

Clinical Practice Guidelines:
The Egyptian Pediatric Advanced Life Support guidelines

Acknowledgement

We would like to acknowledge the Committee of National Egyptian Guidelines, Ministry of Health and the scientific Committee for adapting this Guideline
Chair of the Guideline Development Group: Doha Emam
Members of the Guideline Development Group: Eman I.El-Desoki Mahmoud, Gamal Abbas, Wessam Abdel Aziz, Ahmed Harkan

Abbreviations

ABCDE: Airway, Breathing, Circulation, Disability, Exposure.
ABG: Arterial-blood-gas (analysis)
AED: Automated external defibrillator
AHA: American Heart Association
ASAP: As soon as possible
AVPU: Alert-Verbal-Pain-Unresponsive
BBB: Behaviour, Breathing, Body colour
BLS: Basic Life Support
BMI: Body mass index
BP: Blood pressure
CoSTR: Consensus on Science with Treatment Recommendations
CPR: Cardiopulmonary resuscitation
ECG: Electrocardiogram
ECMO: Extracorporeal membrane oxygenation
ECPR: Extracorporeal cardiopulmonary resuscitation
EEG: Electroencephalography
EMS: Emergency medical service
ERC: European Resuscitation Council
ETAT: Emergency Triage Assessment and Treatment
ETCO₂: End-tidal carbon dioxide
FIO₂: Fraction of inspired oxygen
GCS: Glasgow Coma Scale
HOPE: Hypothermia Outcome Prediction after Extracorporeal life support
HOTT: Hypotension, Oxygenation (hypoxia), Tension pneumothorax and cardiac Tamponade
HR: Heart rate min⁻¹
ICU: Intensive care unit
IHCA: In-hospital cardiac arrest
ILCOR: International Liaison Committee on Resuscitation
IM: Intramuscular
IO: Intraosseous
IV: Intravenous
MAP: Mean arterial pressure
NIBP: Non-invasive blood pressure
NLS: Newborn Life Support
OHCA: Out-of-hospital cardiac arrest
PaCO₂: Partial pressure of carbon dioxide in arterial blood
PALS: Paediatric advanced life-support
PAT: paediatric assessment triangle
PaO₂: Partial pressure of oxygen in arterial blood
PBLS: Paediatric basic life support
PCR: Polymerase chain reaction
PEA: Pulseless electrical activity
PEEP: Positive end expiratory pressure
PEWS: Pediatric Early Warning Score
PLS: Paediatric Life Support
PLS WG: Paediatric Life Support Writing Group
POCUS: Point-of-care ultrasound
pVT: Pulseless ventricular tachycardia
ROSC: Return of spontaneous circulation
RR: Respiratory rate min⁻¹
RRS/RRT: Rapid Response System/ Rapid Response Team
SBAR: Situation, Background, Assessment, Recommendation
SGA: Supraglottic airway device
SpO₂: Arterial oxygen saturation as measured by pulse oximetry
SvO₂: Mixed venous oxygen saturation
SVT: Supraventricular tachycardia

VF: Ventricular fibrillation
VT: Ventricular tachycardia

Glossary

- **Advanced Airway:** Endotracheal tube or supraglottic airway device.
- **Aliquots:** small carefully measured boluses/
- **Defibrillation:** Delivery of an unsynchronized shock to terminate VF or pulseless VT.
- **PAT:** Pediatric assessment triangle
- **Refractory VF/pVT:** Persistent VF or pulseless VT after the third defibrillation shock.
- **ROSC:** Restoration of a sustained spontaneous circulation after cardiac arrest.
- **Waveform Capnography:** Continuous measurement of exhaled CO₂ used to confirm airway placement and monitor CPR quality.

Executive Summary

This guideline standardizes the approach to **critically ill and arrested pediatric patients in Egypt**, based on ERC 2025, AHA 2025, ILCOR, and CoSTR, adapted to local practice

1. Recognition of critically ill child

A. Rapid Response System (RRS/RRT)

- We advise that hospitals caring for pediatric inpatients to implement a pediatric Rapid Response System (RRS) to support early recognition and escalation of deteriorating children outside ICU/PICU. **(Conditional)**
- The pediatric RRS advise include: (1) standardized vital-sign monitoring, (2) age-appropriate early warning criteria (e.g., PEWS), (3) a clear activation pathway, (4) a designated responder team, and (5) quality monitoring/audit. **(Conditional)**
- We suggest hospitals caring for pediatric inpatients to establish and train a pediatric Rapid Response Team (RRT) with pediatric expertise (e.g., pediatrician/ICU physician, critical care nurse, respiratory therapist where available), adapted to local staffing and resources. **(Conditional)**
- Pediatric RRT (or on duty paediatrician) activation criteria should be simple, standardized, age-appropriate, and available 24/7, based on abnormal vital signs, mental status change, increased oxygen requirement, staff concern, or elevated PEWS. **(Strong)**
- Pediatricians should be supported by regular simulation-based multidisciplinary training, including escalation, communication, airway, and shock response. **(Strong)**
- We advise institutions to monitor RRT (paediatricians) performance through quality indicators including response time, unplanned PICU transfer, ward cardiac arrest, and escalation delays,unneeded PICU admission. **(Good Practice Statement)**

B. Early recognition and triage:

- All acutely ill children should undergo rapid initial assessment using a structured paediatric triage or quick-look approach. The Paediatric Assessment Triangle (PAT) may be used for rapid recognition of a potentially critically ill child, followed by an ABCDE assessment when indicated. **(Strong)**
- Reassess the child after every intervention and whenever there is concern about deterioration, repeating the ABCDE assessment as appropriate. **(Strong)**

C. Airway and Breathing :

- Airway patency should be assessed immediately in all critically ill children, with positioning, suction, and airway adjuncts used as needed. **(Strong)**
- Oxygen should be administered to children with hypoxemia, severe respiratory distress, shock, seizures, or altered mental status. **(Strong)**
- Oxygen therapy is advised to be titrated according to clinical response and pulse oximetry where available, avoiding unnecessary hyperoxia. **(Conditional)**
- High-flow nasal oxygen (HFNC) or non-invasive ventilation (NIV) is considered early in moderate respiratory distress where available. **(Conditional)**
- Early intubation is considered in apnea, exhaustion, failure of oxygenation/ventilation, refractory shock, or reduced consciousness with loss of airway protection. **(Conditional)**

D. Circulation and shock:

- Consider IV access early in all critically ill children; IO access use without delay when IV access is not rapidly achieved. **(Conditional)**
- Children with shock should receive isotonic crystalloid in cautious aliquots of 10mL/kg with reassessment after each bolus. **(Strong)**
- Repeated unmonitored fluid boluses should be avoided, especially when cardiogenic shock, severe anemia, or myocarditis is suspected. **(Strong)**
- Early vasoactive support is considered in fluid-refractory shock or when fluid overload/cardiogenic shock is suspected. **(Conditional)**
- Shock management should be etiology-directed (septic, hypovolemic, hemorrhagic, cardiogenic, obstructive, anaphylactic). **(Strong)**

