CICER
Tacaíocht don Treoirlíne Chliniciúil
Clinical Guideline Support

SCOPING REVIEW

Paediatric Early Warning Systems in the Emergency Department

June 2026

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

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
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NATIONAL CLINICAL EFFECTIVENESS COMMITTEE

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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, the Health Information and Quality Authority (HIQA) was awarded research funding spanning the period from 2017 to 2024 to produce 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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Plain Language Summary

What early warning systems exist to help nurses and doctors identify children who might suddenly get sicker in the emergency department, and how were these systems tested?

Key messages

- A Pediatric Early Warning System (PEWS) is a tool used in hospitals to help staff notice early signs that a child is getting sicker so they can act quickly.
- Most early warning systems used with children in the emergency department were originally designed for children staying in hospital wards.
- Some early warning systems used with children in the emergency department have been studied a lot in different countries, but most have not been studied very widely.
- Most early warning systems for children measure similar things, such as heart rate and breathing.
- Only a small number of early warning systems for children give instructions on what nurses and doctors should do if a child is identified as being at risk of suddenly getting sicker.

Background

Every year, around 400,000 emergency department visits each year involve children under 16. When a child arrives in the emergency department, they are assessed to see what level of care they might need or how fast they might need it. Sometimes a child's condition might get worse while they are in the emergency department or can even become life-threatening.

It can be hard for a child to communicate that their symptoms are getting worse, especially if they are very young. To help with this, some hospitals use early warning systems in the emergency department to help doctors and nurses identify if a child's symptoms are getting worse. These systems were originally made for children staying in hospital wards, but now some are being looked at for emergency departments.

What did we want to find out?

We wanted to find out:

1) what early warning systems for children have been developed for the emergency department, or tested or use in the emergency department
2) what those early warning systems look like
3) how good they are at identifying children who are getting sicker quickly while in the emergency department.

What did we do?

We searched for studies testing children's early warning systems in the emergency department. Our search included studies published up to January 2026.

What did we find?

We found 13 studies that assessed 11 early warning systems for children in emergency department settings. Nearly all of the studies looked at whether the use of an early warning system could identify a child who needed to be admitted to the intensive care unit (ICU). Some studies looked at whether an early warning system could identify a child's risk of serious illness or death.

Of the early warning systems we found, three were developed for children in emergency departments, while eight were developed for children in hospital wards, and then tested in the emergency department. Most of the early warning systems measured heart rate, breathing, oxygen level, and level of consciousness (how awake and aware a child is). Three of the studies spoke about what to do after using the early warning system. This included things like checking in with the child more often or calling an emergency medical team.

In summary, we found several early warning systems that have been used with children in the emergency department. The next step may be to focus on a small number of the most promising early warning systems and take a more in-depth look at how well they identify and prevent children suddenly getting sicker in the emergency department.

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List of abbreviations that appear in this report

AUC	area under the curve
CICER	Centre in Ireland for Clinical guideline support and Evidence Reviews
ED	emergency department
EWS	early warning system
GDG	guideline development group
HIQA	Health Information and Quality Authority
HRB	Health Research Board
HSE	Health Service Executive
ICU	intensive care unit
LqSOFA	Liverpool quick Sequential Organ Failure Assessment
MET	medical emergency team
NCEC	National Clinical Effectiveness Committee
NCG	National Clinical Guideline
OECD	Organisation for Economic Co-operation and Development
PAWS	Paediatric Advanced Warning Score
PCC	population, concept, context
PEWS	Paediatric Early Warning System
PICO	population, intervention, comparison, outcome
PICU	paediatric intensive care unit
POPS	Paediatric Observation Priority Score
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 (EDs) and injury units in Ireland.[1] Of these, approximately 400,000 visits are by children less than 16 years of age. In Ireland, in the years 2019-2023, the vast majority of paediatric deaths (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 ED, 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 among children in the ED. These can include sepsis, shock, and respiratory illness. It can be challenging to recognise post-triage clinical deterioration for a number of reasons. The ED can be a demanding 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 unwillingness to communicate their symptoms and precipitating events. 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 in children,[3, 4] and then deteriorate very quickly.[5-7] Furthermore, the term “child” encompasses a diverse range of ages, and normal vital signs vary substantially between neonates and adolescents.[6, 8] Even when clinical deterioration is recognised, there can be barriers to effectively escalating the issue, including lack of standardisation and a lack of clinical confidence.[9]

1.2 Paediatric Early Warning Systems

Early warning systems (EWSs) 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. EWSs 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.[10] 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 derived and validated to correlate with degrees of risk of poor outcomes.

A 2019 systematic review of the validity and effectiveness of paediatric EWSs (PEWSs) found that the most commonly used parameters included heart rate, respiratory rate, respiratory effort, and level of consciousness or behavioural state.[11] Other frequently used parameters include oxygen levels, temperature, systolic blood pressure, capillary refill, and family or staff concerns.[11] The efferent arm of EWSs 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).[10] 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.[10] Successful implementation of EWSs is dependent on multiple direct and indirect influences, including team training, staffing levels, appropriate work environments, and organisational culture.[12]

Despite widespread implementation, the extent of formal validation of PEWSs varies. While some systems have undergone derivation and validation studies, external validation across different healthcare settings and populations is often lacking, with further prospective validation often recommended by the original derivation studies prior to wider use.[13] In practice, derivation, validation, and implementation may occur in parallel, with systems adapted to local contexts during rollout.[11] This overlap presents challenges for robust external validation. Low event rates for outcomes related to clinical deterioration, such as unplanned paediatric intensive care unit (PICU) admission, cardiac arrest, or death, limit statistical power and contribute to uncertainty in performance estimates. In addition, clinical

practice changes associated with use of EWSs may influence outcome rates, particularly where earlier recognition and escalation reduce progression to severe deterioration, or where a particular score threshold may itself prompt escalation of care.

