Survey of early identification systems to identify inpatient children at risk of physiological deterioration

In the UK 70% of adult services have early warning systems and trigger systems to identify patients at risk of physiological deterioration. Methodological challenges, unvalidated criteria that are not universally applied and insufficient staff education have contributed to difficulties in proving benefit.[1]

The more rapid physiological decline experienced by children makes it remarkable that these services are not routinely available for children. As simply adapting adult systems for children is inappropriate because of different age-related physiological and developmental factors, there has been an attempt to develop tools specifically for use in the paediatric population.[2–6] This survey was designed to identify the prevalence and nature of paediatric early identification systems in the UK to inform future research, policy and the development of appropriate services for children.

Methods

A survey was sent to the lead paediatricians, intensivists, anaesthetists and critical care outreach leads of NHS Trusts in the UK caring for children. Personnel were identified from databases held by the Royal College of Paediatrics and Child Health, the Intensive Care National Audit and Research Centre, The Critical Care Directory (2003) and the Paediatric Critical Care Outreach Interest Group. The structured questionnaire, accompanied by an information leaflet, was sent by email and post between April and June 2005.

Results

A response was obtained from 189 hospitals representing 158 of 186 NHS Trusts (85% response rate). Non-responders were less likely to care for inpatient children. Duplicate replies were compared, with preference given to positive responses. Thirty one (21.5%) of the 144 NHS Trusts that care for children as inpatients, reported an early identification system with specific criteria that initiated a call for help. The demographics of the responding services were described as district general (15), tertiary general (four), tertiary children's (nine) and specialist neurology and orthopaedics (three). Nine hospitals had an on-site paediatric intensive care units and 14 had paediatric high dependency facilities.

Eight of the early warning systems appeared to be the same as or local modifications of two subsequently published tools.[2 3] Of the 36 different parameters used for early identification, respiratory rate, respiratory effort, heart rate, shock, and nurse and doctor concern were the most frequently used (table 1).

Discussion

This national cross-sectional survey of early warning systems has shown that 21.5% of the 144 NHS Trusts that care for children as inpatients have an early warning system, but there is no consistency of approach. None of the tools have been validated or shown to improve outcome and some do not take account of the significant differences between paediatric and adult physiology, as they either use or have simply adapted adult scores. The diversity of these systems using unvalidated criteria with numerous parameters reflects a similar pattern of development seen in adult practice.

After the survey was completed, a North American survey and four paediatric early warning systems were published. The survey of North American paediatric hospitals (>50 acute inpatient beds in more than two paediatric wards) similarly found that 24% had activation criteria for an urgent response team.[4] Retrospective Canadian and prospective UK case-control studies show sensitive identification of 75–90% of children at risk of life-threatening events, but unfortunately no outcome or economic data are reported.[2 5] An Australian observational study reported a significant reduction in preventable in-hospital cardiac arrest and mortality following the introduction an urgent response team with calling criteria.[6]

The main limitations of this study were the postal survey methodology and the relatively novel concept of paediatric early warning systems. Clearly, there will be ongoing development and a future survey should allow more detailed comparison of the demographics of paediatric services with and without systems, specific parameter thresholds, and the impact and outcomes that are being tracked. It is imperative that the current paediatric systems are properly evaluated before further ad hoc adoption.

Table 1 The 36 different parameters used for early identification

Parameter	Frequency	Parameter	Frequency
Respiratory rate	18	Diabetic ketoacidosis	5
Heart rate	17	Meningococcaemia	5
Nurse concern	16	Acidosis	5
Doctor concern	14	Abnormal serum potassium	5
Respiratory effort	13	Fluid bolus >10 ml/kg	5
Shock	12	Artificial airway	4
Systolic blood pressure	11	Abnormal serum sodium	4
Oxygen saturation	11	Abnormal coagulation	4
Abnormal consciousness	11	Inotrope infusion	4
Oxygen therapy	10	Apnoea	3
Stridor/wheeze	8	Arrhythmia	3
Post ICU discharge	8	Mean blood pressure	3
Nebulised medication	8	Neutropaenia	2
Urine output	7	Central line (temporary)	1
Temperature	7	Cardiac pacing (temporary)	1
Exhaustion	6	Major trauma	1
Prolonged seizure	6	Burns >10%	1
Respiratory arrest	5	Need for ventilation	1

Contributions and guarantor

Dr Heather Duncan contributed to the design, has analysed the data and stands guarantor for accuracy, and has prepared the scientific report. Dr Roger Parslow, Paediatric Epidemiology Group at the University of Leeds, contributed to the design and supervised data collection and database administration. Adam Wingfield, Paediatric Epidemiology Group at the University of Leeds, managed the database. Ms Caroline Haines contributed to the survey design and information sheet. The Paediatric Early Warning System (PEWS) Investigators Jacques Lacroix and Catherine Farrell (CHU Ste. Justine, Montreal, Quebec, Canada), Ari Joffee (Stollery Children's Hospital, Edmonton, Alberta, Canada), Heather Duncan (Birmingham Children's Hospital, Birmingham, England), and James Hutchison and Christopher Parshuram (Hospital for Sick Children, Toronto, Ontario, Canada) contributed to the design and editorial expertise. The PEWS Investigators are supported by the Heart and Stroke Foundation of Canada and the Birmingham Children's Hospital Research Foundation.