E. Sepsis and Septic shock:

- Sepsis should be recognized early in any child with suspected infection and organ dysfunction or abnormal perfusion. **(Strong)**
- Broad-spectrum antibiotics should be administered as early as possible after recognition of septic shock. **(Strong)**
- Fluid resuscitation in septic shock should be cautious and guided by repeated reassessment. **(Strong)**
- Vasoactive support advised that not to be delayed in fluid-refractory septic shock. **(Conditional)**

F. Disability:

- Neurologic status should be assessed using AVPU or GCS in all critically ill children. **(Strong)**
- Hypoglycemia should be corrected immediately in children with reduced consciousness, seizures, shock, or severe illness. **(Strong)**
- Temperature abnormalities (fever or hypothermia) should be identified and treated early. **(Strong)**

G. Seizures and Neurologic emergencies:

- Actively seizing children advise to receive immediate first-line benzodiazepine therapy. **(Conditional)**
- If IV access is unavailable, buccal or rectal or intranasal benzodiazepines is suggested. **(Conditional)**
- Blood glucose should be checked early in all children with altered consciousness or seizures. **(Strong)**
- Consider second-line antiseizure therapy administered early in persistent seizures/status epilepticus. **(Conditional)**

H. Trauma

- Critically injured children should be managed using pediatric trauma ABCDE principles with simultaneous hemorrhage control. **(Good practice statement)**
- Cervical spine protection should be maintained when trauma mechanism suggests risk. **(Good practice statement)**

statement)

- Early transfer planning should begin immediately in children requiring trauma surgery, neurosurgery, or PICU support beyond local capability. . **(Good practice statement)**

2. Pediatric Cardiac Arrest Management

- Bag-mask ventilation is recommended as initial airway management during pediatric cardiac arrest. **(Strong)**
- High-quality CPR (rate 100–120/min, depth 1/3 chest diameter, full recoil, minimal interruptions) is essential for all pediatric cardiac arrest patients. **(Strong)**
- Chest compression fraction should be maximized, minimizing interruptions to <10 seconds during rhythm checks or interventions. **(Strong)**
- Rhythm analysis should be performed every 2 minutes with immediate resumption of CPR after shock or rhythm check. **(Strong)**
- Early defibrillation is advised for pediatric VF/pulseless VT as soon as a defibrillator is available. **(Conditional)**
- Use of manual defibrillator is preferred; AED with pediatric attenuator is acceptable if manual defibrillator is unavailable. **(Conditional)**
- Epinephrine should be administered for non-shockable rhythms (PEA/asystole) as early as possible and repeated every 3–5 minutes. **(Strong)**
- In shockable rhythms, epinephrine should be given after the third shock. **(Strong)**
- Amiodarone (or lidocaine) is recommended for refractory VF/pVT after defibrillation attempts. **(Conditional)**
- Advanced airway (ETT or supraglottic airway) may be considered by experienced providers if it does not interrupt chest compressions. **(Conditional)**
- Consider Continuous waveform capnography to confirm tube placement and monitor CPR quality when advanced airway is in place. **(Conditional)**
- Reversible causes of cardiac arrest (4 Hs & 4 Ts) should be actively identified and treated during resuscitation. **(Strong)**
- Extracorporeal CPR (ECPR) may be considered in selected pediatric in-hospital cardiac arrest cases in specialized centers. **(Conditional)**

3. Post-Cardiac Arrest (ROSC) Care

- Oxygen therapy should be titrated after ROSC to avoid both hypoxemia and hyperoxia, targeting normal oxygen saturation appropriate for age. **(Strong)**
- Ventilation should be adjusted to maintain normocapnia; both hypo- and hypercapnia should be avoided after ROSC. **(Strong)**
- Invasive blood pressure monitoring is advised in critically ill post-cardiac arrest children to guide hemodynamic management when available. **(Conditional)**
- Hypotension after ROSC should be identified and treated urgently using isotonic fluids to maintain age-appropriate perfusion. **(Strong)**
- We suggest early initiation of vasoactive infusions (e.g., epinephrine, norepinephrine) is recommended in persistent post-arrest shock. **(Conditional)**
- Targeted temperature management should be used in comatose children after ROSC, with strict avoidance of fever. **(Strong)**
- Continuous temperature monitoring is recommended for all post-cardiac arrest pediatric patients. **(Strong)**
- Sedation and analgesia should be provided to prevent pain, agitation, and increased metabolic demand after ROSC. **(Strong)**
- Blood glucose should be monitored and both hypo- and hyperglycemia should be avoided in post-arrest care. **(Strong)**
- Continuous EEG monitoring may be considered in comatose children to detect subclinical seizures or status epilepticus. **(Conditional)**
- Clinical and electrographic seizures is advised to be actively treated after ROSC. **(Conditional)**
- Early neuroprognostication should be avoided immediately after ROSC; neurological outcome assessment should be delayed until after stabilization. **(Strong)**

- Multimodal neurological assessment (clinical exam, EEG, imaging, biomarkers) is suggested for prognosis rather than a single modality. **(Conditional)**
- Consider early evaluation for underlying cause of arrest (cardiac, respiratory, metabolic, toxic, infectious) and treat. **(Conditional)**
- Hemoglobin and oxygen-carrying capacity considered to be optimized; transfusion may be considered in post-arrest anemia with poor perfusion. **(Conditional)**
- Early consultation with pediatric intensive care, cardiology, neurology, and relevant specialties is advised. **(Conditional)**
- Family communication and structured post-resuscitation counseling should be provided early after stabilization. **(Strong)**

Introduction, purpose, scope and audience

Introduction:

Advanced Life Support (ALS) is a core component of modern resuscitation practice, encompassing the structured assessment and management of critically ill patients, peri-arrest deterioration, and cardiac arrest through timely, evidence-based, and team-coordinated intervention. ALS builds upon the foundations of Basic Life Support (BLS) and early defibrillation, integrating advanced airway management, manual defibrillation, vascular access, pharmacologic therapy, rhythm recognition, and post-resuscitation care within a system-based approach to improve survival and neurological outcomes¹.

Despite major advances in resuscitation science, outcomes after cardiac arrest remain highly dependent not only on technical interventions, but also on the quality of systems that support early recognition, rapid response, coordinated teamwork, and continuity of care. Contemporary resuscitation guidelines emphasize that high-quality chest compressions, minimal interruptions, early defibrillation, effective oxygenation and ventilation, prompt treatment of reversible causes, and structured post-cardiac arrest care remain the pillars of successful ALS².

