Mortality after admission in the pediatric emergency department: A prospective study from a referral children's hospital in southern India

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Objective: Data on outcomes after admission in pediatric emergency departments are sparse in India. Our objectives were to determine the clinical and epidemiologic profile of acutely ill children and to identify risk factors for mortality.

Design: Prospective, longitudinal study, conducted in 1999.

Setting: Pediatric emergency department at the Institute of Child Health, a multiple specialty, children's referral, public hospital in Madras, India.

Patients: Children of <12 yrs of age who required acute care in the pediatric emergency department (excluding minor illnesses) recruited consecutively during a 2-mo period.

Measurements and Main Results: Data included demographic variables, clinical profile, diagnoses, therapy, and in-hospital mortality after admission (outcome). In a cohort of 1155 children, there were 141 deaths (12.2%). Mortality was highest in the neonatal group (17.8%), which accounted for 67% of all deaths. Among neonates, breathlessness, poor feeding, birth asphyxia, and prematurity were the most common presenting problems. Among the postneonates, breathlessness, fever, and fits ranked high. Multivariate analyses to determine risk factors were done separately for neonates, postneonates, and those aged 1–12 yrs. Among neonates, age of ≤7 days, prematurity, low birth weight, chest retractions, central-peripheral temperature gap, and respiratory failure requiring ventilation were significant risk factors for mortality. Among the postneonatal group, poor pulse volume and respiratory failure were strong risk factors. In those aged >1 yr, central-peripheral temperature gap and respiratory failure were major risk factors.

Conclusions: The incidence of mortality is high in our setting and further research is needed to identify causes of preventable deaths. Children presenting with signs of hypoperfusion and respiratory failure had poor outcomes. This raises the concern that children may be presenting late, with advanced, severe illness to our pediatric emergency department. The data also suggest that identification of serious illness in children is possible with simple clinical signs and symptoms. (Pediatr Crit Care Med 2002; 3:358–363)

KEY WORDS: pediatric emergency department; mortality; risk factors; outcomes; India

Outcome data of acutely ill children in the pediatric emergency department (PED) setting are routinely audited in most developed countries. Scoring systems and predictive models are used to predict outcomes such as risk of admission (1), level of care (2), severity of illness (3), and mortality (4). There is also a move toward uniformity in reporting of pediatric data in the PED and other settings—the Pediatric Utstein style (5). In contrast, data are often lacking on quality of emergency care, monitoring, diagnosis, and treatment of seriously ill children in developing countries (6). A recent survey of 21 hospitals from seven developing countries showed that emergency treatment areas were poorly organized, initial patient assessment was often inadequate, and treatment often delayed (6).

In India, the specialty of emergency medicine is evolving (7, 8). The Indian Society for Emergency Medicine was started very recently, and attempts are now being made to create formal postgraduate training programs in emergency medicine and critical care (8). A recent survey from Madras (now called Chennai) clearly showed the lack of minimum standards in emergency departments and the poor infrastructure that existed even in a large, metropolitan city (8). Limited resources and the virtual absence of organized emergency services in many places reduce the chances of favorable outcomes among acutely ill children. Although there are hospitals with organized PED services in India, these are located in cities and affiliated with large hospitals and medical schools. By and large, however, the majority of medical colleges, taluk, and district hospitals catering to the socio-economically disadvantaged children in India do not as yet have separate PEDs (9). There is a need to document outcomes of acutely ill children in India and to use it for organizing PED services. The Institute of Child Health (ICH), Madras, India, is uniquely placed to do this. Since 1969, the ICH has had about 650,000–700,000 patients registering at the outpatient departments every year. Partly because care is free and because it is one of the few exclusive pediatric referral centers in the country, an overwhelming number of sick children are referred to the ICH. Until re-

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cently, emergency care was provided after admission, and valuable time would elapse for the admission formalities to be completed before definitive treatment could be started. Appreciating the need for organized emergency care, the PED at ICH was started in 1997. For the first time, physicians, residents, and staff nurses were designated to serve exclusively in the PED. The PED members were encouraged to get certified in Pediatric Advanced Life Support and Neonatal Advanced Life Support (10). Infrastructure was improved, and state-of-the-art monitoring equipment and drugs were made available. Our study was done to determine the clinical and epidemiologic profile of acutely ill children at our PED and to identify risk factors for mortality.