In Ireland, there are existing NCEC National Clinical Guidelines (NCGs) for early warning systems for children in the inpatient setting[14] and for adults in the emergency department,[15] 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. However, none focused solely on validation in the ED setting. A 2017 systematic review[16] 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 (four in the ED setting) for a total of six PEWS. A 2019 systematic review[11] investigating the predictive validity of PEWSs and their effectiveness to reduce mortality and critical events in inpatients identified 27 validation studies for a total of 18 different PEWSs.

A preliminary search of MEDLINE, PROSPERO, the Cochrane Database of Systematic Reviews, and JBI Evidence Synthesis on 17 December 2025 located no current or underway systematic reviews or scoping reviews on PEWSs.

1.4 Purpose of this review

The purpose of this review was to identify existing PEWSs that have been derived and validated in the ED setting or derived in a different setting and subsequently validated in ED, and could potentially be used in a NCG on a children's emergency medicine early warning system in Ireland. Our aim was to identify relevant derivation or validation studies and describe the content of the PEWSs validated in this setting. Given the exploratory nature of these objectives, a scoping review was considered most appropriate.

2 Methods

This scoping review on paediatric early warning systems was carried out in accordance with the JBI methodology for scoping reviews[17] and reported in line with the Preferred Reporting Items for Systematic reviews and Meta-Analyses PRISMA extension for scoping reviews (PRISMA-ScR).[18] The completed PRISMA-ScR checklist is available in Appendix 1. Full details of the methodology for this scoping review are available in the published protocol on the HIQA website.[19]

2.1 Review questions

This review considered the following review questions (RQs):

1. What Paediatric Early Warning Systems have ever been derived and validated in an ED setting or derived in a different setting and subsequently validated in ED in Organisation for Economic Co-operation and Development (OECD) member countries?

   Note: we defined 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.[11] Validation may have been conducted by the tool developers, but must use a sample that is distinct from that used for derivation, either through narrow (that is, split sample) or broad (that is, independent sample) validation.

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	PEWSs that have been validated, meaning that they have been derived using an explicit approach and subsequently validated in an independent population or in a distinct sample for predicting clinical deterioration, for example cardiac arrest, respiratory arrest, code call, resuscitation, and or transfer to intensive care or a high-dependency unit.
Context	EDs

Key: ED – emergency department; PEWS – paediatric early warning system

2.2 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
PEWSs that: ▪ are aimed at children less than 18 years of age ▪ have been derived and validated in the ED setting, or have been derived in a different setting (for example inpatients) and subsequently validated in an ED 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 for derivation ▪ originated within an OECD member country	PEWSs that: ▪ are aimed at adults aged 18 years or older ▪ have only been validated in other care settings, such as primary care or outpatient clinics, prehospital services, out-of-hours primary care, inpatient, or intensive care settings ▪ focus only on initial triage systems ▪ are prediction models that are not designed for clinical implementation ▪ are not published in English.

Key: ED – emergency department; OECD – Organisation for Economic Co-operation and Development; PEWS – paediatric early warning system

2.3 Search strategy

The search strategy was developed and run by an in-house medical librarian and peer-reviewed by a Health Service Executive (HSE) librarian. Electronic searches were conducted in MEDLINE Complete via EBSCOhost, Embase via Elsevier, CINAHL Complete via EBSCOhost, PsycINFO via EBSCOhost, and Cochrane Library on 6 January 2026. The MEDLINE search strategy is included in Appendix 2 and complete search strategy documentation is available from the open repository Zenodo: https://zenodo.org/records/17226547.[20] In addition to the database search, backward- and forward-citation screening was conducted for eligible studies using "citationchaser" software.[21]

As a confirmatory check of the search, during the title and abstract screening in Covidence, any relevant systematic reviews were tagged by reviewers, none of which were found to match our review question. One reviewer checked the list of included studies in these systematic reviews for any additional relevant studies that were not captured by the database search strategy and subsequent backward- and forward-citation screening. Additionally, during the title and abstract screening, studies not meeting the inclusion criteria but mentioning the use of a PEWS in an ED setting were tagged and subsequently reviewed.

2.4 Selection of eligible publications

All citations identified from the search strategy were exported to EndNote 20 for reference management,[22] where duplicates were identified and removed. Using Covidence,[23] two reviewers independently reviewed the titles and abstracts of the remaining citations to identify those for full-text review. The full texts were obtained and independently evaluated by two reviewers applying the defined inclusion and exclusion criteria. Where disagreements occurred, discussions were held to reach consensus and where necessary, a third reviewer was consulted. Studies excluded during the full-text review stage are documented in the study flow diagram in Figure 3.1.

2.5 Data extraction

Data was extracted from peer-reviewed articles by one reviewer and checked for accuracy and omissions by a second reviewer. Where disagreements occur, discussions were held to reach consensus and where necessary, a third reviewer was consulted. Data extraction was conducted in Microsoft Excel, using a purposely designed data extraction form which was piloted before use. The authors of one study were contacted to obtain supplemental materials.

2.6 Data synthesis

Evidence was synthesised through three outputs.

- Output 1 (RQ1): A list of ED validation studies, including key study characteristics and the PEWSs validated.
- Output 2 (RQ1, RQ4, RQ5): A list of the PEWSs validated in the ED setting with citations of key origin papers (RQ1), a count of how many citations each key origin paper has (RQ4), whether the PEWS was originally designed for use in the ED (RQ5), and a summary of the predictive performance (measured as the area under the curve (AUC)) reported in the ED validation studies.
- Output 3 (RQ2): Table of the afferent components of each PEWS, including indicators assessed and scoring thresholds.

We had initially planned to include a table of efferent components for RQ3 ("What does the efferent arm of each PEWS include?"), however as these were rarely reported we summarised our findings narratively instead.

