

**TEXAS CHILDREN'S HOSPITAL**  
**EVIDENCE-BASED OUTCOMES CENTER**  
**Pediatric Early Warning Systems**  
Evidence Summary

**Inclusion Criteria**

- Patients at Texas Children's Hospital for Pediatric care

**Exclusion Criteria**

- Patients at Texas Children's Hospital in the Neonatal Intensive Care Unit
- Patients at Texas Children's Hospital in the Pavilion for Women

**Background**

Early warning system tools can be useful in the identification of patients at risk for acute decompensation. <sup>(1-4)</sup> By identifying patients at risk, healthcare teams are better able to monitor and prevent acute decompensation. <sup>(1)</sup> However, in order for a tool to be accurate it must be both valid and reliable in the patient population that it is to be used in. In order to identify a pediatric early warning system tool that may improve patient outcomes through the early identification of those at risk for acute deterioration, the literature was reviewed and critically appraised.

**Critically Analyze the Evidence**

The **GRADE criteria** were used to evaluate the quality of evidence presented in research articles reviewed during the development of this guideline. The table below defines how the quality of evidence is rated and how a strong versus a weak recommendation is established.

Recommendation	
<b>STRONG</b>	Desirable effects clearly outweigh undesirable effects or vice versa
<b>WEAK</b>	Desirable effects closely balanced with undesirable effects
Quality	Type of Evidence
<b>High</b>	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
<b>Moderate</b>	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
<b>Low</b>	Evidence for at least 1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence
<b>Very Low</b>	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

**PICO Question 1:** In hospitalized pediatric patients does the use of an early warning scoring system improve outcomes?

**PICO Question 2:** In hospitalized pediatric patients, is there an early warning scoring system that is specific to specialty/high-risk populations (i.e. cardiology, hematology/oncology, stem cell transplant, etc.)?

**Critical Points of Evidence\***

**Evidence Supports**

- An early warning scoring system can be used in hospitalized pediatric patients to identify those at risk for acute deterioration and improve related outcomes. <sup>(3,4)</sup> – Strong recommendation, low quality evidence
- The BedsidePEWS early warning scoring system can be used to identify hospitalized pediatric patients, including specialty/high risk populations (i.e. cardiology, hematology/oncology, stem cell transplant, etc), at risk for acute deterioration. <sup>(1,2)</sup> – Consensus recommendation

**Remarks:** Our team has identified that the following variables should also be considered when selecting an early warning system tool: ease of use, objectivity, and the ability to be integrated into an electronic health record (EHR). Our team also recognizes the importance of implementation and sustainability as direct confounding variables to the success of any early warning system tool.

\*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.

**Measures****Process**

- Number of rapid response team (RRT) calls

**Outcome**

- Number of significant deterioration events
- Number of cardiac arrests
- Number of potentially preventable cardiac arrests
- Number of unplanned ICU readmissions
- Number of hospital readmissions

**References**

1. Gawronski, O., Ciofi Degli Atti, M. L., Di Ciommo, V., Cecchetti, C., Bertaina, A., Tiozzo, E., . . . Stem Cell Transplant Unit BedsidePEWS Study Group. (2016). Accuracy of bedside paediatric early warning system (BedsidePEWS) in a pediatric stem cell transplant unit. *Journal of Pediatric Oncology Nursing: Official Journal of the Association of Pediatric Oncology Nurses*, 33(4), 249-256. doi:10.1177/1043454215600154 [doi]
2. McLellan, M. C., Gauvreau, K., & Connor, J. A. (2014). Validation of the cardiac children's hospital early warning score: An early warning scoring tool to prevent cardiopulmonary arrests in children with heart disease. *Congenital Heart Disease*, 9(3), 194-202. doi:10.1111/chd.12132 [doi]
3. Parshuram, C. S., Bayliss, A., Reimer, J., Middaugh, K., & Blanchard, N. (2011). Implementing the bedside paediatric early warning system in a community hospital: A prospective observational study. *Paediatrics & Child Health*, 16(3), e18-22.
4. Parshuram, C. S., Dryden-Palmer, K., Farrell, C., Gottesman, R., Gray, M., Hutchison, J. S., . . . Canadian Critical Care Trials Group and the EPOCH Investigators. (2018). Effect of a pediatric early warning system on all-cause mortality in hospitalized pediatric patients: The EPOCH randomized clinical trial. *Journal of American Medical Association*, 319(10), 1002-1012. doi:10.1001/jama.2018.0948 [doi]