MATERIALS AND METHODS

Setting. The study was done at the ICH, a 537-bed, multiple specialty, children's referral, public hospital attached to the Madras Medical College. Our hospital mainly caters to the economically poor population of Madras City and to two large southern Indian states: Tamil Nadu and Andhra Pradesh. The infant mortality rates in Tamil Nadu and Andhra Pradesh were 53 per 1000 and 63 per 1000, respectively (1997 census of India). In India as a whole, the infant mortality rate was 71 per 1000. Because ICH is affiliated with the largest medical school in the state, training is provided at all levels—to medical students, residents, and fellows. ICH has the largest pediatric residency program in the country. Neonates referred to the hospital and children under 12 yrs of age who required acute care in the PED were included in the study (the upper limit of 12 yrs is because children beyond 12 are managed by adult medicine services in India). These patients were triaged and resuscitated in the PED. The PED team works around the clock and comprises a senior pediatrician, two pediatric residents, and trained nurses. Management of emergencies is based on Advanced Pediatric Life Support, Neonatal Advanced Life Support, and Pediatric Advanced Life Support guidelines (11–13).

Study Design. The design was a prospective, longitudinal study. Between September 1 and October 31, 1999, we prospectively collected data on a variety of risk factors and mortality with the help of a structured data sheet developed using the Pediatric Advanced Life Support and Advanced Pediatric Life Support guidelines (11, 12). The data sheet included demographic variables, symptoms, clinical signs, diagnoses, therapy, and outcomes. The data collection strategy was pragmatic—data were collected as part of routine patient care in the PED. Apart from the structured data sheet, no special effort was made for this study. The implications of this pragmatic design for quality of data are discussed later. Because the study was done as an audit of outcomes, no special informed consent was obtained for this study. Since no formal institutional review board system exists in the hospital, the audit was done with the approval of the PED chief, and permission to publish the results was granted by the former director of ICH.

Patients. On admission, all sick children and neonates underwent a rapid cardiopulmonary assessment. Airway, breathing, and circulation were stabilized depending on the severity of the cardiorespiratory and neurologic compromise. Those children with very minor trauma, mild diarrhea, and illnesses not requiring immediate resuscitation were excluded. For conditions like status epilepticus and acute asthma, specific treatment was given using current evidence-based guidelines. During the study period, 51,899 children registered in the outpatient department. Of these, 1155 children (2.2%; study cohort) were managed in the PED. Of these children, 141 children died at varying time intervals after PED admission, either in the PED or elsewhere in the hospital. We did not collect data on mortality after discharge. Because data were collected as a part of routine patient care, we defined our study variables pragmatically. Because one of our objectives was to identify simple, rapid, easy to identify clinical symptoms and signs as predictors of mortality, we did not collect physiologic or laboratory measurements. Table 1 shows the study variables and the definitions used in our study.

Statistical Analyses. The data were analyzed using STATA software (version 7, Stata Corporation, College Station, TX). Because mortality patterns are heavily influenced by age, all analyses were done separately for three subgroups: neonates (n = 534), postneonates aged 1–12 mos (n = 187), and those aged 1–12 yrs (n = 434). The incidence of mortality was calculated for the entire cohort and the subgroups. For bivariate analysis, the following potential risk factors were evaluated: age, sex, refusal to feed, perinatal depression (birth asphyxia), preterm birth, low birth weight, grunting, chest retractions, cyanosis, central-peripheral temperature gap, poor pulse volume, abnormal posture, and respiratory failure requiring ventilation. Not all of these were relevant to all the subgroups. All these variables were dichotomized for bivariate analysis.

Table 1. Study variables and definitions

Classification	Variable	Definition
Respiration	Grunting	Audible sound produced during expiration
	Retractions	Visible indrawing of subcostal, intercostal, and suprasternal muscles
	Cyanosis	Comparison of examining physician's palm with that of the child for cyanosis
	Respiratory failure requiring ventilation	Bradypnea or apnea, poor respiratory effort, decreased peripheral breath sounds necessitating ventilation (bag and mask or endotracheal intubation)
Circulation	Poor pulse volume	Comparison of femoral pulse simultaneously with the dorsalis pedis, where a normal central pulse is rated as +++ and a normal peripheral pulse is rated as ++; when the dorsalis pedis is difficult to feel or just felt it is rated as + or 0.
	Central-peripheral temperature gap	Assessed by comparing the warmth of the trunk with the peripheries by simultaneously placing the dorsum of the physician's hand on the abdomen of the child and comparing it with that placed on the thigh, below the knee, and then below the ankle.
Central nervous system	Abnormal posture	Floppy or not able to maintain posture, intermittent extensor posturing
Perinatal	Low birth weight	Birth weight of <2500 g
	Preterm	Gestational age of <37 completed weeks
	Birth asphyxia	Referral note from the primary physician or nurse or history suggestive of perinatal depression
	Refusal to feed (poor feeding)	History from the parent/care giver

Relative risks and 95% confidence intervals were computed to assess the strength of association between risk factors and mortality.