2.7 Deviations from the protocol

This review is intended to inform a clinical guideline about an ED-based PEWS in Ireland. Originally, the scope of the protocol was kept broad to include any hospital setting because of an anticipated lack of ED-based studies. However, due to the large number of ED-based studies identified, the scope of the review was narrowed to focus on PEWSs that were validated in the ED setting.

3 Results

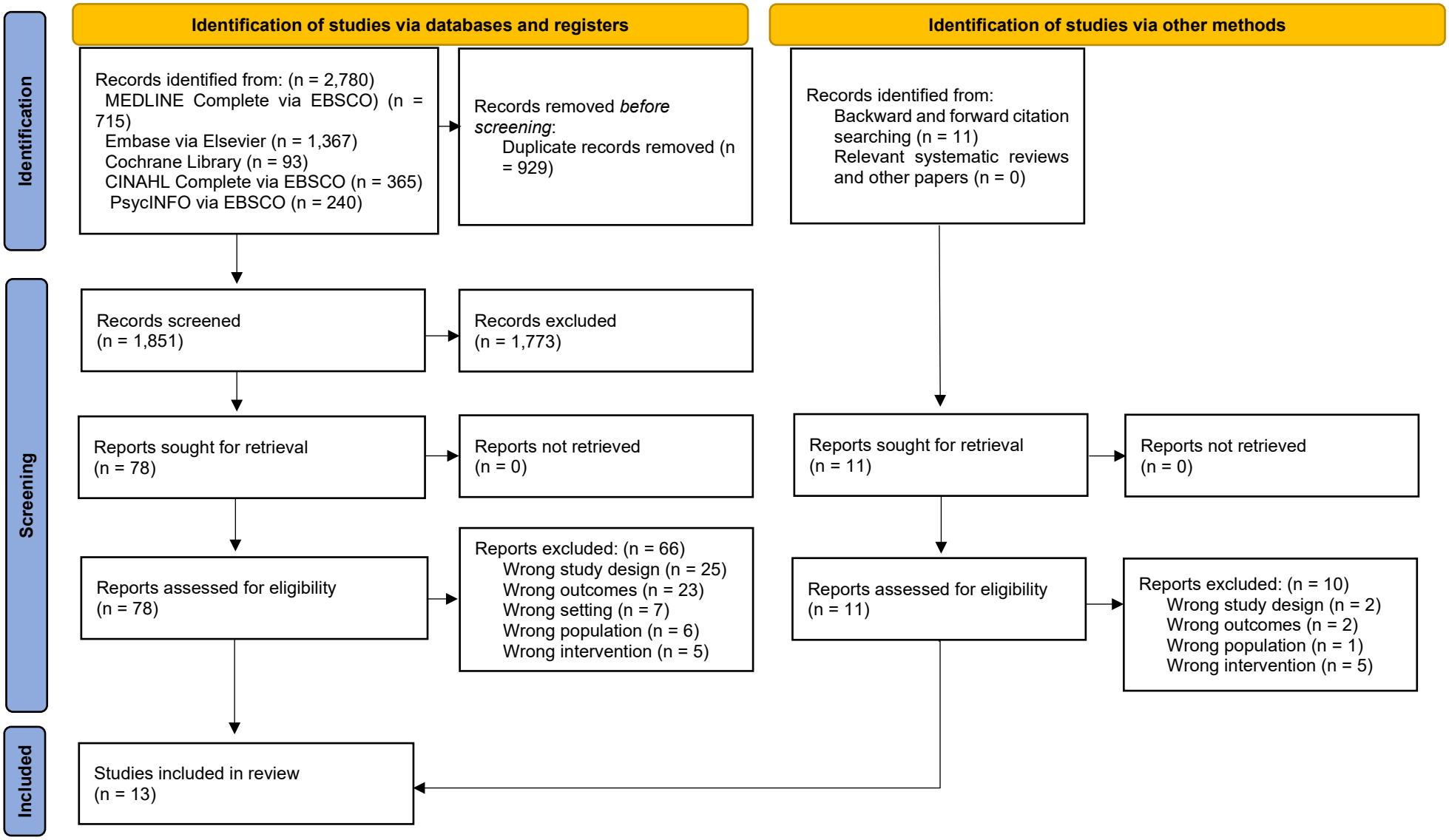
3.1 Search results

The search of electronic databases identified 2,780 citations. After removal of duplicates, the titles and available summaries of 1,851 citations were independently screened by two reviewers, after which 1,773 records were excluded. Seventy-eight full-texts were independently assessed by two reviewers applying the predefined inclusion and exclusion criteria, and 12 were included in the review. Backward- and forward-citation searching for the included records identified 184 backward- and 355 forward-citation results via citation chaser and a further 104 citations were tagged as potentially relevant without meeting the inclusion criteria during the title and abstract screening. Following screening of these citations for relevance independently by two reviewers, 11 records were identified and retrieved for full-text review. On full-text review, one of these studies was included in the review, leading to a total of 13 included studies. No additional studies were identified during the confirmatory check of relevant systematic reviews from the database search. A PRISMA flow chart summarising the search process and subsequent results is provided in Figure 3.1.

3.2 ED validation studies

Thirteen studies were identified for inclusion in this review. Three studies[24-26] derived and validated new PEWSs for the ED setting, while 10 studies[27-36] validated existing systems that were originally derived for other settings. Seven of the included studies[25, 26, 30, 31, 33-35] compared the performance of multiple existing PEWSs. One study[34] compared a total of ten tools, two[37, 38] of which were only minor modifications of the Brighton PEWS[39] and consequently not included in the review as the original Brighton PEWS was already captured in the same study. Four studies[25, 30, 31, 33] included tools (COAST, ManChews, PAT-POPS, Alder Hey PEWS, Bristol PEWS, Newcastle PEWS, Scotland PEWS, NHS National PEWS) for which we were not able to identify original derivation studies and consequently these were also excluded. Following these exclusions, a total of 11 distinct PEWSs[13, 24-26, 39-45] are reported here. Brighton[39] and the Bedside PEWS[13] were the PEWSs most studied in the ED setting, analysed in seven[27-31, 34, 35] and five[26, 33-36] studies respectively.

