratio, 0.27; 95% confidence interval, 0.05-1.01). This was manifested as a decrease from 0.23 to 0.06 respiratory arrests per 1000 patient-days ($P=.03$). There was a consistent decrease, but not a statistically significant difference, in survival of patients who had a respiratory arrest or CPA after the intervention (**Table 4**).

Our incidence of CPAs was 0.10 per 1000 patient-days before and after the introduction of the PMET. During the 30-month period after implementation, there were 12 pediatric CPAs. The distribution of CPA type was as follows: 2 type I (17%), 3 type II (25%), 3 type III (25%), and 4 type IV (33%). Thus, the 2 type I CPAs may have been preventable and should have prompted calls for the PMET prior to the arrests. This was equivalent to 0.016 type I CPAs per 1000 patient-days. However, the remaining 83% of CPAs were not obviously preventable. Table 1 summarizes these events.

COMMENT

Transition to a PMET did not result in a decrease in the incidence of CPAs, but was associated with a decrease in the rate of respiratory arrests requiring intubation on the wards. This finding is important and worthy of further investigation. Our methods did not allow us to capture events in which a patient was ventilated with a bag mask but not intubated, so we cannot comment on whether near respiratory arrest events were decreased by transition to a PMET. However, further analysis revealed that none of the children that were transferred to the PICU after a PMET were intubated immediately on arrival. Thus, there is no indication that children needing intubation on the wards had the procedure delayed due to implementation of the PMET.

Tibballs et al[15] completely eliminated preventable, or type I, CPAs. Similar to us, Brilli et al[16] saw a decrease in the incidence of respiratory arrests but not CPAs. However, despite not eliminating CPAs, they saw improved post–medical emergency team mortality and a decrease in type I CPAs.[16] In the 30-month post-PMET period, we still had 2 potentially preventable CPAs. Pediatric medical emergency teams are ultimately created to prevent all type I CPAs. By reviewing our type I CPAs, we identified areas in which our nursing and resident staff needs more education, which should ultimately increase the safety of our patients.

Recent literature has suggested that the volume of calls for medical emergency teams is inversely associated with the rate of ward CPAs, ie, the more calls, the fewer CPAs.[19] We observed a 68% increase in calls, but do not know if more calls could have prevented the remaining respiratory arrests and preventable CPAs. Despite the increase in calls, the PICU fellow continued to decide whether the patient required PICU admission. Thus the final step in the process was identical and, if appropriate, a patient could remain on the floor after stabilization.

The first issue to consider is whether our call criteria could have been more effective. Duncan et al[20] recently reported on efforts to validate a set of vital signs and symptoms known as the pediatric early warning system (PEWS), in terms of its ability to identify children who had an in-hospital CPA. This and other tools should be methodically evaluated, as having a validated system of triggers will be an invaluable component of a reliable PMET. We should also consider, rather than having a single team to respond to both arrests and deteriorating patients, as Tibballs et al[15] and we have done, whether having a separate PMET and code team exist simultaneously, as Brilli et al[16] reported, would have affected our results. Some would argue that ward staff may be more willing to call for help early if they can call a small team with less associated chaos. However, in our experience, when the PICU fellow was "curbsided" in the past, they often arrived to find a critically ill child and had inadequate resources for the situation. Currently, there is no data to define the most appropriate PMET call criteria or team structure, thus this is an important area of future research.

Type II CPAs may also benefit from the PMET. For example, post-PMET implementation, one nurse caring for an infant with intermittent supraventricular tachycardia noted the infant's pulse was slowing more than expected after receiving a β-blocker. Though it was still technically within the normal range, she called the PMET. On arrival, the infant's pulse was 80/min, so they prepared for possible further decompensation. When the infant's heart rate dropped below 60/min, compressions were immediately started and epinephrine, glucagon, and calcium were quickly administered. The pharmacist prepared medications, the PICU nurse administered them, and the PICU fellow intubated the patient. Compressions were needed for less than 4 minutes before the patient's heart rate and blood pressure recovered. The patient was transferred to the PICU, extubated within hours, and made a full recovery. Afterwards, ward staff specifically stated they would never have considered using glucagon, would not have prepared it as quickly as the pharmacist, and doubted they would have managed the arrest as well without the PMET. Although this CPA was not prevented, management was optimized through early activation of the PMET. Owing to the low incidence of pediatric CPAs, it is likely that a multi-center study would be needed to determine if the increase in survival rates we observed are valid and will translate to improved long-term clinical outcomes for children.