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Introduction of a paediatric pain management protocol improves assessment and management of pain in children in the emergency department

We have demonstrated the success of a pain scoring system and corresponding analgesia

protocol in improving pain management in children attending the emergency department (ED). Pain is often suboptimally managed in children[1] despite evidence that quantification of pain severity is vital to enable provision of appropriate analgesia, and has been shown to reduce time to analgesia in previous studies.[2] Prior to our audit, no protocol for paediatric pain assessment and management was in use in our ED.

We performed a retrospective assessment of 115 children aged 4–16 years attending the ED with painful conditions such as trauma, abdominal pain, headache and head injury. Only 24% of children received analgesia at initial assessment, with a mean delay of 40 min (SE $\pm$7.55), and no child had a pain score performed. After introduction of a pain scoring chart (adapted from the Wong and Baker face chart[3]), with a corresponding analgesia protocol, prospective assessment of a further 116 children (similar to the retrospective cohort in terms of age and diagnosis) showed that a pain score was more likely to be performed (71% vs 0%; $p<0.001$). More children were prescribed analgesia (51% vs 24%, $p = 0.001$) and the mean delay to prescription was reduced to 15 min (SE $\pm$1.79; $p<0.001$). When a pain score was performed, the drug choice was appropriate to pain score in 75% of cases, and, of these, when analgesia was given, dosage was appropriate in 93%.

Introduction of this protocol therefore resulted in an increase in formal pain assessment and prescription of appropriate analgesia, and a reduction in time from triage to analgesia. The use of visual pain scoring analogue scales has a particular advantage in ethnically diverse populations such as that served by our ED, where English is a second language for many families, and is affordable and easily achievable. We would recommend introduction of these tools, and training in their use, to all personnel involved in management of paediatric patients with painful conditions. The introduction of such training, alongside appropriate protocols and scoring charts, can ensure that prescription of analgesia remains appropriate for paediatric patients, even within the setting of a general emergency department.

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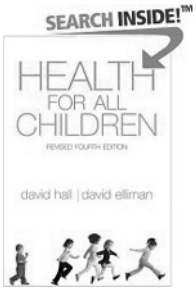
BOOK REVIEW

Health for all children, 4th edition

Edited by David Hall, David Elliman. Oxford: Published by Oxford University Press, 2006, £21.95 (paperback), pp 422.



This 400-page volume has proved quite a difficult book to review. The 'Health for all children' books are a cornerstone of child health practice when considering broad populations of children. The publication of each edition is keenly awaited and goes on to influence both the organisation and prosecution of child health services throughout the UK and beyond. This revision of the fourth edition is due to the publication of several important documents concerning the health and welfare of children in the UK, namely the *National service framework for children* and *Every child matters*. Emerging data from SureStart programmes are also starting to shape the future direction of health and surveillance services for children.

The book follows the familiar layout of previous publications, whereby the opening chapters set out the fundamental concepts underlying preventive child health programmes and summarises the evidence for child health promotion in its widest sense (promoting optimal child development and promoting/supporting parenting) before later chapters explore more specific areas of screening (primary and secondary)—for example, in respect of iron deficiency anaemia and hearing deficits. The revised edition benefits from modern, up-to-date formatting and is easier to read than the original.

Those who have read previous editions of the book will be aware that large working groups contribute to each chapter. However in this revised edition, Hall and Elliman have taken the task of updating the various chapters on themselves. The end result is a book which although looking updated, feels very much like the original fourth edition. In fact, astute and keen followers of the H4AC website will recognise that the revised components of the book are available online, so the revised edition avoids them having to cut and paste this information themselves. Unfortunately, this has led to some pagination issues—for example, the executive summary recommends a screening programme said to be detailed on page 351 of the book. However, the table is on page 351 of the original fourth edition and page 341 of the revised edition. These irritations should not detract from an appreciation of what is an immense work of scholarship that in a concise volume appraises a wide variety of child and family focused interventions from a scientific, sociological and probably a political perspective.

I think that many paediatricians involved with child public health, community-based work and child health promotion will already have the fourth edition, and so the question is obviously whether purchase of this revised edition is warranted. For those trainees and other first-time buyers wishing to gain an insight into these aspects of child public health this book will be invaluable and I recommend it without hesitation. It is also highly recommended for those aficionados who have the original fourth edition but do not have access to the Health for all children website. However, for those who remain up to date with these issues the decision to upgrade to this revised edition lies in equipoise. The book's reasonable price may well tip the balance.

It remains my enduring hope that the increased accessibility of the revised edition will tempt those in positions of influence in primary care organisations and local authorities to read it and to commit to adequately funding the implementation of its sensible, soundly researched and well-reasoned recommendations.

Adrian Brooke

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