Please find the results of our evidence search relevant to the document listed below.

We have searched for guidance, care pathways, evidence-based reviews, published research and patient information leaflets. Please note that this search only includes documents published during the search period.

**Literature search results**

| Enquiry Details | Paediatric observations of temperature, pulse, respirations, blood pressure and O2 saturations  
| Search completed for: | Re evaluation of T, P, R, BP etc for children and introduction of PEWS and improving skills and competency  
| Search completion date: | 11th November 2013  

**Resources searched**

*Database search terms:*
pews.ti,ab;
(p(a)ediatric AND early AND warning).ti,ab
WARNING SYSTEMS/
MONITORING, PHYSIOLOGICAL
VITAL SIGNS
REPRODUCIBILITY OF RESULTS
HOSPITALISED CHILD
CHILD
Early warning scores are generated by combining the scores from a selection of routine observations of patients e.g. pulse, respiratory rate, respiratory distress, conscious level. Different observations are selected for children and adults due to their naturally different physiological responses. If a child's clinical condition is deteriorating the 'score' for the observations will (usually) increase and so a higher or increasing score gives an early indication that intervention may be required. Early intervention can 'fix' problems and can avoid the need to transfer a child to a higher level of care and thus avoid or reduce harm.

**PEWS charts**
Almost every hospital in the UK uses different PEWS charts and calculates PEWS in different ways. There is limited research into the trigger points for scoring and escalation. Even where a system is in place, usage can be variable, scoring unreliable, and escalation unstructured.

Work on PEWS charts was undertaken in Brighton and Brighton. These charts are still in use today in those units, and have been used and/or adapted in a number of other units across the UK. However, through our collaborative network we established that no one organisation used the same chart or included the same parameters in their scoring system. Read about our human factors approach to form design.

You can download our charts and those of other hospitals that have used our approach to inform their own chart design. These are free to use and adapt, but we ask that you attribute the source e.g. adapted from an original design by the NHS Institute for Innovation and Improvement, England.

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<tr>
<th>NHS Institute PEWS Charts (word version)</th>
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<td>Poole Coast Charts - Infant (&lt; 1 year)</td>
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<td>Poole Coast Charts – Preschool (1-5 years)</td>
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<td>Poole Coast Charts – Schoolage (5-12 years)</td>
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<td>Poole Coast Charts – Teenage (12+ years)</td>
<td>Poole COAST Charts – Teenage (12+ years)</td>
</tr>
</tbody>
</table>

www.institute.nhs.uk/safer_care/paediatric_safer_care/pews_charts.html
The NHS Institute has been leading a collaboration with paediatric units across England to address some of the design and implementation issues. The resources available on this site are free to use and adapt.

**View films and our early PEWS work**
Listen to Lorraine Major speak passionately about why PEWS is important for children and North Hampshire and Basingstoke NHS Hospitals Foundation Trust at: 
https://nhs.webex.com/nhs/ldr.php?AT=pb&SP=MC&rID=14107092&rKey=C57F9AB691F40D2E

View presentations about PEWS at: 

**Paediatric Early Warning Scores (PEWS)**

*PaSQ European Union Network for Patient Safety and Quality of Care*

The aim of this Safe Clinical Practice (SCP) is to provide a validated, easy to use, practical, generic tool to monitor and to prevent avoidable deterioration in sick children. Additionally age-appropriate values that enable the effective monitoring of the sick child have been identified and staff has been trained to communicate information about the sick child appropriately and to respond effectively.


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**Systematic Reviews**

**Systematic review of paediatric alert criteria for identifying hospitalised children at risk of critical deterioration.**
Intensive Care Medicine, April 2010, vol./is. 36/4(600-11)
Chapman SM, Grocott MP, Franck LS

**Abstract:** INTRODUCTION: Unrecognised or untreated clinical deterioration can lead to serious adverse events, including cardiopulmonary arrest and unexpected death. Paediatric alert criteria aim to identify children with early signs of physiological instability that precede clinical deterioration so that experienced clinicians can intervene with the aim of reducing serious adverse events and improving outcome. PURPOSE: To identify the number and nature of published paediatric alert criteria and evaluate their validity, reliability, clinical effectiveness and clinical utility. METHOD: Systematic review of studies identified from electronic and citation searching and expert informants. RESULTS: Eleven studies fulfilled the inclusion criteria and described ten paediatric alert criteria. Six studies described the introduction and use of the paediatric alert criteria in practice, four examined the development and testing of the paediatric alert criteria, and one described both. There was marked variability across all aspects of the paediatric alert criteria, including the method of development, and the number and type of component parameters. Five studies explored the predictive validity of the paediatric alert criteria, but only three reported appropriate methodology. Only one study evaluated reliability, and none evaluated clinical utility of paediatric alert criteria. CONCLUSIONS: Evidence supporting the validity, reliability and utility of paediatric alert criteria is weak. Studies are needed to determine which physiological parameters or combinations of parameters, best predict serious adverse events. Prospective evaluation of validity, reliability and utility is then needed before widespread adoption into clinical practice can be recommended.

**Source:** MEDLINE
Published research

Use of paediatric early warning systems in Great Britain: has there been a change of practice in the last 7 years?

Arch Dis Child doi:10.1136/archdischild-2012-302783
D Roland1, A Oliver2, E D Edwards3, B W Mason4, C V E Powell5

Abstract
Objective To determine the use of paediatric early warning systems (PEWS) and rapid response teams (RRTs) in paediatric units in Great Britain.
Design Cross sectional survey.
Setting All hospitals with inpatient paediatric services in Great Britain.
Outcome measures Proportion of units using PEWS, origin of PEWS used, criterion included in PEWS, proportion of units with an RRT and membership of RRT.
Results The response rate was 95% (149/157). 85% of units were using PEWS and 18% had an RRT in place. Tertiary units were more likely than district general hospital to have implemented PEWS, 90% versus 83%, and an RRT, 52% versus 10%. A large number of PEWS were in use, the majority of which were unpublished and unvalidated systems.
Conclusions Despite the inconclusive evidence of effectiveness, the use of PEWS has increased since 2005. The implementation has been inconsistent with large variation in the PEWS used, the activation criteria used, availability of an RRT and the membership of the RRT. There must be a coordinated national evaluation of the implementation, impact and effectiveness of a standardised PEWS programme in the various environments where acutely sick children are managed.

Attached

Validity of different pediatric early warning scores in the emergency department.

Pediatrics, October 2013, vol./is. 132/4(e841-50)
Seiger N, Maconochie I, Oostenbrink R, Moll HA