The Egyptian Advanced Life Support Guidelines have been developed to provide a standardized, evidence-based national framework for the management of pediatric life-threatening emergencies and cardiac arrest across Egypt. These guidelines aim to unify clinical practice across prehospital, emergency, inpatient, and critical care settings, while promoting consistency in training, team performance, and systems of care. Their purpose is to support healthcare professionals in delivering safe, effective, and reproducible advanced life support adapted to the realities of Egyptian healthcare practice.

Scope and Purpose:

The Egyptian Pediatric Advanced Life Support (ALS) Guidelines aim to provide a standardized, evidence-based approach to the recognition and management of critically ill children and children with cardiac arrest across Egypt.

The objectives of the guidelines are to:

- **Standardize resuscitation practice** across prehospital, emergency, inpatient, and critical care settings

- **Adapt international evidence** to the Egyptian healthcare context, resources, and systems of care
- **Improve patient outcomes** through timely recognition, structured intervention, and high-quality team-based resuscitation
- **Support healthcare professionals** with practical, clear, and context-relevant algorithms for pediatric emergency care
- **Promote consistency in training and clinical practice** across institutions and disciplines
- **Strengthen systems of care** by improving communication, escalation, and post-resuscitation management
- **Enhance patient safety and quality of care** through evidence-based, reproducible emergency response
- **Provide a national reference framework** for education, implementation, audit, and quality improvement in advanced life support

Target audience:

These guidelines are intended to support clinicians from the pediatric departments, ICUs, emergency and anesthesiology departments, in delivering safe, effective, and context-appropriate advanced life support while promoting a unified national standard for resuscitation practice in Egypt.

Methods

A comprehensive search for guidelines was undertaken to identify the most relevant guidelines to consider for adaptation.

Inclusion/exclusion criteria followed in the search and retrieval of guidelines to be adapted:

- Selecting only evidence-based guidelines (guideline must include a report on systematic literature searches and explicit links between individual recommendations and their supporting evidence)
- Selecting only national and/or international guidelines
- Specific range of dates for publication (using Guidelines published or updated in the last 10 years)
- Selecting peer reviewed publications only
- Selecting guidelines written in English language
- Excluding guidelines written by a single author not on behalf of an organization in order to be valid and comprehensive, a guideline ideally requires multidisciplinary input
- Excluding guidelines published without references as the panel needs to know whether a thorough literature review was conducted and whether current evidence was used in the preparation of the recommendations.

The following characteristics of the retrieved guidelines were summarized in a table:

- Developing organization/authors

- Date of publication, posting, and release
- Country/language of publication
- Dates of the search used by the source guideline developers

All retrieved Guidelines were screened and appraised using AGREE II instrument (www.agreetrust.org) by at least two members. the panel decided a cut-off point or rank of the guidelines (any guideline scoring above 50% on the rigor dimension was retained). The GDG decided to adapt the ERC 2025¹³, AHA 2025²⁰, ILCOR¹⁴, and CoSTR¹⁴ recommendations adapted to the local context.

Guiding principles and best practice statements

Evidence assessment

According to WHO handbook for Guidelines we used the GRADE (Grading of Recommendations, Assessment, Development and Evaluation) approach to assess the quality of a body of evidence, develop and report recommendations. GRADE methods are used by WHO because these represent internationally agreed standards for making transparent recommendations. Detailed information on GRADE is available through the GRC secretariat and on the following sites:

- GRADE working group: <https://www.gradeworkinggroup.org/>
- GRADE online training modules: <http://cebgrade.mcmaster.ca/>

Table 1: Quality of evidence in GRADE

Quality level	Definition
High	We are very confident that the true effect lies close to that of the estimate of the effect.
Moderate	We are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low	Our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low	We have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

GRADE: Grading of Recommendations Assessment, Development and Evaluation.

Table 2: Significance of the four levels of evidence

Quality	Definition	Implications
High	The guideline development group is very confident that the true effect lies close to that of the estimate of the effect	Further research is very unlikely to change confidence in the estimate of effect
Moderate	The guideline development group is moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different	Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate
Low	Confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the true effect	Further research is very likely to have an important impact on confidence in the estimate of effect and is unlikely to change the estimate
Very low	The group has very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of the effect	Any estimate of effect is very uncertain

Table 3 Factors that determine How to upgrade or downgrade the quality of evidence

Downgrade in presence of	Upgrade in presence of
Study limitations -1 Serious limitations -2 Very serious limitations	Dose-response gradient +1 Evidence of a dose-response gradient
Consistency -1 Important inconsistency	Direction of plausible bias +1 All plausible confounders would have reduced the effect
Directness -1 Some uncertainty -2 Major uncertainty	Magnitude of the effect +1 Strong, no plausible confounders, consistent and direct evidence
Precision -1 Imprecise data	+2 Very strong, no major threats to validity and direct evidence
Reporting bias -1 High probability of reporting bias	

Recommendations

The strength of the recommendation

The strength of a recommendation communicates the importance of adherence to the recommendation.

- **Strong recommendations**

With strong recommendations, the guideline communicates the message that the desirable effects of adherence to the recommendation outweigh the undesirable effects. This means that in most situations the recommendation can be adopted as policy.

- **Conditional recommendations**

These are made when there is greater uncertainty about the four factors above or if local adaptation has to account for a greater variety in values and preferences, or when resource use makes the intervention suitable for some, but not for other locations. This means that there is a need for substantial debate and involvement of stakeholders before this recommendation can be adopted as policy.

- **When not to make recommendations**

When there is lack of evidence on the effectiveness of an intervention, it may be appropriate not to make a recommendation.

Recommendations:

SECTION 1: Recognition of critically ill child:

1. Rapid Response Team (RRT) / Rapid Response System (RRS):

Recommendation	Strength	Level of Evidence	Reference
We advise that hospitals caring for pediatric inpatients to implement a pediatric Rapid Response System (RRS) to support early recognition and escalation of deteriorating children outside ICU/PICU. Rational: Pediatric deterioration is commonly preceded by abnormal physiological signs, and delayed recognition remains a major contributor to preventable ward deterioration, unplanned PICU admission, and in-hospital cardiac arrest.^{3,4,5}	Conditional	Moderate	Canadian Paediatric Society (PMC) ⁶
The pediatric RRS advised to include: (1) standardized vital-sign monitoring, (2) age-appropriate early warning criteria (e.g., PEWS), (3) a clear activation pathway, (4) a designated responder team, and (5) quality monitoring/audit.	Conditional	Moderate	Canadian Paediatric Society (PMC) ⁶
We suggest hospitals caring for pediatric inpatients to establish and train a pediatric Rapid Response Team (RRT) with pediatric expertise (e.g., pediatrician/ICU physician, critical care nurse, respiratory therapist where available), adapted to local staffing and resources.	Conditional	Moderate	Canadian Paediatric Society (PMC) ⁶
Pediatric RRT (or on duty paediatrician) activation criteria should be simple, standardized, age-appropriate, and available 24/7, based on abnormal vital signs, mental status change, increased oxygen requirement, staff concern, or elevated PEWS.	Strong	Moderate	National RRS Standards / CPS ⁷ (Istitlaa)
Pediatricians should be supported by regular simulation-based multidisciplinary training, including escalation, communication, airway, and shock response.	Strong	Moderate	Canadian Paediatric Society (PMC) ⁸
We advise institutions to monitor RRT (paediatricians) performance through quality indicators including response time, unplanned PICU transfer, ward cardiac arrest, and escalation delays,unneeded PICU admission.	Good practice statement		Expert consensus / RRS standards (Istitlaa) ^{9,10,11,12}

