CICER
Tacaíocht don Treoirlíne Chliniciúil
Clinical Guideline Support

PAEDIATRIC EARLY WARNING SYSTEMS

Protocol for a scoping review of existing PEWSs

February 2026

Health Information and Quality Authority
An tÚdarás Um Fhaisnéis agus Cáilíocht Sláinte

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

NATIONAL CLINICAL EFFECTIVENESS COMMITTEE

HRB An Bord Taighde Sláinte Health Research Board

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About CICER

In 2016, the Department of Health requested that the Health Research Board (HRB) fund an evidence synthesis service to support the activities of the Ministerially-appointed National Clinical Effectiveness Committee (NCEC). Following a competitive process, HIQA was awarded research funding spanning the period from 2017 to 2024 to produce the evidence to support the development of National Clinical Guidelines and National Clinical Audits. This funding was renewed through a competitive process to support the work of the Centre in Ireland for Clinical guideline support and Evidence Reviews (CICER) from 2024 to 2028. The CICER team comprises a dedicated multidisciplinary research team supported by staff from the Health Technology Assessment team in HIQA, the Discipline of Public Health and Primary Care in the School of Medicine in Trinity College Dublin, as well as national and international clinical and methodological experts.

With regard to clinical guidelines, the role of the CICER team is to independently review evidence and provide scientific support for the development, by guideline development groups (GDGs), of National Clinical Guidelines for the NCEC. The CICER team undertakes systematic reviews of the clinical effectiveness and cost-effectiveness of interventions included in the guidelines, as well as estimating the budget impact of implementing the guidelines. The CICER team also works closely with the GDGs and provides tailored training sessions; assists in the development of clinical questions and search strategies; performs systematic reviews of international clinical guidelines and supports the assessment of their suitability for adaption to Ireland; and supports the development of evidence-based recommendations informed within the National Clinical Guidelines.

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List of abbreviations that appear in this report

CICER	Centre in Ireland for Clinical guideline support and Evidence Reviews
GDG	guideline development group
HIQA	Health Information and Quality Authority
HRB	Health Research Board
JBI	Joanna Briggs Institute
NCEC	National Clinical Effectiveness Committee
NCG	National Clinical Guideline
OECD	Organisation for Economic Co-operation and Development
PEWS	Paediatric Early Warning System
PICO	population, intervention, comparison, outcome
PCC	population, concept, context
PRISMA-ScR	Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews
RQ	review question

1 Background

1.1 Description of the problem

Every year, there are approximately 1.7 million visits to emergency departments and injury units in Ireland.[1] Of these, approximately 400,000 are by children less than 16 years of age. In Ireland, in the years 2019-2023, the vast majority of paediatric mortality (63% for ages 1-14 and 92% for those aged under 1 year) occurred in the hospital setting.[2] When a patient arrives to the emergency department, a triage assessment is conducted to determine the severity of their condition and to assign a priority level based on urgency. This system is designed to help ensure that those with the most critical needs receive immediate attention. Between initial triage and disposition (the decision to discharge or admit), a patient's condition may unexpectedly worsen, leading to a deterioration in their vital signs, mental status, or other indicators of their overall health.

There are several conditions that may lead to life-threatening post-triage deterioration in the emergency department that are over-represented among children. For example, sepsis affects more than 25 million children globally each year, representing over half of all sepsis cases worldwide:[3] case-fatality rates in paediatric sepsis are currently about 4% among inpatients in Ireland,[4, 5] and rise to about 20% for severe sepsis and septic shock in developed countries.[6] It can be challenging to recognise post-triage clinical deterioration for a number of reasons. The emergency department can be a challenging care environment, with patients presenting with a diverse range of urgent conditions and comorbidities in a context of finite resources.

Detecting clinical deterioration in children can be especially difficult. Children may have a limited ability or an unwillingness to communicate their symptoms and the events that may have caused them. They also tend to have a higher capacity for early physiological compensation that can mask clinical signs of deterioration: for example, hypotension (drop in blood pressure) during shock may show up later than expected,[7, 8] and then deteriorate very quickly.[9-11] The term “child” also encompasses a diverse range of ages, and normal vital signs vary substantially between neonates, early childhood and adolescents.[10, 12] Additionally, even when clinical deterioration is recognised, there can be barriers to effectively escalating

the issue, including lack of standardisation in practice and a lack of clinical confidence. [13]