Abstract: OBJECTIVE: Pediatric early warning scores (PEWS) are being advocated for use in the emergency department (ED). The goal of this study was to compare the validity of different PEWS in a pediatric ED.METHODS: Ten different PEWS were evaluated in a large prospective cohort. We included children aged <16 years who had presented to the ED of a university hospital in The Netherlands (2009-2012). The validity of the PEWS for predicting ICU admission or hospitalization was expressed by the area under the receiver operating characteristic (ROC) curves.RESULTS: These PEWS were validated in 17943 children. Two percent of these children were admitted to the ICU, and 16% were hospitalized. The areas under the ROC curves for predicting ICU admission, ranging from 0.60 (95% confidence interval [CI]: 0.57-0.62) to 0.82 (95% CI: 0.79-0.85), were moderate to good. The area under the ROC curves for predicting hospitalization was poor to moderate (range: 0.56 [95% CI: 0.55-0.58] to 0.68 [95% CI: 0.66-0.69]). The sensitivity and specificity derived from the ROC curves ranged widely for both ICU admission (sensitivity: 61.3%-94.4%; specificity: 25.2%-86.7%) and hospital admission (sensitivity: 36.4%-85.7%; specificity: 27.1%-90.5%). None of the PEWS had a high sensitivity as well as a high specificity.CONCLUSIONS: PEWS can be used to detect children presenting to the ED who are in need of an ICU admission. Scoring systems, wherein the parameters are summed to a numeric value, were better able to identify patients at risk than triggering systems, which need 1 positive parameter.
Beyond statistical prediction: Qualitative evaluation of the mechanisms by which pediatric early warning scores impact patient safety
Journal of Hospital Medicine, May 2013, vol./is. 8/5(248-253)
Bonafide C.P., Roberts K.E., Weirich C.M., Paciotti B., Tibbetts K.M., Keren R., Barg F.K.,
Abstract: BACKGROUND: Early warning scores (EWSs) assign points to clinical observations and generate scores to help clinicians identify deteriorating patients. Despite marginal predictive accuracy in retrospective datasets and a paucity of studies prospectively evaluating their clinical effectiveness, pediatric EWSs are commonly used. OBJECTIVE: To identify mechanisms beyond their statistical ability to predict deterioration by which physicians and nurses use EWSs to support their decision making. DESIGN: Qualitative study. SETTING: A children's hospital with a rapid response system. PARTICIPANTS: Physicians and nurses who recently cared for patients with false-positive and false-negative EWSs (score failures). INTERVENTION: Semistructured interviews. MEASUREMENTS: Themes identified through grounded theory analysis. RESULTS: Four themes emerged among the 57 subjects interviewed: (1) The EWS facilitates safety by alerting physicians and nurses to concerning changes and prompting them to think critically about deterioration. (2) The EWS provides less-experienced nurses with vital sign reference ranges. (3) The EWS serves as evidence that empowers nurses to overcome barriers to escalating care. (4) In stable patients, those with baseline abnormal physiology, and those experiencing neurologic deterioration, the EWS may not be helpful. CONCLUSIONS: Although pediatric EWSs have marginal performance when applied to datasets, clinicians who recently experienced score failures still considered them valuable to identify deterioration and transcend hierarchical barriers. Combining an EWS with a clinician's judgment may result in a system better equipped to respond to deterioration than retrospective data analyses alone would suggest. Future research should seek to evaluate the clinical effectiveness of EWSs in real-world settings. 2013 Society of Hospital Medicine.
Source: EMBASE

The paediatric observation priority score (POPS): a useful tool to predict likelihood of admission from the emergency department.
Emergency Medicine Journal, 01 October 2013, vol./is. 30/10(877-878), 14720205
Kelly, J, Rowland, A G, Cotterill, S, Lees, H, Kamara, M
Abstract: OBJECTIVES & BACKGROUND: No specific early warning score universally validated for use in all children presenting to the Emergency Department (ED) exists. POPS is a novel aggregate scoring system, designed for ED use. METHODS: Prospectively collected physiological and observational data were used to calculate POPS on 2068 patients aged under 16 presenting over one month to a UK District General Hospital Paediatric ED. Logistic regression was used to investigate the effect of POPS at first presentation on admission to hospital within the subsequent 72 hours. RESULTS: 46% of patients were diagnosed with trauma and 54% with a medical condition. Mean age was 5.6 years (SD 4.6), 15.3% were admitted on first presentation. 76 re-presented within 72 hours of discharge from the ED and 19.7% were admitted. The mean POPS on first presentation was 0.87 (SD 1.58) overall (medical patients 1.03 (SD 1.70), trauma patients 0.68 (SD 1.41), p<0.001). POPS had a statistically significant positive effect on admission. A one point increase in POPS was associated with a 70% increase in the odds ratio (OR) of admission (p<0.001), with an area under the ROC of 0.72 (medical patients OR 1.67, area under ROC 0.73, p<0.001; trauma patients OR 1.77, area under ROC 0.69, p<0.001). The sensitivity and specificity of POPS to predict admission likelihood were: POPS>=2 (sensitivity 50%, specificity 85%), POPS>=3 (sensitivity 36%, specificity 93%). CONCLUSION: POPS is a useful tool to predict the admission likelihood from the ED. POPS>=2 correctly predicts 50% of children who should be admitted and 85% of children who should be discharged. Multi-centre validation would help to refine POPS, increasing its sensitivity and specificity to admission likelihood, to improve the safety of discharge decisions and healthcare resource utilisation.
Source: CINAHL
Use of a modified pediatric early warning score in a department of pediatric and adolescent medicine.
PLoS ONE [Electronic Resource], 2013, vol./is. 8/8(e72534)
Solevag AL, Eggen EH, Schroder J, Nakstad B

Abstract: BACKGROUND: Several versions of the Pediatric Early Warning Score (PEWS) exist, but there is limited information available on the use of such systems in different contexts. In the present study, we aimed to examine the relationship between a modified version of The Brighton Paediatric Early Warning Score (PEWS) and patient characteristics in a Norwegian department of pediatric and adolescent medicine. In addition, we sought to establish guidelines for escalation in patient care based on the PEWS in our patient population.

METHODS: The medical records of patients referred for acute care from March to May 2011 were retrospectively reviewed. Children with a PEWS >=3 were compared to children with a PEWS 0-2 with regard to age, diagnostic group and indicators of severe disease.

RESULTS: A total of 761 patients (0-18 years of age) were included in the analysis. A younger age and diagnostic groups such as lower airway and cardiovascular disease were associated with PEWS >=3. Upper airway disease and minor injury were more frequent in patients with PEWS 0-2. Children with PEWS >=3 received fluid resuscitation, intravenous antibiotics, and oxygen supplementation, and were transferred to a higher level of care more often than children with PEWS 0-2.

CONCLUSIONS: A PEWS >=3 was associated with severe illnesses and surrogate markers of cardio-respiratory compromise. Patients with PEWS >=3 should be carefully monitored to prevent further deterioration.

Source: MEDLINE
Full Text: Available from National Library of Medicine in PLoS ONE

Evaluation of the novel respiratory virus surveillance program: Pediatric Early Warning Sentinel Surveillance (PEWSS).
Public Health Reports, September 2013, vol./is. 128 Suppl 2/(88-96)
Armour PA, Nguyen LM, Lutman ML, Middaugh JP

Abstract: OBJECTIVES: Infections caused by respiratory viruses are associated with recurrent epidemics and widespread morbidity and mortality. Routine surveillance of these pathogens is necessary to determine virus activity, monitor for changes in circulating strains, and plan for public health preparedness. The Southern Nevada Health District in Las Vegas, Nevada, recruited five pediatric medical practices to serve as sentinel sites for the Pediatric Early Warning Sentinel Surveillance (PEWSS) program.

METHODS: Sentinel staff collected specimens throughout the year from ill children who met the influenza-like illness case definition and submitted specimens to the Southern Nevada Public Health Laboratory for molecular testing for influenza and six non-influenza viruses.

RESULTS: Laboratory results were analyzed and reported to the medical and general communities in weekly bulletins year-round. PEWSS data were also used to establish viral respiratory seasonal baselines and in influenza vaccination campaigns. The surveillance program was evaluated using the Centers for Disease Control and Prevention’s (CDC’s) Updated Guidelines for Evaluating Public Health Surveillance Systems. PEWSS met three of six program usefulness criteria and seven of nine surveillance system attributes, which exceeded the CDC Guidelines evaluation criteria for a useful and complete public health surveillance program.

CONCLUSION: We found that PEWSS is a useful and complete public health surveillance system that is simple, flexible, accessible, and stable.

Source: MEDLINE

Development of heart and respiratory rate percentile curves for hospitalized children.
Pediatrics, April 2013, vol./is. 131/4(e1150-7), 0031-4005;1098-4275 (2013 Apr)
Bonafide CP, Brady PW, Keren R, Conway PH, Marsolo K, Daymont C

Abstract: OBJECTIVE: To develop and validate heart and respiratory rate percentile curves for hospitalized children and compare their vital sign distributions to textbook reference ranges and pediatric early warning score (EWS) parameters.