Unconditional logistic regression was performed using methods described elsewhere (14): variables that were statistically significant at the 5% level on bivariate analysis were included in the preliminary model. In addition, other variables that were considered biologically important were forced into the model, irrespective of statistical significance. Because many of the risk factors were correlated, collinearity was evaluated by generating correlation matrices and handled by eliminating one of the two collinear variables. Interactions were evaluated by including interaction terms (cross product terms) in the model. From this full model, variables that did not contribute significantly were dropped one at a time until all those remaining contributed significantly. The impact of elimination of each variable was evaluated using the likelihood ratio (LR) test, a test that has a chi-squared distribution. The backward, step-wise process was continued until the best fitting, parsimonious final model was identified. The fit of the final model was assessed using the Hosmer-Lemeshow goodness-of-fit test (15) and area under receiver operating characteristic curve. The results are presented as adjusted odds ratios with 95% confidence intervals.

RESULTS

Baseline Characteristics and Clinical Profile

Among the 1155 children treated in the PED, 534 (46%) were neonates, 187 (16.2%) were postneonates (aged 1–12 mos), and 434 (37.6%) were aged 1–12 yrs. Among the neonates, 33% were less than a day old, 40% were aged between 1 and 7 days, and 27% were older than 7 days. Boys accounted for 44%, 55%, and 54% among neonates, postneonates, and those aged 1–12 yrs, respectively. The clinical profile at admission to the PED is shown in Table 2. Rare events are not shown in this table. Among neonates, breathlessness, poor feeding, birth asphyxia, and prematurity were the most common presenting problems. Among the postneonates, breathlessness, fever, and fits ranked high. In those aged >1, fits, fever, and breathlessness were important.

Mortality

In the cohort of 1155 children, there were 141 deaths. Table 3 shows the mortality data by subgroups, age categories, and sex. The mortality incidence decreased with age, with the highest mortality incidence in the neonatal group and lowest among those aged 1–12 yrs. The neonatal group accounted for 67% of all deaths. In the neonatal group, babies aged ≤7 days had a significantly elevated risk of mortality. The sex differentials were not significant.

Table 2. Chief presenting problem or reason for referral at the time of PED admission among acutely ill children (by subgroups)[a]

Chief Presenting Problem/Reason for Referral	Neonatal Group (n = 534), Frequency (%)	Postneonatal Group (n = 187), Frequency (%)	Children Aged 1–12 yrs (n = 434), Frequency (%)
Breathlessness	137 (26)	98 (52)	139 (32)
History of fits	53 (10)	55 (29)	139 (39)
Fever	40 (8)	67 (36)	161 (37)
Vomiting	44 (8)	20 (11)	66 (15)
Poor feeding	109 (20)	20 (11)	22 (5)
Diarrhoea	46 (9)	26 (14)	17 (4)
Acute abdominal pain/discomfort	16 (3)	8 (4)	22 (5)
Jaundice	57 (11)	0	10 (2)
Wheezing	0	31 (17)	91 (21)
Birth asphyxia	94 (18)	2 (1)	0
Preterm birth	85 (16)	0	0

[a]Percentages do not add up to 100 because of overlapping categories.