**Clinical Standards Preparation**

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children’s Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

**Pediatric Early Warning Systems Content Expert Team**

- Karla Abela, MSN, RN, CCRN-K, CPN, Pediatric Intensive Care
- Darlene Acorda, MSN, RN, CNE, CPNP-PC, Nursing
- Aarti Bavare, MD, Pediatric Intensive Care
- Deitra Brown, MHA, BSN, RN, CCRN-K, Cardiovascular Intensive Care
- Terri Brown, MSN, RN, CPN, Quality & Outcomes Management
- Lisa Davenport, MSN, BS, RN, RNC-NIC, Nursing
- Janet DeJean, MSN, RN, CPON, Cancer Center
- Sheranda Fesler, PhD, MS, BSN, RNC, NE-BC, CPHQ, CPPS, Nursing Clinical Practice
- Jordana Goldman, MD, Pediatric Intensive Care
- Chelsea Lawrence, BSN, RN, BMTCN, CPHON, Cancer Center
- Caridad Martinez, MD, Cancer Center
- Joyce Ramsey-Coleman, MSN, MBA, RN, NEA-BC Patient Safety
- Miranda Rodrigues, MSN, RN, CNL, CCRN-K, Cardiovascular Intensive Care
- Kerry Sembera, MSN, RN, Cardiovascular Intensive Care
- Mona Shah, MD, Cancer Center
- Julia Shelburne, MD, Pediatric Hospital Medicine
- Sharon Staton, MS-S SEM, BSN, RN, CPHON, BMTCN, Cancer Center
- Cheryl Trumble-Wilkins, MSN, RN, CCRN, Nursing
- Liz Wuestner, MSN, RN Pediatric Emergency Center

**EBOC Team**

- Betsy Lewis, MSN, RN, CNL, Evidence-Based Practice Specialist, Evidence-Based Practice Specialist
- Anne Dykes, MSN, RN, APRN, CNS, Assistant Director
- Binita Patel, MD, Chief Medical Quality Officer

**Additional EBOC Support**

- Karen Gibbs, MSN/MPH, RN, Evidence-Based Practice Specialist
- Andrea Jackson, MBA, RN, Evidence-Based Practice Specialist
- Jennifer Loveless, MPH, Evidence-Based Practice Specialist
- Sheesha Porter, MSN, RN, Evidence-Based Practice Specialist
- Warren Boudreau, MSN, RN, Director

No relevant financial or intellectual conflicts to report.

**Development Process**

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
  - PICO questions established
  - Evidence search confirmed with content experts
2. Review of Existing External Guidelines
  - N/A
3. Literature Review of Relevant Evidence
  - Searched: PubMed, Cochrane
4. Critically Analyze the Evidence
  - 1 randomized controlled trial and 3 nonrandomized studies
5. Summarize the Evidence

- Materials used in the development of the clinical standard, literature appraisal, and any order sets are maintained in a Pediatric Early Warning Systems evidence-based review manual within EBOC.

**Evaluating the Quality of the Evidence**

Published clinical guidelines were evaluated for this review using the **AGREE II** criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence *in support of* or *against* specific interventions and identifies where evidence is *lacking/inconclusive*. The following categories describe how research findings provide support for treatment interventions.

**“Evidence Supports”** provides evidence to support an intervention

**“Evidence Against”** provides evidence against an intervention.

**“Evidence Lacking/Inconclusive”** indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn *from the evidence*.

The **GRADE** criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

Recommendation	
<b>STRONG</b>	Desirable effects clearly outweigh undesirable effects or vice versa
<b>WEAK</b>	Desirable effects closely balanced with undesirable effects
Quality	Type of Evidence
<b>High</b>	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
<b>Moderate</b>	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
<b>Low</b>	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
<b>Very Low</b>	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

**Recommendations**

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the management of Early Warning Systems in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

**Approval Process**

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children’s Hospital. Content Expert Teams are involved with every review and update.

**Disclaimer**

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner must use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient's family, to make the ultimate judgment regarding care.

**Version History**

Date	Comments
March 2020	Original completion