2. Early Recognition and Triage:

Recommendation	Strength	Level of Evidence	Reference
All acutely ill children should undergo rapid initial assessment using a structured paediatric triage or quick-look approach. The Paediatric Assessment Triangle (PAT) may be used for rapid recognition of a potentially critically ill child, followed by an ABCDE assessment when indicated.	Strong	Low/very low	ERC 2025 ¹³ /Expert Consensus
Reassess the child after every intervention and whenever there is concern about deterioration, repeating the ABCDE assessment as appropriate.	Strong	Low/very low	ERC 2025 ¹³ /Expert Consensus

3. Airway and Breathing:

Recommendation	Strength	Level of Evidence	Reference
Airway patency should be assessed immediately in all critically ill children, with positioning, suction, and airway adjuncts used as needed.	Strong	Moderate	ERC 2025 ¹³
Oxygen should be administered to children with hypoxemia, severe respiratory distress, shock, seizures, or altered mental status.	Strong	Moderate	ERC 2025 ¹³
Oxygen therapy advised to be titrated to clinical response and pulse oximetry where available, avoiding unnecessary hyperoxia.	Conditional	Moderate	ERC 2025 ¹³ ILCOR CoSTR ¹⁴
High-flow nasal oxygen (HFNC) or non-invasive ventilation (NIV) considered early in moderate respiratory distress where available.	Good Practice Statement		WHO ETAT / expert consensus (NCBI) ¹⁵
Early intubation is considered in apnea, exhaustion, failure of oxygenation/ventilation, refractory shock, or reduced consciousness with loss of airway protection.	Conditional	Low	Expert consensus / PALS principles (NCBI) ^{15, 16}

4. Circulation and Shock:

Recommendation	Strength	Level of Evidence	Reference
Consider IV access early in all critically ill	Conditional	Moderate	WHO ETAT (NCBI) ¹⁵

children; IO access to be used without delay when IV access is not rapidly achieved.			
Children with shock should receive isotonic crystalloid in cautious aliquots of 10mL/kg with reassessment after each bolus.	Strong	Moderate	ERC 2025 ¹³
Repeated unmonitored fluid boluses should be avoided, especially when cardiogenic shock, severe anemia, or myocarditis is suspected.	Strong	Moderate	WHO ETAT (NCBI) ¹⁵
Early vasoactive support is advised in fluid-refractory shock or when fluid overload/cardiogenic shock is suspected.	Conditional	Moderate	SSC Pediatric Sepsis (Society of Critical Care Medicine (SCCM)) ¹⁷
Shock management should be etiology-directed (septic, hypovolemic, hemorrhagic, cardiogenic, obstructive, anaphylactic).	Strong	Low	WHO ETAT / expert consensus (NCBI) ¹⁶

5. Sepsis and Septic Shock:

Recommendation	Strength	Level of Evidence	Reference
Sepsis should be recognized early in any child with suspected infection and organ dysfunction or abnormal perfusion.	Strong	Moderate	SSC Pediatric Sepsis (Society of Critical Care Medicine (SCCM)) ¹⁷
Broad-spectrum antibiotics should be administered as early as possible after recognition of septic shock.	Strong	Moderate	SSC Pediatric Sepsis (Society of Critical Care Medicine (SCCM)) ¹⁷
Fluid resuscitation in septic shock should be cautious and guided by repeated reassessment.	Strong	Moderate	WHO ETAT / SSC (NCBI) ^{15,16}
Vasoactive support advised not to be delayed in fluid-refractory septic shock.	Conditional	Moderate	SSC Pediatric Sepsis (Society of Critical Care Medicine (SCCM)) ¹⁷

6. Disability / Glucose / Temperature:

Recommendation	Strength	Level of Evidence	Reference
----------------	----------	-------------------	-----------

Neurologic status should be assessed using AVPU or GCS in all critically ill children.	Strong	Low	WHO ETAT / expert consensus (NCBI) ^{15,16}
Hypoglycemia should be corrected immediately in children with reduced consciousness, seizures, shock, or severe illness.	Strong	Moderate	WHO ETAT (NCBI) ¹⁵
Temperature abnormalities (fever or hypothermia) should be identified and treated early.	Strong	Low	WHO ETAT / expert consensus (NCBI) ^{15,16}

7. Seizures and Neurologic Emergencies

Recommendation	Strength	Level of Evidence	Reference
Actively seizing children advise to receive immediate first-line benzodiazepine therapy.	Conditional	High	WHO ETAT (World Health Organization) ¹⁵
If IV access is unavailable, buccal or rectal or intranasal benzodiazepines is suggested.	Conditional	High	WHO ETAT (NCBI) ¹³
Blood glucose should be checked early in all children with altered consciousness or seizures.	Strong	Moderate	WHO ETAT (NCBI) ¹⁵
Consider second-line antiseizure therapy administration early in persistent seizures/status epilepticus.	Conditional	Moderate	WHO ETAT (NCBI) ¹⁶

8. Trauma:

Recommendation	Strength	Level of Evidence	Reference
Critically injured children should be managed using pediatric trauma ABCDE principles with simultaneous hemorrhage control.	Good practice statement	Low	ATLS / expert consensus ^{18,19}
Cervical spine protection should be maintained when trauma mechanism suggests risk.	Good practice statement	Low	ATLS / expert consensus ^{18,19}
Early transfer planning should begin immediately in children requiring trauma surgery, neurosurgery, or PICU support beyond local capability.	Good practice statement	Low	Expert consensus ¹⁸