METHODS: For this cross-sectional study, we used 6 months of nurse-documented heart and respiratory rates from the electronic records of 14,014 children on general medical and surgical wards at 2 tertiary-care children's hospitals. We developed percentile curves using generalized additive models for location, scale, and shape with 67% of the patients and validated the curves with the remaining 33%. We then determined the proportion of
observations that deviated from textbook reference ranges and EWS parameters. RESULTS: We used 116,383 heart rate and 116,383 respiratory rate values to develop and validate the percentile curves. Up to 54% of heart rate observations and up to 40% of respiratory rate observations in our sample were outside textbook reference ranges. Up to 38% of heart rate observations and up to 30% of respiratory rate observations in our sample would have resulted in increased EWSs. CONCLUSIONS: A high proportion of vital signs among hospitalized children would be considered out of range according to existing reference ranges and pediatric EWSs. The percentiles we derived may serve as useful references for clinicians and could be used to inform the development of evidence-based vital sign parameters for physiologic monitor alarms, inpatient electronic health record vital sign alerts, medical emergency team calling criteria, and EWSs. 

Source: MEDLINE

Paediatric Early Warning Scores: Holy Grail and Achilles' heel.
of Disease in Childhood Education & Practice, December 2012, vol./is. 97/6(208-15)
Roland D

Abstract: Early Warning Scores (EWS) have become increasingly used by hospitals throughout the world to prevent unexpected admission to intensive care or even death in their inpatient population. It is well known that signs of deterioration are present well before collapse and by a combination of systems, EWS enable healthcare professionals to intervene at an appropriate time. A number of national bodies and regulators in the UK have required the use of Early Warning Scores in locations where children are inpatients. This article attempts to describe the background to their development, identify common problems and provide information for units interested in introducing an EWS into their department. 

Source: MEDLINE

Full Text: Available from Highwire Press in Education and Practice

Comparison of severity of illness scores to physician clinical judgment for potential use in pediatric critical care triage.
Disaster Medicine & Public Health Preparedness, June 2012, vol./is. 6/2(126-30), 1935-Sweney JS, Poss WB, Grissom CK, Keenan HT

Abstract: OBJECTIVE: A pediatric triage tool is needed during times of resource scarcity to optimize critical care utilization. This study compares the modified sequential organ failure assessment score (M-SOFA), the Pediatric Early Warning System (PEWS) score, the Pediatric Risk of Admission Score II (PRISA-II), and physician judgment to predict the need for pediatric intensive care unit (PICU) interventions. METHODS: This retrospective cohort study evaluates three illness severity scores for all non-neonatal pediatric patients transported and admitted to a single center in 2006. The outcome of interest was receipt of a PICU intervention (mechanical ventilation, acute dialysis, depressed consciousness, or persistent hypotension). Predictive ability was assessed using receiver operating curves (ROCs). RESULTS: Of 752 patients admitted to the hospital, 287 received a PICU intervention. Median scores for all tools were significantly higher for children receiving an intervention than for those who did not. ROCs showed PEWS had the least discriminatory ability, followed by PRISA-II and pediatric M-SOFA. No value of the pediatric M-SOFA produced both positive and negative predictive values better than clinician judgment. CONCLUSIONS: No score had a clinically acceptable discriminate ability to predict patients who required a PICU intervention from those who did not. Physician judgment outperformed all three triage scores. 

Source: MEDLINE
Relationship between pediatric early warning score and emergency department disposition

Journal of Investigative Medicine, March 2012, vol./is. 60/3(623), 1081-5589 (March 2012)

Breslin K., Marx J., McBeth R., Pavuluri P.

Abstract: Purpose of Study: To determine the association between the Pediatric Early Warning Score [PEWS] at time of Emergency Department [ED] disposition and level of care (discharge, acute care, or intensive care). The PEWS is a 13-point clinical severity score. Methods Used: This was a prospective study of a convenience sample of patients aged 0-21 years evaluated in the ED of an urban, tertiary care children's hospital between November 2010 and July 2011. Patients were identified via the electronic tracking system at the time of disposition and information to calculate the PEWS was obtained. Demographics, clinical data, and disposition at 12 and 24 hours were obtained from the medical record. Bivariable and multivariable analyses were performed to determine the association of PEWS with level of care. We also sought to identify PEWS that maximized sensitivity and specificity for admission and intensive care. Summary of Results: The sample of 383 patients included 239 discharged home, 126 admitted to acute care, and 18 admitted to intensive care. Assigned PEWS ranged from 0 to 9. After adjusting for triage level and insurance type, a one-point increase in PEWS increased the odds of admission to any level of care by a factor of 1.54 (95% CI 1.29-1.83) and the odds of acute care admission by a factor of 1.49 (1.25-1.78) relative to discharge. Adjusted for triage level, a one-point increase in PEWS increased the odds of intensive care admission by a factor of 2.09 (1.61-2.71) relative to discharge and by a factor of 1.40 (1.12-1.75) relative to acute care. Area under the receiver operator characteristic [ROC] curve was 0.68 (0.62-0.74). PEWS ?3 demonstrated 31% sensitivity and 91% specificity for admission. PEWS ?5 had 28% sensitivity and 96% specificity for intensive care. Among 97 patients with respiratory complaints, the area under the ROC curve was 0.80 (0.71-0.89). Conclusions: PEWS is a rapid, easy-to-use score that is associated with the level of care at ED disposition. It does not provide adequate discriminant ability to be used in isolation to predict ED disposition.

Source: EMBASE

Evaluation of the bedside pediatric early warning system score for pediatric placement after inter-facility transports

Academic Emergency Medicine, April 2012, vol./is. 19/(S349), 1069-6563 (April 2012)

Keyes J., Yen K., Meyer M., Gorelick M.

Abstract: Background: The Bedside Pediatric Early Warning System (BPEWS) score is a pediatric assessment tool that combines seven clinical measurements for the assessment of severity of illness. This tool has been shown to be effective in identifying sick children in the hospital setting. The effectiveness of this tool in identifying pediatric patients undergoing inter-facility transport that require critical care placement has not been evaluated. Objectives: We hypothesize that children with higher BPEWS scores are more likely to be admitted to the pediatric intensive care unit (PICU) or emergency department (ED) than the general pediatric unit. Methods: A random sample of pediatric patients transported by the Children's Hospital of Wisconsin (CHW) Transport Team during a one-year period were assessed. All patient transports to the neonatal intensive care unit and all patients with tracheostomies who were admitted to the PICU according to placement protocols were excluded. Data were collected utilizing a retrospective chart review and included the components of the BPEWS score (heart rate, respiratory rate, systolic blood pressure, oxygen saturation, oxygen therapy, respiratory effort, and capillary refill time) at two different time points during the transport: when the transport team arrived at the outside facility, and again when the transport team arrived at CHW. Mann-Whitney test was used to compare the BPEWS scores at each time point with patient placement to PICU, ED, or general inpatient unit. Results: Data have been collected for 144 patients. Overall, 36% were admitted to the PICU, 32% to the ED, and 32% to the floor. Forty percent are female. Significant differences were found in BPEWS scores based on site of admission. For the initial time point (team arrival at outside facility), scores for PICU, ED, and general inpatient unit were 7.63, 3.26, and 4.59, respectively (p < 0.001). The final time point (team arrival at CHW) BPEWS scores were 6.94, 2.65, and 3.65, respectively (p < 0.001). Conclusion: The BPEWS score, measured at two time points in the transport process, is associated with site of admission. The highest scores are seen for patients admitted to the PICU and the lowest for those admitted to the ED. Logistic regression with ROC curves is planned to determine the optimal BPEWS score to discriminate placement in the PICU compared to the general inpatient unit.
A paediatric early warning scoring system for a remote rural area.
Nursing Children & Young People, 01 July 2012, vol./is. 24/6(23-26), 20462336
Henderson, Sarah
Abstract: Health professionals can fail to identify and treat serious illness or acute deterioration in children because of a lack of relevant training, experience or supervision. In Argyll and Bute in Scotland a standardised, monitoring system was initiated measuring six physiological parameters: temperature, pulse rate, respiratory rate, systolic blood pressure, oxygen saturation and consciousness level. The total score dictates what actions to take. This local system was positively evaluated but a national paediatric early warning scoring system is needed.
Source: CINAHL
Full Text: Available from EBSCOhost in Nursing Children & Young People