Figure 3.1 PRISMA flow chart



The included studies were conducted between 2008[24] and 2025.[35] Five studies were conducted in the United Kingdom,[24, 25, 30, 31, 33] three in the United States,[28, 29, 32] two in Turkey,[27, 35] two in the Netherlands,[34, 36] and one across six European countries.[26] Sample sizes ranged between 95,[24] and 123,751,[26] with seven of the included studies having samples greater than 1,000. Two studies[28, 29] included patients up to 21 years of age, but were included as most of the participants were aged under 18. Three of the studies required informed consent from participants and thus used a subset of patients presenting at ED.[24, 28, 35] One study used a consented subset of patients presenting to ED for derivation purposes, but used a separate, larger cohort of all eligible patients for validation.[25] The remaining nine studies included all eligible patients presenting to ED within a specified time period. The most commonly reported outcome was PICU admission or transfer during the index visit, which was reported in all the studies except for one.[30] Other outcomes included significant illness during the index visit[30] and sepsis-related mortality during the index visit.[25, 33] An overview of the included studies is provided in Table 3.1.

Table 3.1 ED validation studies

Study	Country	Study design	Setting	Population	Sample size	Age range	Relevant outcome(s)	Tool(s)	Scoring by treatment team?	If yes, were they blinded?
Akdeniz 2023[27]	Turkey	Validation study using a prospective cohort sample	Maternity and paediatric hospital ED	All children attending ED 1 May-30 October 2022	228	0-16 or 0-17 years (both reported in the paper)	PICU admission during index visit	Brighton	Yes - ED nurse	Yes – treating physicians were blinded
Breslin 2014[28]	US	Validation study using a prospective cohort sample	Paediatric hospital ED	Convenience sample of children attending ED November 2010-July 2011	383	0-21 years	PICU admission during index visit	Brighton	No - performed by study team	N/A
Egdell 2008[24]	UK	Derivation and validation study using a retrospective case-control sample	General hospital ED	Consecutive children admitted to ICU from ED (cases) and consecutive children admitted to the general ward (controls) from ED 1 September 2003-1 September 2005	95 (49 cases, 46 controls)	0-16 years	PICU admission during index visit	PAWS	No - performed by study team	N/A
Gold 2014[29]	US	Validation study using a prospective cohort sample	Paediatric hospital ED	All children scored as category 2 or 3 on the Emergency Severity Index (ESI) who were admitted to ICU or general wards 1 October 2012-30 September 2013	12,306	0-21 years	Direct PICU admission from ED during index visit, PICU transfer within 6 hours of admission to floor, PICU transfer within 24 hours of admission to floor	Brighton	Yes - ED nurse	Yes – treating physicians were blinded
Lillitos 2016[30]	UK	Validation study using a retrospective cohort sample	Paediatric ED in general hospital	All children attending ED November 2012	1,921	0-17 years	Significant medical illness during index visit, significant surgical illness during index visit	Brighton	No - performed by study team	N/A

Lillitos 2017[31]	UK	Validation study using a retrospective cohort sample	Paediatric ED in general hospital	All children presenting to ED as trauma calls 2011-2015	141	Paediatric sample with a median age of 13, range not specified	PICU admission during index visit	Brighton, Cardiff Vale	No - performed by study team	N/A
Nielsen 2016[32]	US	Validation study using a retrospective case-control sample	Paediatric hospital ED	All children admitted from ED to a general ward and then transferred to ICU (cases) and randomly selected children admitted from ED to a general ward (controls) 1 July 2010-31 December 2011	597 (50 cases, 547 controls)	0-18 years	PICU transfer within 24 hours	PEW system score	Yes - ED nurse	No
Romaine 2020[25]	UK	Derivation and validation study using a prospective cohort sample for derivation and a retrospective cohort sample for validation	Paediatric hospital ED	Convenience sample of febrile (temperature ≥ 38°C) children attending ED November 2010-April 2011 (development), all febrile children attending ED 1 September 2015-31 August 2017 (validation)	1,121 (derivation), 12,241 (validation)	0-15 years	CC (PICU or HDU) admission within 48 hours, sepsis-related mortality within 28 days	LqSOFA	No - performed by study team	N/A
Romaine 2021[33]	UK	Validation study using a retrospective cohort sample	Paediatric hospital ED	All febrile (temperature ≥ 38°C) children attending ED 1 September 2015-31 August 2017	11,449	0-15 years	CC (ICU or HDU) admission within 48 hours, sepsis-related mortality within 28 days	Bedside, POPS	No - performed by study team	N/A
Seiger 2013[34]	Netherlands	Validation study using a prospective cohort sample	Paediatric hospital ED	All children attending ED August 2009-June 2012	17,943	0-15 years	PICU admission during index visit	Bedside, Brighton, Cardiff Vale, PAWS, PEW System Score, PEW	No - performed by study team	N/A

								Tool, Brilli et al, Tibballs et a		
Tazegul 2025[35]	Turkey	Validation study using a prospective cohort sample	Paediatric ED in general hospital	Convenience sample of children attending ED 1 January - 1 April 2023	193	0-17 years	ICU admission during index visit	Bedside, Brighton, Brilli et al, Tibballs et al	No - performed by study team	N/A
Vredebregt 2019[36]	Netherlands	Validation study using a retrospective cohort sample	General hospital ED	All children attending ED with an internal medical problem July 2015-July 2016	2,812	0-15 years	ICU admission during index visit	Bedside	No - performed by study team	N/A
Zachariasse 2020[26]	Austria Netherlands, Portugal, UK (derivation), Greece (validation)	Derivation and validation study using a prospective cohort sample	5 diverse EDs (derivation); 1 paediatric hospital ED (validation)	Consecutive children attending 5 EDs 1 Jan 2012-1 Nov 2015 (derivation), all febrile (temperature ≥38°C) children attending ED 2 random weeks each month January 2017-April 2018 (validation)	119,209 (derivation), 4,542 (validation)	0-15 years	PICU admission during index visit	Bedside, ED-PEWS, PAWS	No - performed by study team	N/A