SECTION 2: Cardiac arrest management in pediatric

Recommendation	Type of Recommendation	Level of Evidence	References
Bag-mask ventilation is recommended as initial airway management during pediatric cardiac arrest.	Strong	Moderate	ERC Paediatric Life Support 2025 ¹³
High-quality CPR (rate 100–120/min, depth 1/3 chest diameter, full recoil, minimal interruptions) is essential for all pediatric cardiac arrest patients.	Strong	Moderate	ERC Paediatric Life Support 2025 ¹³ ; AHA PALS 2025 ²⁰ ; ILCOR 2025 ¹⁴
Chest compression fraction should be maximized, minimizing interruptions to <10 seconds during rhythm checks or interventions.	Strong	Moderate	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
Rhythm analysis should be performed every 2 minutes with immediate resumption of CPR after shock or rhythm check.	Strong	Low	ERC 2025 ¹³
Early defibrillation is recommended for pediatric VF/pulseless VT as soon as a defibrillator is available.	Conditional	Moderate	ERC Paediatric Life Support 2025 ¹³ ; AHA PALS 2025 ²⁰
Use of manual defibrillator is preferred; AED with pediatric attenuator is acceptable if manual defibrillator is unavailable.	Conditional	Moderate	ERC 2025 ¹³ ; ILCOR 2025 ¹⁴
Epinephrine should be administered for non-shockable rhythms (PEA/asystole) as early as possible and repeated every 3–5 minutes.	Strong	Moderate	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
In shockable rhythms, epinephrine should be given after the third shock.	Strong	Moderate	ERC 2025 ¹³ ; ILCOR 2025 ¹⁴
Amiodarone (or lidocaine) is recommended for refractory VF/pVT after defibrillation attempts.	Conditional	Low	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
Advanced airway (ETT or supraglottic airway) may be considered by experienced providers if it does not interrupt chest compressions.	Conditional	Low	ERC 2025 ¹³
Consider Continuous waveform capnography to confirm tube placement and monitor CPR quality when advanced airway is in place.	Conditional	Moderate	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
Reversible causes of cardiac arrest (4 Hs & 4 Ts) should be actively identified and treated during resuscitation.	Strong	Low	ERC 2025 ¹³ ; ILCOR 2025 ¹⁴
Extracorporeal CPR (ECPR) may be considered in selected pediatric in-	Conditional	Low	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰

hospital cardiac arrest cases in specialized centers.			
---	--	--	--

SECTION 3: Pediatric Post–Cardiac Arrest Care (After ROSC)

Recommendation	Type of Recommendation	Level of Evidence	References
Oxygen therapy should be titrated after ROSC to avoid both hypoxemia and hyperoxia, targeting normal oxygen saturation appropriate for age.	Strong	Moderate	ERC Paediatric Life Support 2025 ¹³ ; AHA PALS 2025 ²⁰ ; ILCOR 2025 ¹⁴
Ventilation should be adjusted to maintain normocapnia; both hypo- and hypercapnia should be avoided after ROSC.	Strong	Moderate	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
Invasive blood pressure monitoring is considered in critically ill post–cardiac arrest children to guide hemodynamic management when available.	Conditional	Low	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
Hypotension after ROSC should be identified and treated urgently using isotonic fluids to maintain age-appropriate perfusion.	Strong	Moderate	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
We suggest early initiation of vasoactive infusions (e.g., epinephrine, norepinephrine) in persistent post-arrest shock.	Conditional	Moderate	ERC 2025 ¹³ ; ILCOR 2025 ¹⁴
Targeted temperature management should be used in comatose children after ROSC, with strict avoidance of fever.	Strong	Moderate	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
Continuous temperature monitoring is recommended for all post–cardiac arrest pediatric patients.	Strong	Moderate	ERC 2025 ¹³
Sedation and analgesia should be provided to prevent pain, agitation, and increased metabolic demand after ROSC.	Strong	Low	ERC 2025 ¹³
Blood glucose should be monitored and both hypo- and hyperglycemia should be avoided in post-arrest care.	Strong	Moderate	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
Continuous EEG monitoring may be considered in comatose children to detect subclinical seizures or status epilepticus.	Conditional	Low	ERC 2025 ¹³
Clinical and electrographic seizures should be actively treated after ROSC.	Strong	Moderate	ERC 2025 ¹³
Early neuroprognostication should be avoided immediately after ROSC; neurological outcome assessment should	Strong	Moderate	ERC 2025 ¹³ ; ILCOR 2025 ¹⁴

be delayed until after stabilization.			
Multimodal neurological assessment (clinical exam, EEG, imaging, biomarkers) is suggested for prognosis rather than a single modality.	Conditional	Low	ERC 2025 ¹³
Consider early evaluation for underlying cause of arrest (cardiac, respiratory, metabolic, toxic, infectious) and treat.	Conditional	Moderate	ERC 2025 ¹³ ; AHA PALS 2025 ²⁰
Hemoglobin and oxygen-carrying capacity considered to be optimized; transfusion may be considered in post-arrest anemia with poor perfusion.	Conditional	Low	ERC 2025 ¹³
Early consultation with pediatric intensive care, cardiology, neurology, and relevant specialties is advised.	Conditional	Low	ERC 2025 ¹³
Family communication and structured post-resuscitation counseling should be provided early after stabilization.	Strong	Low	ERC 2025 ¹³

Implementation considerations:

1. Health System Organization

- Establish a **hospital-wide Pediatric Rapid Response System (RRS)** integrated into emergency, wards, and PICU.
- Define clear **escalation pathways** from ward → RRT → PICU.
- Assign a **clinical governance lead for pediatric resuscitation** in each institution.
- Ensure **24/7 availability** of resuscitation capability in all hospitals receiving children.

2. Human Resources & Team Structure

- Minimum composition of pediatric resuscitation capability:
 - Pediatric-trained physician (or emergency physician trained in PALS)
 - Critical care nurse
 - Airway-skilled provider
- Define **clear team roles** (team leader, airway, compressor, medication nurse, recorder).
- Ensure backup coverage for nights, weekends, and resource-limited settings.

3. Training & Competency Maintenance

- Mandatory **PALS/ERC-based certification** for all staff involved in pediatric emergencies.
- Regular **simulation-based training (in-situ preferred)** for:
 - Cardiac arrest scenarios
 - RRT activation scenarios
 - Post-ROSC stabilization
- Structured **team debriefing after every cardiac arrest**.
- Competency reassessment at regular intervals (e.g., every 6–12 months).

4. Early Warning Systems (PEWS Implementation)

- Adoption of a **standardized Pediatric Early Warning Score (PEWS)** across institutions.
- Integration into:
 - Nursing charts
 - Electronic medical records (if available)
- Define **clear thresholds for escalation and RRT activation**.

- Mandatory response time targets after trigger activation.

5. Equipment and Infrastructure

- Ensure availability of:
 - Pediatric airway equipment (age-appropriate sizes)
 - Defibrillators with pediatric capability or attenuators
- Standardized **resuscitation carts (“crash carts”)** in all pediatric areas.