Efficacy of the pediatric early warning score (PEWS) in predicting placement of a pediatric placement to the ward or PICU
An E., Mink R.
Critical Care Medicine, December 2012, vol./is. 40/12 SUPPL. 1(186), 0090-3493
Abstract: Introduction: Early warning scoring systems use physiologic parameters to alert and prompt timely intervention and referral. One scoring system, the PEWS, creates a singular value from 1 to 13 based on behavior, cardiovascular and respiratory parameters, nebulizer use, and persistent postsurgical vomiting. High scores indicate a more critically ill child. Use of the PEWS tool could potentially improve the identification of seriously ill children in the emergency department and aid in their placement to the ward or PICU. Hypothesis: Use of the PEWS in the emergency department could aid in determining the appropriate location, ward or PICU, for children admitted to the hospital. Methods: The medical records of pediatric patients admitted to the ward or PICU from the emergency department over a 6-month period were reviewed. PEWS scores were determined from the emergency department triage notes. Patients were excluded if they were admitted electively, admitted from clinics, transferred from another hospital or hospitalized for non-medical reasons. Patients who were admitted to the PICU due to a lack of beds on the ward were considered to have been admitted to the ward. Statistical analysis used Mann-Whitney U. Data are median [25th, 75th percentile]. Results: 993 consecutive patients were evaluated of which 849 were admitted to the ward and 144 to the PICU. The PEWS scores for those admitted to the PICU (3[0,6]) were greater (p<0.05) than those admitted to the ward (1[0,3]). A receiver-operating characteristic curve with respect to PICU admission showed an area under the curve of 0.71 (95% CI= 0.66-0.76). For a PEWS score of 75, the sensitivity was 42% and specificity 92% in predicting admission to the PICU. Conclusions: A PEWS?5 in the emergency department helps to identify children who require PICU admission. Further research on this screening tool needs to be validated in another population and institution.
Source: EMBASE

Burton paediatric early warning system score
Archives of Disease in Childhood, October 2012, vol./is. 97/(A421)
Ahmed M., Sobithadevi D., Lall R., Ghose A., Boswell S., Reynolds T.
Abstract: Background Early warning scores compliment clinical decision making and can identify trends depicting deterioration in patient's condition. Age appropriate Burton Paediatric Early Warning System (BPEWS) score charts were developed in 2011 using nine indicators which included physiological parameters, therapeutic intervention and doctor/nurse concern. Aim To assess the usefulness of BPEWS as a reliable and valid indicator for all children in need of urgent medical assessment and intervention. Methods A retrospective analysis of all children transferred to paediatric intensive care setting over the preceding 12 months was carried out to validate BPEWS charts. Detailed case notes review was undertaken to evaluate if BPEWS could have been useful to alert us of patients' deterioration in the 24 hour period prior to transfer. Each case note was assessed by two reviewers. Results An average of 8.7 sets of observations per patient was recorded in the 24 hours period prior to intensive care transfer. Off the 200 sets of observations recorded in 23 patients, 93% sets would have triggered based on BPEWS. 44% sets of observation scores were in
The effectiveness of the paediatric early warning tool (PEWT) in identifying children requiring admission to a critical care unit

Abstract: Introduction The Paediatric Early Warning Trigger (PEWT) Tool is used at our hospital to aid early identification of clinical deterioration and promote effective escalation of care. Our hospital is a teaching hospital, with inpatient general, respiratory, haematology, surgery, neurosurgery, hepatology and gastroenterology beds and a paediatric critical care unit (CCU). Method The use of PEWT was prospectively audited during July 2010 for all Paediatric admissions, excluding critical care or NICU admissions. All observation charts included a PEWT scoring system that assessed 5 physiological parameters. The data were collected twice daily using a standard proforma including demographics, documentation of triggering, frequency of triggering and admission to CCU. Results Data was collected on 331 children (age [range] 6.3 [0.01-18.6] years), 62 (19%) children triggered. Seven children (all of whom triggered) were admitted to CCU. The children admitted to CCU were more likely to have triggered in more than one time period (median [range] number of triggers 3 [1-7] v 0 [0-16], p<0.0001). Overall, identification of triggering on PEWT detected CCU admission with a sensitivity of 100% and a specificity of 83% with a positive predictive value of 0.13 and a negative predictive value of 1.00. Area under receiver operated curve (AUC) analysis showed that triggering PEWT was highly predictive of CCU admission (AUC [95% CI] 0.91 [0.87- 0.96]) as was the number of triggering epochs (AUC [95% CI] 0.92 [0.88-0.97]). Conclusion Triggering PEWT is strongly associated with CCU admission. However, given its low positive predictive value, PEWT has poor efficacy for establishing the need for critical care based on triggering scores alone. Therefore, CCU admission may not be the most appropriate outcome measure for evaluating the effectiveness of PEWT, instead effectiveness of interventions would be more appropriate but more difficult to measure. If a national paediatric scoring system is to be developed it will need to be designed to detect effectiveness of interventions.

Source: EMBASE
Full Text: Available from Highwire Press in Archives of Disease in Childhood

Implementing the bedside paediatric early warning system in a community hospital: A prospective observational study

Abstract: BACKGROUND: Late transfer of children with critical illness from community hospitals undermines the advantages of community-based care. It was hypothesized that implementation of the Bedside Paediatric Early Warning System (Bedside PEWS) would reduce late transfers. METHODS: A prospective before-and-after study was performed in a community hospital 22-bed inpatient paediatric ward. The primary outcome, significant clinical deterioration, was a composite measure of circulatory and respiratory support before transfer. Secondary outcomes were stat calls and resuscitation team calls, paediatrician workload and perceptions of frontline staff. RESULTS: Care was evaluated for 842 patient-days before and 2350 patient-days after implementation. The median inpatient census was 13. Implementation of the Bedside PEWS was associated with fewer stat calls to paediatricians (22.6 versus 5.1 per 1000 patient-days; P<0.0001), fewer significant clinical deterioration events (2.4 versus 0.43 per 1000 patient-days; P=0.013), reduced apprehension when calling the physician and no change in paediatrician workload. DISCUSSION: Implementation of the Bedside PEWS is feasible and safe, and may improve clinical outcomes.

Source: EMBASE
Full Text: Available from National Library of Medicine in Paediatrics and Child Health
Multicentre validation of the bedside paediatric early warning system score: A severity of illness score to detect evolving critical illness in hospitalised children

Critical Care, August 2011, vol./is. 15/4, 1364-8535;1466-609X (03 Aug 2011)
Parshuram C.S., Duncan H.P., Joffe A.R., Farrell C.A., Lacroix J.R., Middaugh K.L.,

Abstract: Introduction: The timely provision of critical care to hospitalised patients at risk for cardiopulmonary arrest is contingent upon identification and referral by frontline providers. Current approaches require improvement. In a single-centre study, we developed the Bedside Paediatric Early Warning System (Bedside PEWS) score to identify patients at risk. The objective of this study was to validate the Bedside PEWS score in a large patient population at multiple hospitals.

Methods: We performed an international, multicentre, case-control study of children admitted to hospital inpatient units with no limitations on care. Case patients had experienced a clinical deterioration event involving either an immediate call to a resuscitation team or urgent admission to a paediatric intensive care unit. Control patients had no events. The scores ranged from 0 to 26 and were assessed in the 24 hours prior to the clinical deterioration event. Score performance was assessed using the area under the receiver operating characteristic (AUCROC) curve by comparison with the retrospective rating of nurses and the temporal progression of scores in case patients.

Results: A total of 2,074 patients were evaluated at 4 participating hospitals. The median (interquartile range) maximum Bedside PEWS scores for the 12 hours ending 1 hour before the clinical deterioration event were 8 (5 to 12) in case patients and 2 (1 to 4) in control patients (P < 0.0001). The AUCROC curve (95% confidence interval) was 0.87 (0.85 to 0.89). In case patients, mean scores were 5.3 at 20 to 24 hours and 8.4 at 0 to 4 hours before the event (P < 0.0001). The AUCROC curve (95% CI) of the retrospective nurse ratings was 0.83 (0.81 to 0.86). This was significantly lower than that of the Bedside PEWS score (P < 0.0001).