Table 3. Mortality by age and sex among neonates, postneonates and those aged 1–12 yrs

Age/Sex Category	No. of Children	No. of Deaths	Incidence of Mortality (%)
Neonatal group (all)	534	95	17.8
Males	235	40	17.0
Females	299	55	18.4
≤7 days	359	75	20.9
>7 days	175	20	11.4
Postneonatal group (all)	187	24	12.8
Males	103	14	13.6
Females	84	10	11.9
1–6 mos	130	16	12.3
>6 mos	57	8	14.0
Children aged 1–12 years (all)	434	22	5.1
Males	235	9	3.8
Females	199	13	6.5
1–5 yrs	303	12	3.9
>5 yrs	131	10	7.6
All subgroups combined	1155	141	12.2

Risk Factors for Mortality

Bivariate Analysis. Bivariate analyses were done to identify risk factors for mortality. All variables were dichotomous and coded as yes or no. Age was dichotomized within each subgroup and comparisons were: among the neonates, those aged >7 days (reference category) vs. those aged less; among the postneonates, those aged >6 mos (reference) vs. those aged 1–6 mos; in the third subgroup, those aged >5 yrs (reference) vs. those aged 1–5 yrs. As shown in Table 4, nine risk factors were significantly associated with mortality among neonates. Of these, respiratory failure requiring ventilation, central-peripheral temperature gap, abnormal posturing, prematurity, and grunting seemed to be most important. In the postneonatal group, poor pulse volume, respiratory failure, central-peripheral temperature gap, and cyanosis were significant. In those aged >1 yr, respiratory failure, central-peripheral temperature gap, poor pulse volume, cyanosis, and posturing had elevated risk.

Multivariate Analysis. As shown in Table 5, among the neonates, the following variables made up the final model: age, low birth weight, preterm birth, retractions, central-peripheral temperature gap, and respiratory failure requiring ventilation. All were statistically significant, with respiratory failure, central-

Table 4. Risk factors for mortality among neonates, postneonates, and those aged 1–12 yrs (bivariate analysis)[a]

	Risk Ratio (95% CI)		
Risk Factor	Neonatal Group (n = 534)	Postneonatal Group (n = 187)	Children Aged 1–12 yrs (n = 434)
Age[b]	1.82 (1.15, 2.89)	0.87 (0.39, 1.93)	0.52 (0.22, 1.17)
Male sex	0.92 (0.63, 1.33)	1.14 (0.53, 2.43)	0.58 (0.25, 1.34)
Low birth weight	1.89 (1.26, 2.84)	1.76 (0.59, 5.19)	
Preterm birth	2.32 (1.60, 3.36)		
Birth asphyxia	0.67 (0.38, 1.18)		
Poor feeding	1.24 (0.81, 1.89)		
Grunting	2.25 (1.53, 3.31)	1.08 (0.45, 2.55)	2.18 (0.77, 6.15)
Chest retractions	1.98 (1.36, 2.87)	1.48 (0.64, 3.40)	1.84 (0.81, 4.17)
Cyanosis	1.57 (0.94, 2.60)	2.44 (1.02, 5.82)	4.73 (1.58, 14.1)
Poor pulse volume	1.57 (1.07, 2.30)	4.45 (1.94, 10.1)	6.46 (2.70, 15.4)
Central-peripheral temperature gap	2.45 (1.70, 3.52)	3.32 (1.59, 6.93)	7.29 (3.16, 16.8)
Abnormal posture	2.35 (1.65, 3.36)	1.61 (0.72, 3.61)	3.11 (1.37, 7.02)
Respiratory failure requiring ventilation	2.80 (1.84, 4.25)	3.75 (1.82, 7.72)	8.20 (3.78, 17.7)

CI, confidence interval.

[a]All risk factors were not evaluated in all subgroups; also, due to insufficient numbers or missing data, risk ratios could not be computed for some risk factors; [b]Age was dichotomized as >7 days (reference category) vs. ≤7 days among neonates; >6 mos (reference) vs. 1–6 months among postneonates; >5 yrs (reference) vs. 1–5 yrs among those aged 1–12 yrs.

Table 5. Risk factors for mortality among neonates, postneonates, and those aged 1–12 yrs (multivariate analysis)

	Adjusted Odds Ratio (95% CI)		
Risk Factor	Neonatal Group[a] (n = 534)	Postneonatal Group[b] (n = 187)	Children Aged 1–12 yrs[c] (n = 434)
Age, ≤7 days	1.87 (1.05, 3.34)		
Low birth weight	1.73 (1.00, 2.96)		
Preterm birth	2.07 (1.13, 3.81)		
Chest retractions	1.89 (1.17, 3.06)		
Cyanosis		1.86 (0.53, 6.47)	3.01 (0.62, 14.4)
Poor pulse volume		3.48 (1.22, 9.89)	
Central-peripheral temperature gap	2.38 (1.30, 4.36)		4.98 (1.84, 13.4)
Respiratory failure requiring ventilation	2.38 (1.05, 5.39)	3.45 (1.14, 10.43)	6.60 (2.43, 17.9)

CI, confidence interval.