1.2 Paediatric Early Warning Systems

Paediatric early warning systems (PEWSs) are tools that help clinicians identify and communicate clinical deterioration. They are used in healthcare settings to identify and track potential deterioration in a patient's condition. Early warning systems are a combination of an afferent (recognition) scoring system with an efferent (response) pathway delineating clear escalation actions and plans for patient review and intervention.[14] The afferent arm of the scoring systems typically includes a combination of physiological and behavioural parameters, with a summary score calculated based on the included parameters, that has been developed and validated to correlate with degrees of risk of poor outcome. A 2019 systematic review of the validity and effectiveness of PEWSs found that the most commonly used parameters included heart rate, respiratory rate, respiratory effort, and level of consciousness or behavioural state.[15] Other frequently used parameters include oxygen levels, temperature, systolic blood pressure, capillary refill, and family or staff concerns.[15] The efferent arm of early warning systems typically consists of a tiered response, with a low score prompting a ward-level response (for example, review by the nurse in charge or a junior doctor and increased monitoring), with higher scores requiring a higher level of response (for example, review by consultant in charge or a rapid response team).[14] Early warning systems are typically implemented within structured quality improvement and governance frameworks to support consistent detection and management of clinical deterioration. Their use is underpinned by hospital policies and standardised escalation protocols, with clearly defined roles for monitoring, review, and escalation.[14]

In Ireland, there are existing National Clinical Effectiveness Committee (NCEC) National Clinical Guidelines (NCGs) for early warning systems for children in the inpatient setting[16] and for adults in the emergency department,[17] but not for children in the emergency department.

1.3 Previous reviews of Paediatric Early Warning Systems

Several systematic reviews of PEWSs have been conducted. A 2017 systematic review[18]

investigated the available evidence on the effectiveness of different PEWSs to detect deterioration and the effectiveness of their response mechanisms, as well as the evidence on PEWS implementation strategies. The review identified 38 primary studies reporting on original or adapted PEWS, with sensitivity, specificity, receiver operating characteristic curve, positive predictive value and or negative predictive value reported in 11 studies for a total of six PEWSs. A 2019 systematic review[15] investigating the predictive validity of PEWSs and their effectiveness to reduce mortality and critical events identified 27 validation studies for a total of 18 different PEWSs.

A preliminary search of MEDLINE, PROSPERO, the Cochrane Database of Systematic Reviews, and Joanna Briggs Institute (JBI) Evidence Synthesis located no current or underway systematic reviews or scoping reviews on PEWS.

1.4 Purpose of this review

The purpose of this review is to identify existing validated PEWSs from hospital settings, that could potentially be used in a National Clinical Guideline (NCG) on a children's emergency medicine early warning system in Ireland. Our aim is to describe the content of these existing PEWSs, and the extent of primary research based upon them.

2 Methods

This protocol outlines the planned approach for conducting a scoping review of existing validated PEWSs from hospital settings. The proposed review will be conducted in accordance with the JBI methodology for scoping reviews[19] and reported in line with PRISMA extension for scoping reviews (PRISMA-ScR).[20]

2.1 Review questions

This review will consider the following review questions (RQs):

1. What Paediatric Early Warning Systems from hospital settings have ever been validated in Organisation for Economic Co-operation and Development (OECD) member countries?

Note: we define a "validated" PEWS as one whose performance characteristics have been reported for predicting clinical deterioration, for example cardiac arrest, respiratory arrest, code call, resuscitation, and or transfer to intensive care or a high-dependency unit.[15] Validation may have been conducted by the tool developers, but must use a sample that is distinct from that used in development.

2. What does the afferent arm of each PEWS include?

3. What does the efferent arm of each PEWS include?

4. How widely studied is each PEWS?

5. Which of the identified PEWSs were designed for use in the emergency department setting (as opposed to designed for other hospital settings)?

These RQs were formulated in line with the Population, Concept, Context (PCC) framework a modified version of the PICO (Population, Interest, Comparison, Outcome) framework, as presented in Table 2.1.

Table 2.1 Population, Concept, Context (PCC) for review

Population	Children (less than 18 years of age)
Concept	PEWS systems that: ▪ Have been validated, meaning that their performance characteristics have been developed using an explicit approach and subsequently validated for predicting clinical deterioration, for example cardiac arrest, respiratory arrest, code call, resuscitation, and or transfer to intensive care or a high-dependency unit ▪ Include both afferent and efferent arms
Context	Inpatient hospital wards, paediatric intensive care units, and or emergency departments

2.2 Search strategy

Electronic searches will be conducted in Medline Complete via EBSCOhost, Embase via Elsevier, CINAHL Complete and PsycINFO via EBSCOhost, and Cochrane Library, from date of database inception. A draft Medline search is provided in Appendix 1 and includes database specific thesauri and free-text terms. In addition to the database search, backward- and forward-citation screening will be conducted for eligible studies using the citation chasing tool citationchaser (https://estech.shinyapps.io/citationchaser/).[21]

2.3 Eligibility criteria

The inclusion and exclusion criteria for this review are provided in Table 2.2.