Conclusions: The Bedside PEWS score identified children at risk for cardiopulmonary arrest. Scores were elevated and continued to increase in the 24 hours before the clinical deterioration event. Prospective clinical evaluation is needed to determine whether this score will improve the quality of care and patient outcomes.

2011 Parshuram et al

Source: EMBASE
Full Text: Available from National Library of Medicine in Critical Care

Implementation and benefit of the pediatric emergency warning score in a community hospital system

Zuckerman S.L., Sedillo D.J., Tamayo J., Koenig J.
Circulation, November 2011, vol./is. 124/21 SUPPL. 1, 0009-7322 (22 Nov 2011)

Abstract: Introduction: In-hospital cardiac arrest has a high mortality that has not shown significant improvement despite advances in cardiopulmonary resuscitation techniques. Rapid response teams (RRTs) have been developed to aggressively stabilize the decompensating in-patient and prevent progression to arrest. Academic centers have shown a benefit of the employment of RRTs in adults, but the evidence is less certain in academic pediatric centers. Early warning systems have been developed to detect patients at risk for deterioration. Use of the Pediatric Early Warning Score (PEWS) has reduced the need for RRTs in some pediatric academic centers, but the PEWS has not been validated in community hospital settings.

Hypothesis: Implementation of the PEWS for all in-patient pediatric admissions in a non-academic community hospital system would improve patient safety, bed placement selection and care team communication.

Methods: PEWS was implemented as a sixth vital sign for all pediatric patients in a community hospital following intensive education of the nursing and medical staff. Algorithms were developed for clinical response to PEWS values.

Results: Since implementation of the PEWS, there have been no in-patient pediatric arrests. At-risk pediatric patients have been identified through their PEWS. Patients with increased PEWS (4-6) have received prompt intervention and stabilization. Patients with PEWS (6 or >) were transferred in a timely manner to an increased level of care in the same facility. The PEWS directly influenced initial bed placement. Nursing felt strongly that the PEWS improved their ability to convey patient distress or instability to the medical staff.

Conclusions: The PEWS can be successfully implemented in a community hospital system. The PEWS will facilitate pediatric in-patient care through improved patient safety, bed placement selection, and care team communication. The PEWS may be have even greater value in the community hospital setting because there are fewer layers of care providers.

Source: EMBASE
Full Text: Available from Highwire Press in Circulation
Determining the effect of objective and subjective criteria on a risk assessment tool in a children's emergency department
Emergency Medicine Journal, October 2011, vol./is. 28/(A12-A13)
Roland D., Davies F., Lewis G.
Abstract: Objectives and Background Children with serious illness can be difficult to spot, especially for non-experienced staff. Although adult "early warning scores" are now commonly used in Emergency Departments (ED), there is no such system for children. The Paediatric Observation Priority Score (POPS) is a physiological and observational scoring system (range 0e16) designed for use by healthcare professionals of varying clinical experience at initial assessment in our ED. The aim is to use POPS to identify sick children, aid healthcare professionals in confidently discharging or re-directing patients and providing a departmental level of acuity to aid resource allocation. A first phase of the validation process examined the utility of the more subjective criteria of POPS (level of alertness, work of breathing, nursing concern and relevant background history) against the physiological criteria (heart rate, breathing rate, saturations and temperature) in determining admission to the children's hospital assessment unit from the ED. Methods Convenience sample case note review of attendances to the ED, analysing patient discharge disposition against initial POPS recorded. Results 942 (injuries not included) presentations from 2009 to 2010 were included in the study with an overall admission rate (Table presented) of 36% (339/942). RR of admission of admission with a POPS of >0 was 2.1 (CI 1.6 to 2.7). Conclusion The large range of confounding influences affecting the admission of children to hospital makes an initial point of care assessment predictive model difficult. This work demonstrated interesting variation in performance of the component sections of the POPS score. The use of subjective, user dependant factors, may inhibit the performance of physiological values which have traditionally be used in aiding illness recognition. Further work is ongoing to improve the performance of the tool as an adjunct to risk assessment and resource allocation.
Source: EMBASE

Association of Pediatric Early Warning System Score (PEWS) with ICU and hospital outcome
Pediatric Critical Care Medicine, May 2011, vol./is. 12/3 SUPPL. 1(A139)
Rubin S., Bart R., Khemani R.
Abstract: Objectives: Evaluate association between ICU pediatric early warning system score (PEWS) and outcome. Methods: Retrospective review of 1104 children consecutively admitted to the ICU from a general pediatrics ward at a large, tertiary care children's hospital from 1/03 to 12/08. PEWS was generated using first available data within two hours of ICU admit and four hours before ICU discharge. Results: Patients who survived to hospital discharge had lower admit PEWS [6(2,10)] than those who died in the ICU [8(5,11)] or died after discharge during the same hospitalization (hospital death) [8(4.7,11.3)] , K-W ANOVA, P<0.001. Higher discharge PEWS was associated with ICU readmission and hospital death. Odds of ICU readmission and hospital death increased by 1.18(1.08,1.28) and 1.42(1.28,1.59) respectively for each point increase in ICU discharge PEWS. The discrimination ability of ICU discharge PEWS for the outcomes of ICU readmission and hospital death was best at scores of 7 (PPV= 0.2, NPV= 0.87, AUC=0.562) and 6(PPV= 0.15, NPV= 0.96, AUC= 0.647) respectively. Of 88 hospital deaths, 16(18%) were DNR at ICU transfer. Conclusion: Children with higher ICU admit PEWS are more likely to experience ICU or hospital death. Children with higher ICU discharge PEWS are at increased risk of ICU readmission and hospital death, although no threshold score has adequate discrimination ability to be useful as a screening tool for either outcome. Future efforts should focus on developing a screening tool that could accurately identify patients at high risk of read-mission or hospital death.
Source: EMBASE
Paediatric early warning system chart and response audit

**Abstract:** Objectives: The introduction of the Paediatric Early Warning System (PEWS) has fundamentally changed the approach to observation and monitoring of hospitalised children. This audit aimed to determine whether documentation of charts is complete, and if clinical responses are appropriate. Methods: Data were collected from 58 in-patients at Birmingham Children's Hospital in November 2009. Patient charts were assessed for age-appropriateness and correct documentation of time, date, patient details, physiological parameters and PEWS score. For scores over four clinical responses were evaluated using medical notes. Results: 97% (56/58) of charts were age appropriate. Patient details were complete in 60% (35/58), date in 62% (36/58) and time in 100% (58/58). Heart rate and respiratory rate were complete in 100% (58/58), oxygen saturations, oxygen therapy, respiratory distress and capillary refill time in 98% (57/58), blood pressure in 83% (48/58), neurological observations/ AVPU in 69% (40/58) and temperature method in 64% (37/58). The event marker was used in 84% (49/58). Patient specific parameters were present in 40% (4/10) where appropriate. PEWS score was accurate in 88% (51/58); a recent score was recorded in 88% (51/58). 19 patients scored PEWS 5-8 and five scored over eight; of those warranting medical review this occurred in 29% (4/14) scoring 5-8 and 67% (2/3) scoring over eight. Conclusion: The findings demonstrate good practice in the use of age-appropriate charts, documentation of physiological parameters and PEWS scores. A PEWS score of 9 is not always triggering a response. Further research could evaluate this threshold and identify barriers to calling for assistance.

Source: EMBASE

Education - An essential element in the early recognition of deteriorating children

**Abstract:** Objectives: The objectives of the Paediatric COMPASS education are for participants to understand the underlying physiology of paediatric vital signs, to interpret abnormal observations, and to communicate effectively. Methods: ACT Health previously completed the Early Recognition of the Deteriorating Patient Project for adult inpatient areas. A similar paediatric specific program was deemed essential to ensure staff had appropriate understanding of the value of vital signs in children. The Paediatric COMPASS Education Package includes a CD, manual, online quiz, lecture and four case studies supported by a Paediatric Early Warning Score (PEWS) derived from age specific observation charts. Results: 95% of clinical staff (115 medical and nursing) had completed training before its pilot. COMPASS education sessions feedback was overwhelmingly positive (100% of respondents found it useful, and 97% of respondents would modify work practice). Education and implementation of the new observation charts resulted in improved vital sign monitoring and 63% earlier identification and review of deteriorating children. (Table presented) Conclusion: The introduction of the multimodal education program along with a track and trigger system has improved the documentation and medical review of children. The program will be extended to other areas caring for children including the emergency department and recovery. The COMPASS program is easily accessible, cost efficient, adaptable and has proven itself with these positive results. Tools are available to facilities outside ACT (www.compass.act.gov.au).