Research gaps:

Despite strong international guidance, several critical gaps exist in pediatric resuscitation science, particularly relevant to Egypt and similar healthcare systems:

1. Rapid Response Systems (RRT/RRS)

- Lack of **local data on effectiveness of RRT implementation in Egyptian hospitals**
- Need for studies on:
 - Optimal Pediatric Early Warning Score (PEWS) thresholds in local populations
 - Cost-effectiveness of RRT deployment in resource-limited settings
 - Impact on preventable ICU admissions and cardiac arrests

2. Recognition of Critically Ill Children

- Validation of **early warning scoring systems in Egyptian pediatric populations**
- Research on:
 - Sensitivity/specificity of PEWS in emergency departments
 - Integration of digital monitoring systems and AI alerts

3. Pediatric Cardiac Arrest Management

- Limited regional data on:
 - Optimal epinephrine timing in low-resource systems
 - Outcomes of in-hospital vs out-of-hospital pediatric arrest in Egypt
- Need for:
 - National pediatric cardiac arrest registry
 - Prospective observational resuscitation studies

4. Post-Cardiac Arrest Care

- Evidence gap in:
 - Targeted temperature management strategies in resource-limited ICUs
 - Neurological prognostication tools in pediatric settings
- Need for:
 - Standardized post-ROSC care bundles
 - Biomarker and EEG-based prognostic studies in Egyptian PICUs

Monitoring and evaluating the impact of the guideline

A. Facility based indicators:

Pediatric Resuscitation Audit Checklist

Hospital		Department	
Date		Auditor	
Case/Code Number			
Comments			

1. Recognition of Clinical Deterioration

Audit Item	Yes	No	N/A
1-Rapid response team	☐	☐	☐
2-Vital signs documented regularly (age-appropriate)	☐	☐	☐
3-Structured deterioration recognition system if available (PEWS) or equivalent (Abnormal vital signs identified and documented)	☐	☐	☐
4-Escalation pathway activated according to hospital policy (Senior clinician notified) (ASA)	☐	☐	☐
5-Time from deterioration recognition to escalation recorded	☐	☐	☐
6-Reassessment documented after intervention	☐	☐	☐

2. Initial Response

Audit Item	Yes	No	N/A
7-Airway assessed promptly	☐	☐	☐
8-Oxygen administered when indicated	☐	☐	☐
9-Monitoring attached (ECG, SpO ₂ , BP)	☐	☐	☐
10-IV access obtained promptly or	☐	☐	☐

IO(if available and when IV access difficult)			
11-VBG &Blood glucose measured	☐	☐	☐

3.Cardiac Arrest Management

Audit Item	Yes	No	N/A
12-Code blue team	☐	☐	☐
13-Cardiac arrest recognized promptly	☐	☐	☐
14-CPR started immediately of arrest recognition	☐	☐	☐
15-Correct compression rate to ventilation (15:2)	☐	☐	☐
16-Rhythm and pulse checks limited to ≤10 seconds	☐	☐	☐
17-Defibrillator attached rapidly when indicated	☐	☐	☐
18-Shock joules delivered according to guidelines	☐	☐	☐
19-CPR resumed immediately after shock delivery for 2 min.	☐	☐	☐
20-Adrenaline administered according to guidelines	☐	☐	☐
21-Reversible causes (4Hs & 4Ts) considered	☐	☐	☐
22-Time elapsed from starting chest compression until rhythm check 2min	☐	☐	☐

4.Post-ROSC Care

Audit Item	Yes	No	N/A
23-Return of spontaneous circulation (ROSC) documented	☐	☐	☐

24-Airway: Oxygenation optimized; target SpO2 94-98%	☐	☐	☐
25-Breathing: Ventilation optimized;co2 35- 45mmHg	☐	☐	☐
26-Circulation: Blood pressure monitored aim MAP>10th percentile	☐	☐	☐
27-Blood glucose monitored (normoglycemic)	☐	☐	☐
28-Temperature monitored(36-37.5)	☐	☐	☐
29-Neurological status assessed and documented GCS	☐	☐	☐
30-Family informed appropriately	☐	☐	☐

5. Equipment and Medication Readiness

Audit Item	Yes	No	N/A
31-Pediatric resuscitation trolley available	☐	☐	☐
32-Daily equipment check documented	☐	☐	☐
33-Defibrillator functional checked daily	☐	☐	☐
34-Oxygen source available and functional	☐	☐	☐
35-Bag-mask devices available in pediatric size	☐	☐	☐
36-Airway equipment available in appropriate pediatric sizes	☐	☐	☐
37-Emergency drugs available and not expired	☐	☐	☐

Documentation and Debriefing

Audit Item	Yes	No	N/A
38-Arrest record completed	☐	☐	☐
39-Critical interventions timed and documented	☐	☐	☐
40-Drugs documented accurately	☐	☐	☐

Compliance Summary

Total Applicable Items: _____

Total Yes Responses: _____

Compliance Score (%) = (Yes ÷ Applicable Items) × 100

Overall Rating: _____

B. High authority based indicators

1. System Performance Indicators (RRS/RRT)

Indicator	Definition	Target
RRT activation rate	Number of RRT calls per 1000 admissions	Institution-specific benchmark
Time from trigger to RRT arrival	Minutes from call to bedside response	≤ 5–10 min
Appropriate activation rate	% of RRT calls meeting PEWS/criteria	>80%
Missed deterioration cases	Patients who arrested without prior RRT activation	Should decrease over time
Repeat RRT calls within 24h	Recurrent instability after first RRT	Monitor trend ↓

2. Early Recognition of Deterioration

Indicator	Definition	Target
PEWS compliance rate	% of patients with documented PEWS	>90%
Escalation compliance	% of abnormal PEWS with documented escalation	>85–90%
Time from abnormal vitals to	Delay in response to deterioration	<30–60 min

action		
Unplanned ICU transfer	Transfer from ward without prior ICU planning	Decrease over time

3. Cardiac Arrest Quality Indicators

Indicator	Definition	Target
Time to CPR initiation	Collapse → first chest compression	<1 minute
Time to first defibrillation (VF/pVT)	Collapse → shock delivery	<3–5 minutes in monitored patients
CPR quality compliance	Adequate rate, depth, recoil	>80–90% adherence
Chest compression fraction	% time compressions delivered	>80%
EtCO ₂ during CPR (if available)	Marker of CPR quality	Documented in ≥80% of arrests
ROSC rate	Return of spontaneous circulation	Institution benchmark

4. Medication & Advanced Intervention Indicators

Indicator	Definition	Target
Epinephrine timing compliance	Given within recommended interval	>80% compliance
Correct dosing accuracy	Weight-based drug accuracy	>90%
Airway success rate	Successful advanced airway placement	Documented + first-pass success tracked
Interruption time during advanced airway insertion (ETT, LMA)	CPR pause during intubation	<10 seconds