[a]Hosmer-Lemeshow goodness-of-fit, p = .15; area under receiver operating characteristic (ROC) curve = 0.75; [b]Hosmer-Lemeshow goodness-of-fit, p = .72; area under ROC curve = 0.74; [c]Hosmer-Lemeshow goodness-of-fit, p = .87; area under ROC curve = 0.79.

peripheral temperature gap, and prematurity emerging as the strongest risk factors. In the postneonatal subgroup, the following variables made up the final model: cyanosis, poor pulse volume, and respiratory failure. Of these, poor pulse volume and respiratory failure were statistically significant. In those aged >1 yr, cyanosis, central-peripheral temperature gap, and respiratory failure made up the final model. Only central-peripheral temperature gap and respiratory failure were statistically significant.

DISCUSSION

Assessing the outcomes of acutely ill patients in a large-volume, referral, PED is a challenge. Children are referred with a wide variety of problems, which are further complicated by advanced disease, multiple system disease processes, and malnutrition. Hence, identification of risk factors for mortality would assist not only in prognostication but also in resource allocation for this vulnerable section of patients. The overall mortality incidence in our setting was fairly high. This, to some extent, is expected because our PED is a referral center. However, we need to further study this issue and identify causes of preventable deaths and implement changes to decrease the mortality rate. We plan to evaluate our quality of care and improve our treatment protocols by using evidence-based guidelines for the common conditions identified in our study.

As expected, mortality was highest in the neonatal group, accounting for 67% of all deaths. Although we did not address this in our study, we hypothesize that this could be due to delayed referral of sick neonates, resulting in more advanced illness at presentation. Among the neonates, breathlessness, poor feeding, prematurity, and low birth weight were the most common reasons for admission. Prematurity, low birth weight, chest retractions, central-peripheral temperature gap, and respiratory failure were significant risk factors for mortality. These findings reinforce the role of using simple signs and symptoms to identify children who are at risk of dying. Initiatives for identifying and managing serious illness in children have been spearheaded by the World Health Organization and the United Nations International Children's Emergency Fund, and guidelines are available for health workers in developing countries (16–18). The guidelines address integrated management of childhood illness and management of acute respiratory infections and diarrhea (16–18). The importance of age, prematurity, and low birth weight are emphasized in these guidelines. Chest retractions are used to identify pneumonia in acute respiratory infection guidelines. Our definition of chest retractions, however, is a variant of the World Health Organization definition because the assessment of sick children was performed in a referral hospital by trained pediatricians and not by basic health workers for whom the World Health Organization recommendation is to use the least number of clinical features to identify serious respiratory illness (18). More recently, to improve referral-level pediatric care, guidelines have been developed to improve the triage of all sick children and to provide appropriate emergency care. This emergency triage assessment and treatment algorithm uses simple signs like respiratory distress, apnea, cyanosis, capillary refill, and cold peripheries (17). Although our data are in agreement with some of the criteria used by the World Health Organization guidelines, we did not compare our

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chosen risk factors against the World Health Organization criteria. Therefore, we do not claim that our criteria perform any better than the World Health Organization simplified criteria.

Among the postneonatal group, poor pulse volume and respiratory failure requiring ventilation were strong risk factors for mortality. In those aged >1 yr, central-peripheral temperature gap and respiratory failure were very strongly associated with mortality. The importance of some of these risk factors is well known (16). Interestingly, central-peripheral temperature gap and respiratory failure requiring ventilation, despite being subjective signs, emerged as important risk factors. One of the earliest signs of poor perfusion is cool peripheries. This sign is hard to quantify but can be learned by experience (19). The core-peripheral temperature gap is considered useful in providing information about patients' hemodynamic status during cardiac surgery (20, 21). However, other studies suggest that it correlates poorly with hemodynamic variables such as stroke volume index, cardiac index, systemic vascular resistance index, central venous pressure, and lactate (22, 23). Respiratory failure requiring ventilation in the PED seemed to be a strong risk factor for mortality among all children. Published data on the effect of this variable on in-hospital mortality are sparse. However a recent study on the importance of prehospital pediatric airway management in improving mortality and neurologic outcome highlights the need for better care in this area in the Indian context (24). Given these results, perhaps, the clinical features of circulatory failure and respiratory failure can be emphasized in the World Health Organization/United Nations International Children's Emergency Fund guidelines to ensure early recognition of critical illness and early referral. In this manner, in a healthcare system that relies heavily on village and community health workers in rural areas, the pediatric chain of survival could be enhanced by teaching and training in rapid detection of critical illness in children with these simple signs. This would ensure early entry into a hospital and early treatment of cardiorespiratory compromise in an advanced life support facility (25).