Source: EMBASE

Pediatric early warning system (PEWS) score: Accuracy and inter-rater reliability

**Abstract:** Introduction: The Pediatric Early Warning System (PEWS) score was developed to screen children on the pediatric ward for signs of critical illness. Early detection leading to intervention may prevent clinically significant deterioration and improve morbidity and mortality. Potential for early warning scores to affect outcome is based on accurate and reliable score assignment. However, evaluation of accuracy and inter-rater reliability is lacking in the PEWS literature. Hypothesis: Preceded by a comprehensive nurse education program, PEWS score assignment is accurate and reliable. Methods: A committee of PEWS experts, assembled for this study, implemented an education program for all nurses who assigned PEWS scores on the pediatric ward. Nurses then
completed a series of hypothetical vignettes in which they independently assigned PEWS scores to the same five fictional pediatric patients. Nurse-assigned scores were compared with an answer key created a priori by PEWS expert consensus opinion. Difference between nurse-assigned and expert-assigned scores was evaluated using the Wilcoxon signed-rank test. Accuracy of nurse-assigned scores was determined by agreement with expert answers (within 1 point of the PEWS scale). CHLA uses a PEWS-based management algorithm in which ICU consult is recommended if PEWS score is 4. To evaluate clinically relevant score assignment, PEWS scores were categorized into 0-3 and 4. Inter-rater reliability of continuous and categorical PEWS scores was assessed by Fleiss’ kappa. Results: 352/487 (72%) nurses completed the vignettes. Nurse-assigned and expert-assigned PEWS scores were similar (P = 0.2) with 92% agreement overall. PEWS, assessed as a continuous variable, had moderate inter-rater reliability (Fleiss’ kappa = 0.41). PEWS, assessed as a categorical variable, had substantial inter-rater reliability (Fleiss’ kappa = 0.78). Conclusions: Following a focused nurse education program, PEWS score assignment was accurate and inter-rater reliability of clinically relevant PEWS scores was substantial.

Source: EMBASE

Staff perceptions of a pediatric early warning score in a tertiary care children's hospital

Critical Care Medicine, December 2011, vol./is. 39/(117), 0090-3493 (December 2011)
McClain B., Sevier L., Browning W., Hall R., Strohler B.

Abstract: Introduction: Pediatric Early Warning Scores (PEWS) were developed to help bedside providers recognize patients at risk for deterioration. Limitations to implementation include disruptions to nurse workflow and poor specificity that leads to unnecessary bedside evaluations by the physician team. Hypothesis: A simple, five-point PEWS can identify patients at risk for deterioration without creating extra work for the bedside nurse or physician team. Methods: Bedside nurses on a medical acute care floor in a tertiary care child's hospital were trained to use the PEWS. The nurses recorded the duration of the assessment and answered a seven question survey after completing the score. The PEWS is a composite score with one category each for mental status and hemodynamics and three categories for the respiratory system. The score links to an algorithm that provides decision support for escalation of support and frequency of reassessments. For the study, the nurses were given the algorithm but were not required to follow it. Results: The study captured 174 assessments for 45 patients. The mean time for completion of an assessment was 6:13 minutes. The mean score was 1.2 for dayshift and 2.2 for nightshift. Ten out of 140 responses (7%) felt the score did not accurately describe the acuity of the patient. The PEWS only prompted the nurse to involve the physician team when the nurse was not concerned about the patient in 1 out of 139 responses (< 1%). The frequency of assessment assigned by the algorithm matched the nurses' level of concern for 132 out of 139 responses (95%). Conclusions: The PEWS used in this study accurately describes the acuity of pediatric inpatients while adding little extra work for the bedside provider.

Source: EMBASE

Cohort study to test the predictability of the Melbourne criteria for activation of the medical emergency team.

Archives of Disease in Childhood, 01 February 2011, vol./is. 96/2(174-179), 00039888
Edwards ED, Mason BW, Oliver A, Powell CV

Abstract: Objective To test the predictability of the Melbourne criteria for activation of the medical emergency team (MET) to identify children at risk of developing critical illness. Design Cohort study. Setting Admissions to all paediatric wards at the University Hospital of Wales. Outcome measures Paediatric high dependency unit admission, paediatric intensive care unit admission and death. Results Data were collected on 1000 patients. A single abnormal observation determined by the Melbourne Activation Criteria (MAC) had a sensitivity of 68.3% (95% CI 57.7 to 77.3), specificity 83.2% (95% CI 83.1 to 83.2), positive predictive value (PPV) 3.6% (95% CI 3.0 to 4.0) and negative predictive value 99.7% (95% CI 99.5 to 99.8) for an adverse outcome. Seven of the 16 children (43.8%) would not have transgressed the MAC prior to the adverse outcomes. Four hundred and sixty-nine of the 984 children (47.7%) who did not have an adverse outcome would have transgressed the MAC at least once during the admission. Conclusion The MAC has a low PPV and its full implementation would result in a large number of false positive triggers. Further research is
required to determine the relative contribution of the components of this complex intervention (Paediatric Early Warning System, education and MET) on patient outcome.

**Source:** CINAHL

**Full Text:** Available from *Highwire Press* in *Archives of disease in childhood*

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**Multicentre validation of the bedside paediatric early warning system score: a severity of illness score to detect evolving critical illness in hospitalised children.**

Critical Care (London, England), 2011, vol./is. 15/4(R184), 1364-8535;1466-609X (2011)

Parshuram CS, Duncan HP, Joffe AR, Farrell CA, Lacroix JR, Middaugh KL, Hutchison JS,

**Abstract:** INTRODUCTION: The timely provision of critical care to hospitalised patients at risk for cardiopulmonary arrest is contingent upon identification and referral by frontline providers. Current approaches require improvement. In a single-centre study, we developed the Bedside Paediatric Early Warning System (Bedside PEWS) score to identify patients at risk. The objective of this study was to validate the Bedside PEWS score in a large patient population at multiple hospitals.

METHODS: We performed an international, multicentre, case-control study of children admitted to hospital inpatient units with no limitations on care. Case patients had experienced a clinical deterioration event involving either an immediate call to a resuscitation team or urgent admission to a paediatric intensive care unit. Control patients had no events. The scores ranged from 0 to 26 and were assessed in the 24 hours prior to the clinical deterioration event. Score performance was assessed using the area under the receiver operating characteristic (AUCROC) curve by comparison with the retrospective rating of nurses and the temporal progression of scores in case patients.

RESULTS: A total of 2,074 patients were evaluated at 4 participating hospitals. The median (interquartile range) maximum Bedside PEWS scores for the 12 hours ending 1 hour before the clinical deterioration event were 8 (5 to 12) in case patients and 2 (1 to 4) in control patients (P < 0.0001). The AUCROC curve (95% confidence interval) was 0.87 (0.85 to 0.89). In case patients, mean scores were 5.3 at 20 to 24 hours and 8.4 at 0 to 4 hours before the event (P < 0.0001). The AUCROC curve (95% CI) of the retrospective nurse ratings was 0.83 (0.81 to 0.86). This was significantly lower than that of the Bedside PEWS score (P < 0.0001).

CONCLUSIONS: The Bedside PEWS score identified children at risk for cardiopulmonary arrest. Scores were elevated and continued to increase in the 24 hours before the clinical deterioration event. Prospective clinical evaluation is needed to determine whether this score will improve the quality of care and patient outcomes.