5. Post-Cardiac Arrest Care Indicators

Indicator	Definition	Target
Oxygen titration compliance	Avoidance of hyperoxia/hypoxia	>85%
Hemodynamic stability achieved	SBP appropriate for age after ROSC	Increasing trend
Time to vasoactive support	ROSC → vasopressor start in shock	<15–30 min
Fever prevention compliance	Temperature maintained <38°C	>90%
Neurological monitoring use	EEG / neuro assessment documented	Increasing utilization
Seizure detection and treatment	Documented seizure management after ROSC	>90% treated promptly

6. Outcome Measures (Clinical Impact)

Outcome	Definition	Target
Survival to ROSC	Any sustained ROSC after arrest	Improve over baseline
Survival to ICU discharge	Survival after arrest admission	Increase trend
Survival to hospital discharge	Final survival outcome	Increase trend
Neurologically favorable survival	CPC 1–2 or age-appropriate function	Key quality endpoint
Pediatric in-hospital cardiac arrest rate	Arrests per 1000 admissions	Decrease over time

Updating of the guideline

This guideline will be updated periodically. This will be done whenever strong new evidence is available and necessitates update.

Annexes



Management of critically ill child using ABCDE approach¹

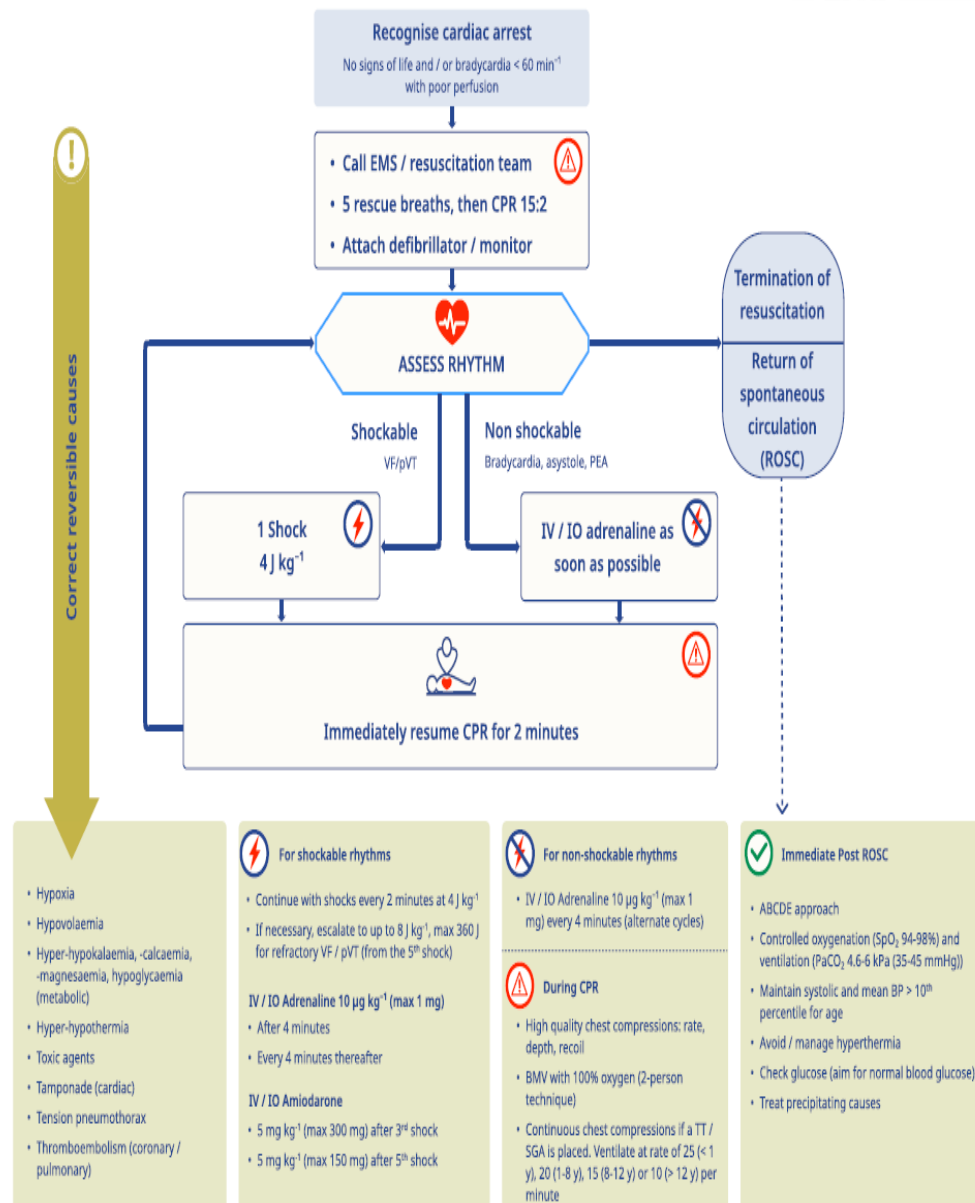
ED-PEWS

Emergency Department – Paediatric Early Warning Score

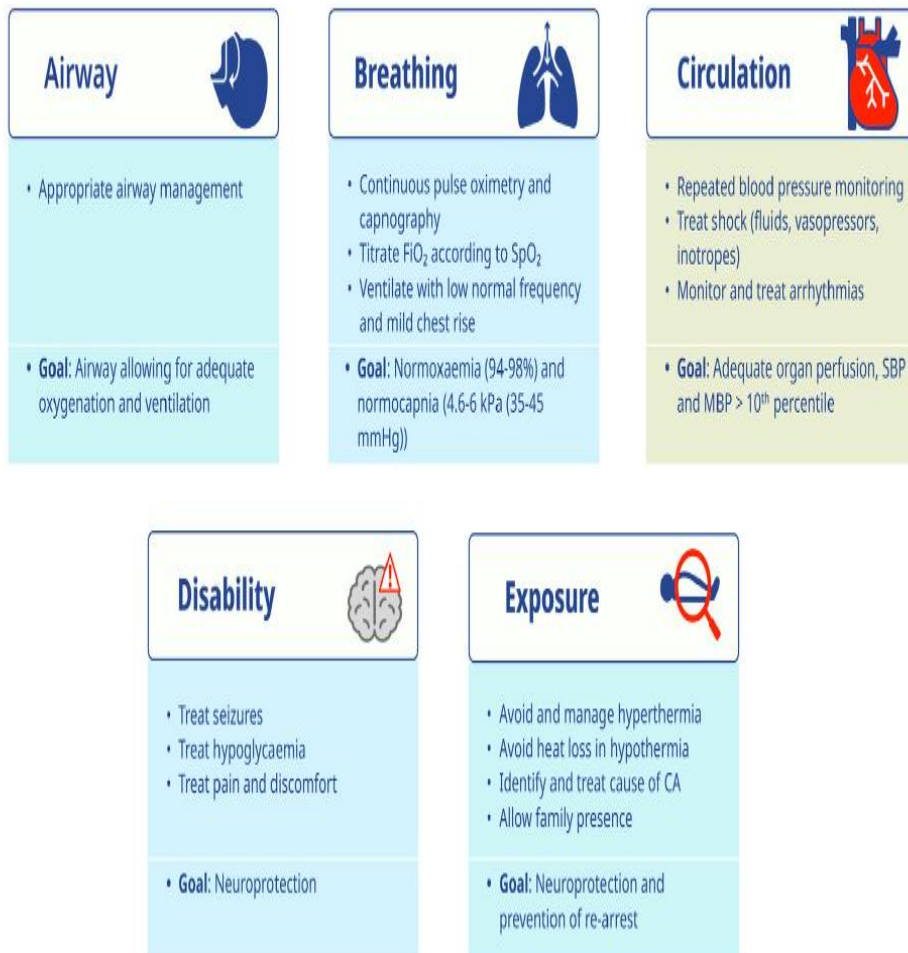
Physiological parameter	Score							
	0	3	4	5	6	9	14	15
Age (years)	0–4	5–11			12–16			
Respiratory rate (breaths/min)	<30	30–39		40–59		≥60		
SpO_2 (%)	≥98		94–97			88–93		<88
Heart rate (beats/min)	<100	100–139		140–179		≥180		
Capillary refill time		Increased (>2 s)						
Work of breathing							Increased	
Consciousness							Decreased consciousness	
Total ED-PEWS	0–68 points							
Low risk ED-PEWS <6 Low probability of clinical deterioration			Intermediate risk ED-PEWS 6–14 Close monitoring and clinical judgement			High risk ED-PEWS ≥15 High probability of clinical deterioration		

ED-PEWS = Emergency Department Paediatric Early Warning Score; SpO_2 = peripheral oxygen saturation.

Emergency Department Pediatric Early Warning score²¹



ALS algorithm, ERC guidelines¹



Immediate post resuscitation care¹

References

1. Guidelines on Cardiopulmonary Resuscitation 2025. European Resuscitation Council.
2. Jasmeet Soar, Joyce Yeung, Keith Couper, et al. Adult Advance Life support guidelines, Resuscitation council UK, 2025.
3. Adam Cheng and Angelo Mikrogianakis. Rapid response systems for pediatrics: suggestions for optimal organization and training. *Pediatric child health*, 15 Feb. 2018; 23(1):51-57. doi:10.1093/pch/pxx133.
4. Sharek PJ, Parast LM, Leong K, et al. **Effect of a rapid response team on hospital-wide mortality and code rates outside the ICU in a children's hospital.** *JAMA*. 2007;298(19):2267–2274. doi:10.1001/jama.298.19.2267
5. Brilli RJ, Gibson R, Luria JW, et al. **Implementation of a medical emergency team in a large pediatric teaching hospital prevents respiratory and cardiopulmonary arrests outside the intensive care unit.** *Pediatric Critical Care Medicine*. 2007;8(3):236–246. doi:10.1097/01.PCC.0000262947.71278.45