Our approach to identifying risk factors for mortality is not comparable with the scoring systems and predictive models currently in use. Our study aimed at identifying clinical determinants of increased mortality before performing laboratory investigations. We did not intend to create or validate a scoring instrument for prediction. Currently the clinical risk index of babies seems to be a useful index for predicting in-hospital mortality in the neonatal intensive care unit (26–28). The scoring system includes, apart from extremely low birth weight and gestational age of <31 wks, absence of lethal malformations, maximum and minimum FIO_2 requirements, and maximum base excess. The logistic difficulties of assessing clinical risk index of babies in the PED precluded its use in our setting. In intensive care units, the Pediatric Risk of Mortality score is a widely used tool to measure severity of illness. In a study of the use of Pediatric Risk of Mortality score in the PED to predict outcome, it was found to be an objective and efficient method for predicting mortality (4). However, the Pediatric Risk of Mortality uses 14 physiologic variables measured over 24 hrs. Many of these variables are dependent on laboratory investigations and hence expensive and time consuming. The Pediatric Index of Mortality is simpler than the Pediatric Risk of Mortality and uses eight variables collected at admission (29). However, it does involve measurements such as base excess and FIO_2.

Our study had several limitations. The data were collected during only two consecutive months and therefore may not represent the entire year. The data may have been influenced by seasonal variation, short-term fluctuations, and factors such as referral patterns. Mortality after discharge is an important concern in developing countries (30). Because we did not collect data on mortality after discharge, our mortality rates are underestimates. Also, exclusion of minor illnesses from the cohort may have implications for validity: our findings may be relevant only to a preselected, high-risk population already identified as have serious illness in our PED. Unfortunately, we could not collect outcome data on those who were excluded. Our data were collected as part of routine patient care and by multiple observers in a large, high-volume PED. Although this reflected the realities of a typical, busy, public-hospital PED, measurement error and the subjective nature of some of our variables were major concerns. Lack of objective measurements and interobserver variability may have lead to random and systematic errors. In fact, interobserver variability has been shown to be a problem even with established scoring systems (31). Objective measurements (such as laboratory tests) may have strengthened our measurements and reduced error. Although we had information on a variety of risk factors, we could not study important predictors such as malnutrition (weight for age), developmental factors, severity of underlying disease, and other chronic conditions. Due to lack of socioeconomic data, we could not adjust for socioeconomic status. Residual confounding, therefore, cannot be ruled out.

Multivariate analysis had its own limitations. Collinearity was a concern even though an effort was made to handle it during analysis. Variable selection for inclusion in the model inherently involved making certain subjective decisions. An attempt was made to identify risk factors for in-hospital mortality, but we could not validate our findings. Future studies should compare objective and subjective measurements to see if objective measurements perform any better than subjective measurements in predicting mortality. A combination of both subjective and objective measurements may prove to be more valuable. Lastly, the results from our study should not be generalized unless it is validated in other populations. Despite these limitations, we believe our approach has relevance for planning PED services in India.

CONCLUSIONS

Prematurity and low birth weight are major problems in our milieu, highlighting the need for better antenatal and perinatal care. Respiratory failure requiring ventilation and signs of poor perfusion at admission indicate the severity of underlying illness. They suggest that children may be presenting late, with advanced illness, which could partly explain the high mortality. These results are worrisome and underline the need for early identification and referral of serious illness. Because the majority of children in India live in rural areas, identification of simple signs and symptoms of serious illness could enable resuscitation and early referral. Our study underscores the importance of some of the simple signs that are already being used in the World Health Organization/United Nations International Children's Emergency Fund guidelines. We hope our data will serve as a stimulus to do more PED research in India and to evolve appropriate PED services and educational tools for healthcare providers. Research is a key component of emergency medical services planning (32). Because pediatric emergency medicine is an evolving specialty in India, the experience of developed countries could guide India in organizing PED services.

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