**Source:** MEDLINE

**Full Text:** Available from *National Library of Medicine* in *Critical Care*

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**Does a standardised scoring system of clinical signs reduce variability between doctors’ assessments of the potentially dehydrated child?**

Journal of Paediatrics & Child Health, March 2010, vol./is. 46/3(103-7)

Roland D, Clarke C, Borland ML, Pascoe EM

**Abstract:** AIMS: Clinical assessment of dehydration in children is often inaccurate. We aimed to determine if a scoring system based on standardised clinical signs would reduce the variability between doctors’ assessment of dehydration.

METHODS: A clinical scoring system was developed using seven physiological variables based on previously published research. Estimated percentage dehydration and severity scores were recorded for 100 children presenting to a Paediatric Emergency Department with symptoms of gastroenteritis and dehydration by three doctors of different seniority (resident medical officer, registrar and consultant). Agreement was measured using intra-class correlation coefficient (ICC) for percentage ratings and total clinical scores and kappa for individual characteristics.

RESULTS: Estimated percentage dehydration ranged from 0-9%, mean 2.96%, across the three groups. Total clinical scores from 0-10, mean 2.20. There was moderate agreement amongst clinicians for the percentage dehydration (ICC 0.40). The level of agreement on the clinical scoring system was identical (ICC 0.40). Consultants gave statistically lower scores than the other two groups (Consultant (Con) vs. Resident P = 0.001, Con vs. Registrar P = 0.013). There was a marked difference in agreement across characteristics comprising the scoring system, from kappa 0.02 for capillary refill time to 0.42 for neurological status.

CONCLUSION: The clinical scoring system used did not reduce the variability of assessment of dehydration compared to doctors' conventional methods. In order to reduce variability improving
education may be more important than production of a scoring system as experience appears to be a key determinant in the assessment of a potentially dehydrated child.

Source: MEDLINE

Observations and monitoring: routine practices on the ward.
Paediatric Nursing, 01 May 2010, vol./is. 22/4(28-32), 09629513

Author(s): Oliver A, Powell C, Edwards D, Mason B

Abstract: Aim To review routine observations on all children admitted to the Children's Hospital for Wales and the feasibility of implementing an early warning score for children developing critical illness. Method Nursing staff, while performing their routine duties, recorded the physiological observations of temperature, heart rate, respiratory rate and blood pressure, as well as identifying airway threat, recording oxygen saturation levels, level of consciousness using the AVPU scale (alert, responds to voice, responds to pain, unresponsive) and identifying if they had concerns about a child on a new paediatric observation chart. The clinical care policy for each ward determined the frequency of recording observations. Results Data were collected for 1,000 patients on whom 9,075 sets of observations were performed. Of those 9,075 sets, temperature was the most frequently recorded observation at 88.4% (95% confidence interval (CI) 87.7-89), followed by heart rate at 86.8% (95% CI 86.1-87.5), respiratory rate at 79.7% (95% CI 78.9-80.5), AVPU at 36.4% (95% CI 35.4-37.4) and blood pressure at 25.1% (95% CI 24.2-26.0). A complete set of observations needed for the Cardiff and Vale Paediatric Early Warning System to trigger effectively were only recorded in 52.7% (95% CI 52.4-53.1) of patients. Conclusion There were variations in the frequency, type and recording of observations. This issue needs to be addressed if scoring systems are to be implemented. The findings of this observational study suggest that the required basic observations of acutely ill children are not being carried out.

Source: CINAHL
Full Text: Available from EBSCOhost in Paediatric Nursing

Sensitivity of the pediatric early warning score to identify patient deterioration.
Pediatrics, April 2010, vol./is. 125/4(e763-9), 0031-4005;1098-4275 (2010 Apr)
Akre M, Finkelstein M, Erickson M, Liu M, Vanderbilt L, Billman G

Abstract: OBJECTIVE: We evaluated the Pediatric Early Warning Score (PEWS) sensitivity as an early indicator of patients deterioration leading to a Rapid Response Team (RRT)/code event. We hypothesized that at least 80% of patients had a critical PEWS preceding the event. We determined staff awareness of deterioration in patient status prior to the event as evidenced by consults, addition of monitoring equipment or increased frequency of assessment. The timing of these events was compared to critical PEWS times.METHODS: One hundred and seventy non-ICU RRT and 16 code events were identified between October 2006 and February 2008. We completed retrospective PEWS at four-hour intervals or less for twenty-four hours preceding the event. The PEWS algorithm, guiding staff to consult at a critical score > or =4 or a single domain score equal to 3, was applied.RESULTS: For 85.5% of patients the earliest indicator of deterioration, evidenced by a critical PEWS, was a median of 11 hours 36 minutes and the earliest preceding the event was 30 minutes. For 97.1% of patients the earliest median time to a consult was 80 minutes. Oximetry was added 6.9 hours for 43.5% of patients. 7% of patients had increased nursing assessment. A subgroup of patients had 1) critical PEWS, 2) consult and 3) addition of a monitor. The median time for earliest critical PEWS for these was significant (P < 0.001).CONCLUSION: PEWS can potentially provide a forewarning time >11 hours, alerting the team to adapt the care plan and possibly averting an RRT or code.

Source: MEDLINE
Full Text: Available from Highwire Press in Pediatrics
The Paediatric Early Warning Tool in Combination with a Nurse-Led Outreach Team: Impact on Outcomes for Critically Ill Children

Posters

Pediatric Research (2010) 68, 368–368; doi:10.1203/00006450-201011001-00726

S Sandhu1, T Ralph1, K Bradbury1, J Reid1, A Wolfe1 and A Mayer1

Introduction: Paediatric early warning tools (PEWT) were developed to identify clinical deterioration in acutely ill patients. Deviations from defined physiological parameters are used to initiate medical review and intervention. PEWT was incorporated into observation charts at a UK tertiary referral hospital and an outreach response team was trialled providing immediate high dependency care.

Aims: An audit was undertaken to determine the effectiveness of the outreach team combined with PEWT and assess the impact on patient outcome.

Method: A nurse-led outreach team was trialled for 3 months during 2009. Patient observation charts were reviewed for all inpatients over one week. Data was collected to determine: number of patient triggers, actions taken and patient outcome (133 patient observation charts reviewed). Data collection was repeated once the trial had finished (n=167).

Results: 28% (n=37) of patients triggered when team available ((133 charts); mean age 6.3 years (SD=5.5)) which was comparable to the period without the team 28% (47/167, p=0.1); 5.8 years (SD=5.6)) when triggered. Help was requested on 12 (32%) occasions compared with 8 (17%, p<0.05) with and without teams respectively. No arrest calls occurred during the period with the team; 2 occurred during the period without. A reduction in critical incident reporting was observed during team availability.

Conclusions: Decreased emergency team calls and critical incidents were observed by introduction of an outreach team and PEWT. The outreach team received a positive response from all staff, providing immediate high dependency care. Use of the PEWT allowed earlier review and prompt medical intervention.

Prospective cohort study to test the predictability of the Cardiff and Vale paediatric early warning system

Archives of Disease in Childhood, 2009, vol./is. 94/8, 1468-2044 (Aug 2009)

Edwards, E D.

Abstract: The objective was to develop and test the predictability of a paediatric early warning score to identify children at risk of developing critical illness. The design was a prospective cohort study. The setting was admissions to all paediatric wards at the University Hospital of Wales. The outcome measures were respiratory arrest, cardiac arrest, paediatric high-dependency unit admission, paediatric intensive care unit admission and death. The results were, data were collected on 1,000 patients. A single abnormal observation determined by the Cardiff and Vale paediatric early warning system (C&VPEWS) had a 89.0% sensitivity (95% CI 80.5 to 94.1), 63.9% specificity (95% CI 63.8 to 63.9), 2.2% positive predictive value (95% CI s.0 to 2.3) and a 99.8% negative predictive value (95% CI 99.7 to 99.9) for identifying children who subsequently had an adverse outcome. The area under the receiver operating characteristic curve for the C&VPEWS score was 0.86 (95% CI 0.82 to 0.91). The conclusion was identifying children likely to develop critical illness can be difficult. The assessment tool developed from the advanced paediatric life support guidelines on identifying sick children appears to be sensitive but not specific. If the C&VPEWS was used as a trigger to activate a rapid response team to assess the child, the majority of calls would be unnecessary.