6. Cheng A, Mikrogianakis A; Canadian Paediatric Society, Acute Care Committee. **Rapid response systems for paediatrics: Suggestions for optimal organization and training.** *Paediatrics & Child Health*. 2018;23(1):51–57. doi:10.1093/pch/pxx133
7. Tibballs J, Kinney S. **Reduction of hospital mortality and of preventable cardiac arrest and death on introduction of a pediatric medical emergency team.** *Pediatric Critical Care Medicine*. 2009;10(3):306–312. doi:10.1097/PCC.0b013e318198b02c
8. Canadian Paediatric Society, Acute Care Committee. **Rapid response systems for paediatrics: Suggestions for optimal organization and training.**
9. Ottawa: Canadian Paediatric Society; 2018. Available at: Canadian Paediatric Society Position Statement.
10. Kotsakis A, Lobos AT, Parshuram C, et al.; Ontario Pediatric Critical Care Response Team Collaborative. **Implementation of a multicenter rapid response system in pediatric academic hospitals is effective.** *Pediatrics*. 2011;128(1):72–78. doi:10.1542/peds.2010-0756
11. Duncan H, Hutchison J, Parshuram CS. **The Pediatric Early Warning System score: A severity of illness score to predict urgent medical need in hospitalized children.** *Journal of Critical Care*. 2006;21(3):271–278. doi:10.1016/j.jcrc.2006.06.007
12. Akre M, Finkelstein M, Erickson M, Liu M, Vanderbilt L, Billman G. **Sensitivity of the Pediatric Early Warning Score to identify patient deterioration.** *Pediatrics*. 2010;125(4):e763–e769. doi:10.1542/peds.2009-0338
13. **European Resuscitation Council (ERC).** *ERC Guidelines 2025: Paediatric Life Support*. Resuscitation. 2025;215(Suppl 1):110767. doi:10.1016/j.resuscitation.2025.110767 .
14. **International Liaison Committee on Resuscitation (ILCOR).** *Pediatric Life Support Consensus on Science and Treatment Recommendations (CoSTR)*, 2025. Resuscitation. 2025.
15. WHO. Paediatric Emergency Triage, Assessment and Treatment (ETAT): Care of Critically Ill Children. Geneva: World Health Organization; 2016.
16. WHO. Guideline Updates on Paediatric Emergency Triage, Assessment and Treatment. NCBI Bookshelf.
17. Surviving Sepsis Campaign. International Guidelines for the Management of Septic Shock and Sepsis in Children. SCCM.
18. **Resources for Optimal Care of the Injured Patient.** Chicago, IL: American College of Surgeons; 2022. Provides trauma system standards, transfer criteria, trauma team activation, and escalation principles relevant to pediatric trauma systems.

19. Rozzelle CJ, Aarabi B, Dhall SS, et al. **Management of pediatric cervical spine and spinal cord injuries.** *Neurosurgery.* 2013;72(Suppl 2):205–226. doi:10.1227/NEU.0b013e318277096c.
20. **American Heart Association (AHA).** 2025 AHA Guidelines for CPR and ECC: *Pediatric Advanced Life Support.* Circulation. 2025.
21. **Zachariasse JM, Nieboer D, Maconochie IK, et al.** Development and validation of a Paediatric Early Warning Score for use in the emergency department: a multicentre study. *Lancet Child Adolesc Health.* 2020;4(8):583-591. doi:10.1016/S2352-4642(20)30139-5.