Table 2.2 Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Early warning systems that: ▪ are aimed at children less than 18 years of age ▪ are used in a hospital and or emergency department setting ▪ have been validated (that is, their performance characteristics have been reported for predicting clinical deterioration, for example cardiac arrest, respiratory arrest, code call, resuscitation, and or transfer to intensive care or a high-dependency unit) in a sample that is distinct from that used in development ▪ are novel or have been substantially modified (defined as the addition or subtraction of a parameter as part of the score calculation, or changing of the actions on the efferent arm ▪ originated within an OECD member country.	Early warning systems that: ▪ are aimed at adults aged 18 years or older ▪ refer only to other care settings, such as primary care or outpatient clinics, prehospital services, or out-of-hours primary care ▪ focus only on initial triage systems or scores have not been validated for use ▪ are a minor modification of an existing PEWS (for example, changed a threshold or adapted a response action to the local context) ▪ not published in English.

2.4 Selection of eligible publications

All citations identified from the database searches (see Appendix 1) will be exported to EndNote (Version 20) for reference management,[22] where duplicates will be identified and removed. Using Covidence,[23] two reviewers will independently review the titles and abstracts of the remaining citations to identify those for full-text review. The full texts will be obtained and independently evaluated by two reviewers applying the defined inclusion and exclusion criteria. Where disagreements occur, discussions will be held to reach consensus and where necessary, a third reviewer will be involved. Citations excluded during the full-text review stage will be documented alongside the reasoning for their exclusion and included in a study flow diagram.

2.5 Data extraction and management

Data will be extracted from peer-reviewed articles by one reviewer and checked for accuracy and omissions by a second. Where disagreements occur, discussions will be held to reach consensus and where necessary, a third reviewer will be involved. Data extraction will be conducted in Microsoft Excel, using a purposely designed data extraction form (Appendix 2). The data extraction form will be piloted before use and refined as necessary.

2.6 Data synthesis

Evidence will be synthesised through five outputs, one in response to each RQ.

- Output 1: A list of PEWSs with citations of key origin papers. This will include substantially modified versions as separate PEWS, defined as the addition or subtraction of a parameter as part of the score calculation, or a changing of the actions on the efferent arm.
- Output for RQ 2: Table(s) of the afferent components of each PEWSs, including indicators assessed and how the scoring thresholds are calculated.
- Output for RQ 3: Table(s) of the efferent components of each PEWSs, including the recommended responses (for example, clinician review or increased monitoring).
- Output for RQ 4: Count of how many citations each key origin paper has.

- Output for RQ 5: Specification as to whether each located PEWS was designed for use in an emergency department setting.

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Appendix 1: Search strategy

Database: Medline via Ebsco

Run: 12/12/2025

#	Query	Limiters/Expanders	Last Run Via	Results
S17	S11 AND S16	Limiters - English Language Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	708
S16	S12 OR S13 OR S14 OR S15	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	2,298,879
S15	XB (trauma or injury) N2 (centre* or center* or unit))	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	4,988
S14	XB ((emergenc* or ED) N2 (room* or accident or ward or wards or unit or units or department* or physician* or doctor* or nurs* or treatment* or present* OR visit* OR setting* or service* OR patient OR patients OR medicine))	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	270,869
S13	XB hospital* or "casualty department*" or “pediatric intensive care” or "neonatal intensive care" or NICU or “paediatric intensive care” or PITU or PCCU or "paediatric intensive therapy" or "pediatric intensive therapy" or "paediatric critical care" or "pediatric critical care" or A&E or PICU	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	2,031,686

S12	(MH "Hospitals+") OR (MH "Emergency Service, Hospital+") OR (MH "Intensive Care Units, Neonatal") OR (MH "Intensive Care Units, Pediatric+")	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	464,853
S11	S3 AND S10	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	1,272
S10	S4 OR S5 OR S6 OR S7 OR S8 OR S9	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	8,682
S9	XB ("calling criteria" or "escalation policy" OR "escalation policies" OR "escalation protocol" OR "escalation protocols")	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	344
S8	XB "Rapid Response system*" or "rapid response trigger*"	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	598
S7	XB ("Track and Trigger" or "trigger system" or "trigger score*")	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	257
S6	XB ("pediatric early warning" or "paediatric early warning" or PEWS or BPEWS)	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	1,265
S5	XB ("early warning" N2 (score* or system* or tool* or chart*))	Expanders - Apply equivalent subjects Search modes -	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	6,706

		Proximity	Database - MEDLINE Complete	
S4	(MH "Early Warning Score")	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	595
S3	S1 OR S2	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	5,513,278
S2	XB (Babies OR baby OR child* or infancy or infant* OR neonat* OR neo-nat* OR newborn* OR new-born* OR paediatric* OR pediatric* OR young OR adolescen* OR preadolescen* OR pre-adolescen* OR preteen* OR pre-teen* OR teen*)	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	3,410,790
S1	(MH "Infant+") OR (MH "Child+") OR (MH "Adolescent") OR (MH "Pediatrics+")	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	4,244,238

Appendix 2: Data extraction template

Name of PEWS	
Author	
Year	
Country	
Care setting(s)	
Population (e.g. age, patient type)	
Number of times cited	
Nature of validation	
Components of afferent arm: indicators assessed, scoring thresholds calculation	
Components of efferent arm	
Funding source(s) of tool's development	

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