Children with type III and IV CPAs, or children who have CPAs with essentially no discernible warning signs and symptoms, seem to have the least potential to benefit from a switch from a traditional code team to a PMET. Traditionally, pediatricians have been taught that CPAs in children are not only rare but are almost always preceded by respiratory compromise, thus we were particularly surprised at the number of type IV CPAs. Only 5 of 12 (43%) of our CPAs could be construed as respiratory- or hypoxia-related and only one of those was seemingly preventable. Not surprisingly, the 3 type III CPAs (sudden bradycardic life-threatening events) were all in children aged 1 year or younger, whereas the 4 type IV events (sudden pulseless events) were in patients aged 10 to 19 years. Thus, while children are generally resilient, our own data and that from Tibballs et al[15] and Brilli et al[16] reflect that hospitalized children are still at risk of primary CPAs. Regardless of whether a pediatric hospital intends to implement a PMET, it is important to continue quality-assurance programs for management of in-hospital, out of–intensive care unit CPAs.

The second issue was related to events not captured by our outcome measures. The following is an outline of 2 similar cases, pre- and post-PMET: In the pre-PMET period, an infant became tachycardic, tachypneic, mottled, and cool. The nurse called the intern repeatedly, but he believed, because the infant was alert with a normal blood pressure, that the patient was fine. After several hours and visits by the intern, the nurse went through unofficial channels to ask the PICU fellow to assess the child. On arrival, the PICU fellow requested a series of interventions that required many ward nurses to leave their own patients to implement the plan. The infant had severe metabolic acidosis and free air on abdominal film. Several hours after the nurse first became concerned, the infant was taken to the operating room for an exploratory laparotomy. Eighteen months post-PMET, another infant developed essentially identical symptoms. The nurse called the intern who again did not fully appreciate the severity of the situation. The nurse did not believe the child was safe so she informed the intern she was calling the PMET. The team arrived within minutes, quickly performed a series of interventions and transferred the infant to the PICU. The ward nurses continued caring for their other patients while the PMET staff performed these interventions. The infant was stabilized in the PICU and taken to the operating room for an exploratory laparotomy. The first infant had a very long section of his bowel resected and ultimately died of septic shock. The second infant had a short portion of his small bowel resected with a primary reanastomosis and quickly recovered.

We cannot prove that the first infant would have done better post-PMET or that the second infant would not have done as well pre-PMET, but the quality of care delivered to the second child was clearly superior to that of the first. Neither infant's data were captured with our study outcome measures. These types of cases are important to consider as we attempt to define appropriate outcome measures for future studies of PMETs' effectiveness.

Finally, the third issue is nursing perception of the PMET. Unfortunately, we did not perform a formal assessment of nursing satisfaction, but consider the following: On presentation of final study data to our cardiopulmonary resuscitation advisory committee, we asked whether, in the face of statistically equivocal results and no change in the rate of CPAs on the wards, we should consider reverting to a traditional code team. A senior nurse manager representing the nursing staff essentially ended further discussion by stating, "We refuse to go back to the old hierarchical system. We've finally empowered our staff to call for help when they need it and it is not safe for the children to go back."

Our study has several limitations, including the small sample size and observational nature of the design. Also, in retrospect, we realize that by debriefing team members postarrest in the preintervention period, we may have begun to change the culture and theoretically lowered the preintervention incidence of CPAs. This Hawthorne effect would have decreased our ability to detect a difference related to introduction of the PMET. However, our data are consistent with the only other published studies of PMETs.[15,16]

CONCLUSIONS

Transition to a PMET was associated with a decrease in the rate of respiratory arrests requiring intubation on the general pediatric wards. The incidence of CPAs on the wards was unchanged, but the suggestion of longer postarrest survival after PMET is an important consideration for future research. We also believe it is important to consider other equally valuable outcome measures in future studies. In addition, categorization of ward CPAs into type was very illuminating and helped to identify targets for future education of ward nurses and house staff. Finally, our study reveals that there may be inevitable pediatric CPAs on the wards; thus, in addition to considering ways to avoid as many type I CPAs as possible, hospitals should ensure that their ward staff function as effective first responders to increase the likelihood that a child who has a CPA will receive high-quality basic and advanced life support.

Accepted for Publication: July 29, 2007.
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Author Contributions: Dr Hunt had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Hunt, Zimmer, Shilkofski, and Miller. *Acquisition of data:* Hunt, Rinke, Matlin, Garger, and Dickson. *Analysis and interpretation of data:* Hunt, Zimmer, Rinke, Matlin, and Miller. *Drafting of the manuscript:* Hunt, Zimmer, Rinke, Shilkofski, and Garger. *Critical revision of the manuscript for important intellectual content:* Hunt, Zimmer, Rinke, Shilkofski, Matlin, Garger, Dickson, and Miller. *Statistical analysis:* Hunt and Miller. *Administrative, technical, and material support:* Zimmer, Rinke, Shilkofski, Garger, Dickson, and Miller. *Study supervision:* Shilkofski and Miller.
Financial Disclosure: None reported.
Additional Contributions: Jamie Haggerty assisted with data collection, Kristen Nelson, MD, assisted with validating the categorization of CPAs, and Peter Pronovost, MD, PhD, provided critical review of the manuscript.

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