Key: CC – critical care; ED – emergency department; LqSOFA – Liverpool quick Sequential Organ Failure Assessment; PAWS – Paediatric Advanced Warning Score; PEWS – paediatric early warning; PICU – paediatric intensive care unit; POPS – Paediatric Observation Priority Score

3.3 PEWSs validated in ED

This review identified 11 PEWSs, reported in 13 studies, with three of these derived and validated in the ED[24-26] and eight derived elsewhere and subsequently validated for detecting clinical deterioration in the ED.[13, 39-45] The identified PEWSs were derived between 2005[39, 45] and 2020.[25, 26] The origin papers of the identified PEWSs have been cited between 46[26] and 511[41] times (see Table 3.2). Of the studies initially derived in other settings, the Brighton PEWS[39] was validated in the ED in seven separate studies and the Bedside PEWS[13] in five. The Cardiff Vale,[42] PEW system score,[41] and PEWSs derived by Brilli et al.[40] and Tibballs et al.[45] were validated in two studies each, while the PEW tool[43] and Paediatric Observation Priority Score (POPS)[44] were validated in one study each. Of the three PEWS derived and validated in the ED, the Paediatric Advanced Warning Score (PAWS) was validated in two subsequent studies, while there were no subsequent validation studies identified for the Liverpool quick Sequential Organ Failure Assessment (LqSofa)[25] or ED-PEWS.[26]

Table 3.2 contains overall AUCs as a measure of predictive performance for the identified outcomes in the included validation studies. AUC is a summary measure of a model's ability to discriminate between those with and without the outcome of interest; values range from 0.5 (no better than chance) to 1.0 (perfect discrimination). There is no established cut-off for what may be considered an acceptable AUC. While values of less than 0.6 are generally considered poor and values 0.9 or higher excellent, there is a lot of variation in how values between 0.6 and 0.9 are interpreted.[46] A recent overview of commonly used cut-off values suggest that values above 0.7 tend to be considered reasonable.[47] Of the PEWS originally derived in other settings, the Bedside PEWS[13] performed the best, with AUCs between 0.79 and 0.99 across five validation studies. The Brighton PEWS[39] was the most widely validated system and showed mixed performance, with AUCs between 0.64 and 0.95 across 11 outcomes in seven studies. The three studies derived for ED showed reasonable performance in their initial derived studies, with AUCs of 0.83,[26] 0.81 and 0.87,[25] and 0.86,[24] although PAWS[24] performed slightly worse in two subsequent validation studies (AUCs 0.77 and 0.78).

Table 3.2 PEWSs validated in ED

PEWS	Year	Origin paper citations (n)[a]	Derived in ED	ED validation studies	Validation outcomes	AUC (95% CI)
Bedside PEWS[13]	2009	314	No	Seiger 2013[34]	Prediction ability for PICU admission by score	0.82 (0.79–0.85)
				Vredebregt 2019[36]	Prediction ability for PICU admission by score	0.85 (0.68–1.00)
				Zachariasse 2020[26]	Prediction ability for PICU admission by score	0.79 (0.71-0.87)
				Romaine 2021[33]	Prediction ability for sepsis-related mortality by score	0.99 (0.98-1)
					Prediction ability for CC admission by score	0.95 (0.93-0.97)
				Tazegul 2025[35]	Prediction ability for PICU admission vs discharge by score	not reported
					Prediction ability for PICU vs general admission by score	not reported
Brighton PEWS[39]	2005	370	No	Seiger 2013[34]	Prediction ability for PICU admission by score	0.79 (0.76–0.81)
				Breslin 2014[28]	Prediction ability for PICU vs general admission by score	0.68 (0.54-0.82)
				Gold 2014[29]	Prediction ability for direct PICU admission by score	0.79 (not reported)
					Prediction ability for PICU transfer within 6 hours by score	0.73 (not reported)
					Prediction ability for PICU transfer within 24 hours	0.66 (not reported)
				Lillitos 2016[30]	Prediction ability for significant medical illness by score	0.75 (0.72-0.79)
					Prediction ability for significant surgical illness by score	0.64 (0.52-0.76)
				Lillitos 2017[31]	Prediction ability for PICU admission by score	0.76 (not reported)
				Akdeniz 2023[27]	Prediction ability for PICU admission by score	0.95 (0.92-0.98)
				Tazegul 2025[35]	Prediction ability for PICU admission vs discharge by score	not reported
					Prediction ability for PICU vs general admission by score	not reported
Brilli et al[40]	2007	329	No	Seiger 2013[34]	Prediction ability for PICU admission by score	0.74 (0.71–0.77)
				Tazegul 2025[35]	Prediction ability for PICU admission vs discharge by score	0.72 (0.62-0.83)
					Prediction ability for PICU vs general admission by score	0.58 (0.44-0.72)
Cardiff Vale[42]	2009	135	No	Seiger 2013[34]	Prediction ability for PICU admission by score	0.60 0.57–0.62
				Lillitos 2017[31]	Prediction ability for PICU admission by score	0.73 (not reported)
ED-PEWS[26]	2020	46	Yes	Zachariasse 2020[26]	Prediction ability for PICU admission by score	0.83 (0.79–0.87)
LqSOFA[25]	2020	80	Yes	Romaine 2020[25]	Prediction ability for CC admission by score	0.81 (0.76-0.86)
					Prediction ability for sepsis-related mortality by score	0.87 (0.65-1)
PAWS[24]	2008	139	Yes	Egdell 2008[24]	Prediction ability for PICU admission by score	0.86 (not reported)