Full Text: Available from National Library of Medicine in Archives of Disease in Childhood

Use of a paediatric early warning system in emergency departments.

Emergency Nurse, 01 April 2009, vol./is. 17/1(22-25), 13545752

Adshead N, Thomson R

Abstract: Implementing an early warning system to identify deterioration can help adult-trained nurses accurately assess children's needs and interventions, say Nicola Adshead and Raynie Thomson.

Source: CINAHL

Full Text: Available from EBSCOhost in Emergency Nurse

Related powerpoint presentation:
Paediatric early warning systems: where do we go from here?
Paediatric Nursing, 01 February 2009, vol./is. 21/1(14-17), 09629513
McCabe A, Duncan H, Heward Y

Abstract: The Confidential Enquiry into Maternal and Child Health report published in 2008 recommended that there should be a standardised monitoring system with embedded early identification systems for children at risk of critical Illness or deterioration. Recent studies have demonstrated improvement in patient outcomes following the implementation of paediatric early warning scores and response teams in children's units and hospitals. However, it is not enough to use an early warning score in isolation; it needs to be embedded into a paediatric early warning system, with a rationalised approach to the observation and monitoring of hospitalised children. Lessons can be learnt from the adult experience of implementing early warning systems. A national, multidisciplinary, collaborative approach to the development, implementation and evaluation of paediatric early warning systems is recommended.

Source: CINAHL

Full Text: Available from EBSCOhost in Paediatric Nursing

Development and initial validation of the Bedside Paediatric Early Warning System score.
Critical Care (London, England), 2009, vol./is. 13/4(R135)
Parshuram CS, Hutchison J, Middaugh K

Abstract: INTRODUCTION: Adverse outcomes following clinical deterioration in children admitted to hospital wards is frequently preventable. Identification of children for referral to critical care experts remains problematic. Our objective was to develop and validate a simple bedside score to quantify severity of illness in hospitalized children. METHODS: A case-control design was used to evaluate 11 candidate items and identify a pragmatic score for routine bedside use. Case-patients were urgently admitted to the intensive care unit (ICU). Control-patients had no 'code blue', ICU admission or care restrictions. Validation was performed using two prospectively collected datasets. RESULTS: Data from 60 case and 120 control-patients was obtained. Four out of eleven candidate-items were removed. The seven-item Bedside Paediatric Early Warning System (PEWS) score ranges from 0-26. The mean maximum scores were 10.1 in case-patients and 3.4 in control-patients. The area under the receiver operating characteristics curve was 0.91, compared with 0.84 for the retrospective nurse-rating of patient risk for near or actual cardiopulmonary arrest. At a score of 8 the sensitivity and specificity were 82% and 93%, respectively. The score increased over 24 hours preceding urgent paediatric intensive care unit (PICU) admission (P < 0.0001). In 436 urgent consultations, the Bedside PEWS score was higher in patients admitted to the ICU than patients who were not admitted (P < 0.0001). CONCLUSIONS: We developed and performed the initial validation of the Bedside PEWS score. This 7-item score can quantify severity of illness in hospitalized children and identify critically ill children with at least one hours notice. Prospective validation in other populations is required before clinical application.

Source: MEDLINE

Full Text: Available from National Library of Medicine in Critical Care
## Case Studies and Regional Examples

**Case Study - HSE: Implementation of a Paediatric Early Warning System**  
Caroline O'Connor RCN Paediatric Department  
An early warning score is a set of simple algorithms relating to the finding of physiological parameters. These parameters are given a number depending on the range of severity within which they fall into, the total number added at the end of the observations taken is the score given (Sterling 2002)

**What does an early warning system do?**  
It quantifies patient status  
Supports early recognition of clinical deterioration  
Promote concise communication among care providers to alter plans of care in response to changing patient status.

*Greenway’s concept was used:*  
Plan (Implementation date, drafts compiled)  
Do (Education, key staff identified, guideline compiled to aid implementation and answer questions)  
Review (Reflective diary. Audit of Use and effectiveness)

*Charts were redesigned to include an escalation pathway for the Paediatric Assessment Unit and the Childrens Ward.*  
An implementation phase of one month was extended to three months due to low patient numbers. Two reflective journals were in place (in the childrens ward and the paediatric assessment unit). After three months review of the journals and informal feedback took place, necessary changes were made.

The initial implication of the introduction of the PEWS charts showed an improvement in communication of patient status.

The auditing process will be ongoing and while it is generally retrospective, at times specific charts that should have triggered a critical PEWS will be audited to assess the sensitivity and specificity of the charts. Also the appropriateness of individual parameters that were set for children will be audited.

[www.hse.ie/eng/about/Who/qualityandpatientsafety/QPS_goodpractice/earlywarningsyst.html](http://www.hse.ie/eng/about/Who/qualityandpatientsafety/QPS_goodpractice/earlywarningsyst.html)
Policy for Patient Observation and Monitoring in Child Health 2012
Royal Cornwall Hospitals NHS Trust

Worcestershire Acute Hospitals NHS Trust
Paediatric Monitoring and Observation Guideline, 2013
This is the guideline for monitoring and observation of children and young people, including Paediatric Early Warning System (PEWS), Pain management, GCS scoring, transfer requirements and the need for High Dependency care.

- PEWS is a relatively new concept that is being adopted by Trusts nationwide. Major studies have been undertaken over the last few years.
- The Department of Health (2000) identified that early recognition of deterioration in adults leads to improved outcomes.
- 70% of adult areas have some kind of EWS/Patient At Risk Score (NICE guidelines for Acutely Ill patients (2007)
- Duncan (2008) identified that children show signs of deterioration in their respiratory and cardiac rates prior to a cardiac arrest.
- Early detection of deteriorating clinical signs and observation leads to optimal care in the most appropriate place HDU/ITU and has been linked to decreased mortality and morbidity. (Duncan et al 2006)
- PEWS at WAHT has been developed from the already existing adult PARS system. Other scoring systems have been looked at, such as Bristol, Brighton, Alderhay and BCH (which was under construction). The PEWS at WAHT has also been developed alongside the NICE guidelines for feverish illness in children. (DoH 2007)
- It was felt that as Worcestershire Acute Hospitals NHS Trust (WAHT) refers to many hospitals as well as BCH, it was not necessary to conform to one specific PEWS.
- Within Worcestershire PEWS was developed from the PARS, Patient At Risk Score, (with kind permission of the critical care outreach team) using the same scoring system. It was decided that as this is the system that the trust is familiar with, it was safe practice to adopt this system for paediatric patients. The PARS will be used on patients over the age of 13 years.
- PARS has been validated within the trust since 2006. The PEWS have not yet been validated for use within the NHS. National work is underway to address this.
- A PEWS score should be generated for every child who is under 13 years, who attends inpatient children’s wards, Emergency Departments (professional judgement can be exercised in Minors) and theatres.
- PEWS must be completed with ABC as part of Triage on arrival to the wards and within a 15 minute standard by a qualified nurse.

Tameside Hospital: Paediatric Early Warning Scoring Policy
The purpose of this policy is to describe the PEWS tool which has been developed and implemented as a result of research which indicates that the clinical risk to infants and children is reduced by early intervention, and that the PEWS system enables the early identification of signs of deterioration and initiating appropriate responses and management from the medical team.

Attached
Spotting the Sick Child

It is recognised that the assessment of an acutely sick child is challenging and requires health care professionals to have the appropriate skills and competencies. The original DVD of Spotting the Sick Child was developed to support health care professionals spot children with serious illness. Since its release in 2004 the DVD has been a great success and is still a popular seller in the medical education market.

Spotting the Sick Child 2 was commissioned by the Department of Health and has been developed as a collaboration between academics, clinicians, instructional designers and web developers (see contributors) to provide an online interactive and evidence based tool using real life clinical scenario's and footage.

http://www.spottingthesickchild.com/

In order to access Spotting the Sick Child you will need to register an account. There is no fee for registration.

Please note that this website is intended for use by healthcare professionals, academics and medical educators only. By completing the following registration process you confirm that your job role is one of these.

https://www.spottingthesickchild.com/register