				Seiger 2013[34]	Prediction ability for PICU admission by score	0.77 (0.74–0.80)
				Zachariasse 2020[26]	Prediction ability for PICU admission by score	0.78 (0.72-0.85)
PEW system score[41]	2006	511	No	Seiger 2013[34]	Prediction ability for PICU admission by score	0.82 (0.79–0.84)
				Nielsen 2016[32]	Prediction ability for PICU transfer by score	0.69 (not reported)
PEW tool[43]	2006	151	No	Seiger 2013[34]	Prediction ability for PICU admission by score	0.75 (0.72–0.78)
POPS[44]	2016	51	No	Romaine 2021[33]	Prediction ability for CC admission by score	0.91 (0.88-0.94)
					Prediction ability for sepsis-related mortality by score	0.95 (0.91-0.99)
Tibballs et al[45]	2005	291	No	Seiger 2013[34]	Prediction ability for PICU admission by score	0.72 (0.69–0.75)
				Tazegul 2025[35]	Prediction ability for PICU admission vs discharge by score	0.58 (0.44-0.72)
					Prediction ability for PICU vs general admission by score	0.52 (0.37-0.67)

Key: AUC – area under curve; CC – critical care; CI – confidence interval; ED – emergency department; LqSOFA – Liverpool quick Sequential Organ Failure Assessment; PAWS – Paediatric Advanced Warning Score; PEWS – paediatric early warning; PICU – paediatric intensive care unit; POPS – Paediatric Observation Priority Score;

[a] As of 26 March 2026

3.4 Afferent arms of the included PEWSs

Seven of the included PEWS used cumulative scores[13, 24-26, 39, 41, 44] and four used trigger-type scores, where the system was triggered if one or more of a set list of conditions were met.[40, 42, 43, 45] Nine of the systems used age-specific cut-offs, incorporating three[26] or five[13, 24, 25, 41-45] age categories. One PEWS did not use age-specific cut-offs,[40] while age categories were not specified in the original development paper for the Brighton PEWS,[39] instead referring to observations above or below "normal" value. The most commonly used parameters were heart and respiratory rate, which were used in all except one PEWS.[40] Oxygen saturations were used in nine PEWSs,[13, 24, 26, 40-45] as was some measure of level of consciousness.[24-26, 39, 40, 42-45] An overview of indicators used in the afferent arms of included PEWSs is available in Table 3.3. Indicators used in less than three PEWSs are included in the 'Other' column.

3.5 Efferent arms of the included PEWSs

Efferent arms of the included PEWSs were only described in three of the 11 origin papers.[39, 40, 45] For the Brighton PEWS,[39] the calculated total score indicates one of four actions: informing the nurse in charge, increasing the frequency of observations, calling for medical review and informing the outreach team, and calling out the full medical team and outreach team. The thresholds for the scoring system are not specified; however, it is recommended that any sub-score of three (maximum score) or an overall score greater than four (out of nine) should trigger calling out the full medical and outreach teams. Further, it is advised that this action could be adapted to take into account the local facilities and resources, for example in the absence of on-site paediatric intensive care support, a high score could be adapted to involve consulting a lead centre. For the trigger-based PEWS derived by Brilli et al.,[40] any trigger of the system would require the medical emergency team (MET) to arrive within 15 mins of activation, with MET functions including assessment, stabilisation if necessary, and triage of general care floor patients to the most appropriate unit in the hospital. Similarly, in Tibballs et al's[45] trigger-based PEWS, any trigger of the system would require a MET to provide immediate medical treatment as required and communicate with the admitting bed-card unit members to formulate further treatment.

Table 3.3 Afferent arms of included PEWSs

PEWS	Scoring type	Age ranges	Response arm described	System indicators											
				HR	CRT	BP	RR	Respiratory effort	Airway threat	SaO2	O2 therapy	Temp	LOC	Staff concern	Other
Bedside PEWS[13]	Score (0-26)	<3m 3m-1yr 1-4yr 4-12yr 12-18yr	No	✓	✓	✓	✓	✓	×	✓	✓	×	×	×	No
Brighton PEWS[39]	Score (0-9)	Not specified	Yes	✓	✓	×	✓	✓	×	×	✓	×	✓	×	Yes [a]
Brilli et al[40]	Trigger	None	Yes	×	×	×	×	✓	×	✓	×	×	✓	✓	Yes [b]
Cardiff Vale[42]	Trigger	<1yr 1–2yr 2–5yr 5–12yr 12-16yr	No	✓	×	✓	✓	✓	✓	✓	✓	×	✓	✓	No
ED-PEWS[26]	Score (0-68)	<5yr 5-12yr 12-17yr	No	✓	✓	×	✓	✓	×	✓	×	×	✓	×	No
LqSOFA[25]	Score (0-4)	<1yr 1-2yr 2-7yr 7-13yr 13-18yr	No	✓	✓	×	✓	×	×	×	×	×	✓	×	No
PAWS[24]	Score (0-21)	<1yr 1–2yr 2–5yr 5–12yr 12-16yr	No	✓	✓	×	✓	✓	×	✓	×	✓	✓	×	No
PEW system score[41]	Score (0-26)	<3m 3-12m 1-4yr 4-12yr 12-18yr	No	✓	×	✓	✓	×	×	✓	✓	✓	×	×	Yes [c]

PEW tool[43]	Trigger	<6m 6-12m 1-5yr 5-12yr ≥12yr	No	✓	✓	✓	✓	×	✓	✓	×	×	✓	✓	Yes [d]
POPS[44]	Score (0-16)	<1yr 1-2yr 2-5yr 5-12yr 13-16yr	No	✓	×	×	✓	✓	×	✓	×	✓	✓	✓	Yes [e]
Tibballs et al[45]	Trigger	2w-4m 4-12m 1-5yr 5-12yr 12-17yr	Yes	✓	×	✓	✓	✓	✓	✓	×	×	✓	✓	Yes [f]

Key: BP – blood pressure; CRT – capillary refill time; HR – heart rate; ICU – intensive care unit; m – month; LOC – level of consciousness; LqSOFA – Liverpool quick Sequential Organ Failure Assessment; O2 – oxygen; PAWS – Paediatric Advanced warning Score; PEWS – paediatric early warning system; POPS – Paediatric Observation Priority Score; RR – respiratory rate; Sa02 – arterial oxygen saturation; w – week; yr – year

[a] quarter hourly nebuliser; persistent vomiting after surgery

[b] cyanotic, parent concern

[c] fluid therapy (dynamic), abnormal airway, home oxygen, previous ICU admission, central line, transplant (any), severe cerebral palsy, G tube, three or more medical specialties (static), number of medications taken per day

[d] apnoea, perfusion, convulsion unresponsive to anticonvulsant therapy, hyperkalaemia, suspected meningococcus, suspected ketoacidosis

[e] oncology patient, significant patient medical history, congenital heart disease

[f] apnoea, cardiac or respiratory arrest, cyanotic

4 Discussion

This scoping review identified a limited body of evidence on PEWSs validated in ED settings, with 13 studies validating 11 distinct systems. Three of these systems were specifically derived for use in the ED, with the remaining eight originally derived for inpatient settings. Most of the systems were derived more than ten years ago. However, two were derived in the 2020s.[25, 26] Seven of the systems utilise cumulative scoring, while four are trigger-based. The indicators used in the identified PEWSs were relatively consistent. The Brighton and Bedside PEWSs (both originally inpatient systems) were most frequently tested in the ED, with the latter in particular demonstrating reasonable predictive performance across multiple validation studies. Most PEWSs showed moderate to good discrimination for predicting clinical deterioration, most commonly operationalised as PICU admission or transfer; however, variation in study design and application limits the strength of conclusions that can be drawn about performance.

Overall, the three PEWS derived for use in the ED setting tended to show better predictive performance when compared to the systems derived in an inpatient setting, but two of these have not yet been tested beyond their original narrow validation. The difference in performance may be explained by differences between each setting. EDs are characterised by rapid patient turnover, time-limited observation, and diagnostic uncertainty, which differ substantially from the inpatient settings where most of the identified PEWSs originated. These differences may influence both predictive performance and feasibility in the ED.

Of the tools initially derived in an in-patient setting, the Bedside PEWS showed consistently good performance. The PEWS currently used in inpatient settings in Ireland, the I-PEWS,[14] also uses the Bedside PEWS as an anchor point for its included indicators, while adding indicators for level of consciousness and staff and or parent concern. This may be an option for adaptation for the ED setting in Ireland.

It is however important to note, that while tools may demonstrate acceptable discrimination, this may not reflect their ability to detect clinically meaningful deterioration within the shorter ED timeframe, which is also largely unexplored in the included validation studies, as these predominantly rely on single rather than repeated PEWS scores. From a feasibility perspective, the shorter duration of ED stays and variability in observation

frequency may limit the ability of these systems to capture dynamic changes over time. Consequently, validation in the ED does not necessarily ensure suitability for this context or translation into a clinically meaningful benefit in this setting.

Seven of the identified systems utilise cumulative scoring, while four are trigger-based. In recent years, the move has been towards cumulative systems, as they may provide a more comprehensive, trend-based, and sensitive system for improving patient safety.[48] The predictive performance, as measured by AUCs, of the included tools was variable, with cumulative systems overall tending to demonstrate stronger discrimination than trigger-based systems, which is in line with previous findings.[49] AUCs help to provide an insight into predictive performance, however more in-depth consideration of predictive performance could assess additional measures. For instance, sensitivity and specificity are known to differ between these types of warning systems, with trigger-based systems usually displaying high specificity (that is, a strong ability to correctly identify individuals who are not at risk, thereby minimising false positive results) and comparatively lower sensitivity (that is, reduced ability to detect all individuals who are truly at risk, resulting in a higher likelihood of false negative findings), with the reverse seen for cumulative systems.[50] Finding the appropriate balance between sensitivity and specificity is context-dependent and an important area for consideration.

The indicators used in the identified PEWSs were relatively consistent, with heart rate, respiratory rate, oxygen saturations, respiratory effort, and some measure of level of consciousness most frequently utilised as indicators, reflecting a broad consensus on the warning signs of paediatric deterioration. Overall, the tools derived in ED were similar to the ones derived in in-patient settings in terms of indicators used. However, it is worth noting that none of the three tools derived in ED used blood pressure, airway threat, oxygen therapy, or staff concern, while all three included level of consciousness. Less commonly used parameters include some more associated with the concept of situational awareness, such as parent or clinician concern or gut-feeling, and communication concerns. Within this concept, traditional EWSs based on vital signs represent only one component and are complemented by additional features that enhance situational awareness by drawing attention to the current context and ensure that all relevant sources of information are captured and effectively used.[12] Recent research has found that parent concern for clinical

deterioration in children presenting to hospital was associated with higher risk of ICU admission and mechanical ventilation compared to children with no documented concerns, and caregiver concern was more strongly associated with ICU admission than any abnormal vital sign.[51] Family and or clinician concern are included in recent national PEWSs for in-patients, including the Irish I-PEWS [14] and the NHS England national PEWS,[52] and may be important parameters for consideration, despite historically not as commonly used in PEWSs.

The efferent component was poorly described across the PEWSs' origin papers, with only a minority providing detail on how abnormal scores should trigger clinical action. As PEWSs inherently include both detection and response components when implemented in practice, it is likely that the efferent arm is adapted to local context and available resources, rather than being consistently evidence-based.

While quality appraisal of the identified ED validation studies was not conducted as part of this review, the included studies had many strengths. Seven of the studies used large samples of greater than 1,000 children and most included all children presenting to ED within a specified time-period, thus minimising selection bias. Some important limitations were however identified. Of note, PICU admission was the most commonly used outcome across the studies. The use of PICU admission as a proxy for clinical deterioration warrants particular consideration in the ED context. While this outcome is commonly used in validation studies, it may be less appropriate in the emergency setting than in inpatient populations.

In the ED, a proportion of children present with conditions of sufficient severity that PICU admission is anticipated from the outset, reflecting baseline illness acuity rather than subsequent clinical deterioration. As a result, PEWS measured against PICU admission in this context may overestimate the ability of these systems to detect true deterioration, instead capturing children who are appropriately triaged for higher levels of care on initial assessment and confirming the pre-existing severity of their condition. As noted in a previous review of systems designed to detect clinical deterioration,[53] this approach may be further limited by a lack of repeat observations underpinning the analysis. In the validation studies included in this review, PEWS performance was typically evaluated using either the score at presentation to ED or the highest score recorded in ED. While this

approach may demonstrate an ability to identify children who are clinically unwell, it does not adequately assess the ability of the PEWS to detect dynamic changes over time. As patient trajectories in ED may evolve over a short period of time, reliance on single or peak score may overestimate the effectiveness of PEWSs as tools for early detection of deterioration. This highlights the need for studies incorporating repeated observations and temporal trends, as well as potentially excluding, or otherwise accounting for, those triaged for PICU admission upon ED presentation.

Other limitations of the identified validation studies include variability in study design, including the use of retrospective data and wide differences in sample size, which may introduce bias and limit generalisability. Additionally, lack of blinding in outcome assessment may have been an issue in some of the studies, as clinicians responsible for patient management were not always blinded to PEWS scores, raising the possibility that the score itself may have influenced outcomes like PICU admission, resulting in observer bias. In most studies, however, the scoring was performed by members of the study team not directly involved in patient care. Finally, there was variation in inclusion criteria between the studies, with studies including all children presenting to ED, a subset of consented children presenting to ED, children presenting as trauma calls, and children presenting to ED with a temperature, thus limiting the generalisability of the findings.

This review has several important strengths. It followed a structured methodology consistent with established scoping review guidance, allowing for a comprehensive mapping of the available evidence. The search strategy was developed and peer-reviewed by medical librarians and was broad and systematic in nature, with backward- and forward-citation searching used to capture relevant studies that might otherwise be missed. Focusing specifically on validation in ED settings fills an underexplored gap and is an important step towards developing or adapting a system in the Irish context. By considering both the afferent and efferent components of the PEWSs, the review highlights system-level issues, including the limited evidence on escalation pathways.

Certain limitations of the review should however be acknowledged. To ensure relevance to the Irish context, the review was restricted to studies conducted in OECD member countries and published in English, which may have excluded potentially relevant evidence. While the findings of the review provide an overview of the existing evidence of PEWSs validated in

the ED setting, this review was not intended to comment on the development and validation processes used. As a scoping review, no formal assessment of study quality or risk of bias was conducted, which limits the ability to make definitive judgements about the strength or certainty of evidence. Focusing on validation studies necessarily narrowed the scope, and consequently literature addressing implementation, usability, or clinical impact was not included.

In summary, this scoping review provides a structured overview of the current evidence relating to the PEWSs in ED settings and identifies a limited but still developing body of work in this area. While several systems demonstrate potential utility, the review primarily serves to map candidate systems and clarify the current state of the evidence rather than prescribe definitive selection or implementation of a single system. A follow-on systematic review may be warranted to more rigorously evaluate predictive performance of a select number of potential systems, including the Bedside PEWS, which is the foundation for the PEWS currently in use in Irish in-patient settings and has shown good predictive performance in this review.

In addition, further evidence synthesis could examine the effectiveness of tools in improving outcomes and also other aspects of tool performance, such as: patient-level clinical outcomes of PEWS implementation, including deterioration and mortality; implementation outcomes such as fidelity and acceptability; ED outcomes such as patient flow, and hospital outcomes, such as transfer rates. Pending the availability of sufficient data, meta-analyses may also be undertaken. Collectively, these considerations may provide an important evidence base to support the development of a context-appropriate National Clinical Guideline for a PEWSs in Irish ED settings.

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Appendix 1 PRISMA-ScR checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	PLS on p4-5, abstract not appropriate
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	12
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	13
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	13
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	14
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	15
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	40
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	15
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	16
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	N/A
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	16
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	18
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	20, 24, 27
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	20,24, 27
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	16
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	29
Limitations	20	Discuss the limitations of the scoping review process.	32
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	33
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	2

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.
† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).
‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.
§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

Appendix 2 Medline via EBSCO search strategy

Database Name	Medline via EBSCO
Date search was run	06 Jan 2026

#	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	715
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	2,327,154
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	32,939
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	272,816
S13	XB hospital* or "casualty department*" or “pediatric	Expanders - Apply equivalent subjects	Interface - EBSCOhost Research Databases	2,048,382

	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	Search modes - Proximity	Search Screen - Advanced Search Database - MEDLINE Complete	
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	466,477
S11	S3 AND S10	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	1,286
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	8,836
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	348
S8	XB "Rapid Response system*" or	Expanders - Apply equivalent	Interface - EBSCOhost Research	604

	"rapid response trigger*"	subjects Search modes - Proximity	Databases Search Screen - Advanced Search Database - MEDLINE Complete	
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	258
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	1,281
S5	XB ("early warning" N2 (score* or system* or tool* or chart*))	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	6,839
S4	(MH "Early Warning Score")	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	602
S3	S1 OR S2	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE Complete	5,535,564
S2	XB (Babies OR baby OR child* or infancy or infant* OR neonat* OR neo-nat* OR newborn* OR new-	Expanders - Apply equivalent subjects Search modes - Proximity	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	3,428,937

	born* OR paediatric* OR pediatric* OR young OR adolescen* OR preadolescen* OR pre-adolescen* OR preteen* OR pre-teen* OR teen*)		Database - MEDLINE Complete	
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	4,256,829

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