Appendix B
First Aid – 2026 Evidence Updates

Table of Contents

2026 Evidence Update
FA 7010 – Pulse Oximetry

Worksheet author(s): Finlay Macneil
Task Force: First Aid
Date Submitted to SAC rep for peer review and approval: Aug 25
SAC rep: Nici Singletary
PICOST / Research Question:
Population: Adults and children in the out-of-hospital or home setting with an acute illness or injury
Intervention: Use of pulse oximetry in addition to standard first aid assessment
Comparators: Standard first aid assessment without the use of pulse oximetry
Outcomes: Any clinical outcome
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) are eligible for inclusion. Grey literature, social media and non-peer reviewed studies, unpublished studies, conference abstracts and trial protocols are eligible for inclusion.
Timeframe: All years.
Literature search updated to November 16, 2022

Year of last full review: 2022
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
Good Practice Statements:
First aid providers who use pulse oximeters for the assessment of acute illness or injuries should be proficient in their use and understand their limitations, including equipment factors, environmental considerations, and patient-specific factors that may produce inaccurate and unreliable readings.
The use of a pulse oximeter for first aid assessment should not supersede or replace physical assessment.

Database searched: Medline and Embase
Time Frame: (existing PICOST) – 2022-July 25
Date Search Completed: July 25
Search Results (Number of articles identified and number identified as relevant): 1572/8
Narrative Summary of Evidence Update:
Eight new studies identified, all experimental examining the accuracy of consumer oximeters against a reference hospital grade oximeter, one also had some observational clinical outcome components. These studies were undertaken in adult subjects in 5 studies, children in 2 and a bench simulation in one study. There were no studies of use of pulse oximetry in First Aid.
Experimental Studies:

- Four of the studies {Hundessa 2022 841; Kosevi 2024 387; Metlay 2024 2747; Swamy 2024 1971} looked at the accuracy of 6 fingertip pulse oximeters, 5 of which were stand alone, 3 of these were bench tests on simulated degrees of hypoxia with SpO2 from 70-100% and different skin tones, and one connected to a smartphone for power. These studies showed a range of accuracy for the consumer grade oximeters as detailed in the table below. Some showed acceptable accuracy, but usually in the range of normal SpO2, from 90 to 100%, and some were often outside the acceptable range of within 3% of the true reading.
- Two of the studies {Dcruz 2024 e5536; Kosevi 2024 387} looked at the accuracy of propriety computer algorithms applied to a 60 sec capture of the face with camera in a device. Dcruz' study looked at 100 adults and found "the HR, BP, SpO2, and RR values raised by the Docsun Telehealth Portal compared against the clinically approved medical devices, proved to be accurate by meeting predefined accuracy guidelines." Kosevi looked at recordings in 74 children and found that the both

the fingertip and camera based oximeters were particularly inaccurate in children under 30 Kg weight.

- Two of the studies {Weis 2024 1971; Ghaly 2022 5304} looked at the accuracy of wearables, Apple watch in both studies as well as the Withings Scanwatch in Ghaly's study. Both studies found that the wearables did not have acceptable sensitivity for hypoxia.
- One study {Salton 2022 3115} looked at a relatively expensive but portable handheld device which measured heart rate, respiratory rate, temperature, SpO2 and BP. This study found that there was poor correlation between the handheld device (Buttterflife™) and hospital grade oximeter for SpO2 in 42 patients in an acute care setting, with a Spearman's rho of 0.24, The device did detect deterioration in outpatients in the observational component of the study noted below.
- One study {Swamy 2025 1931} undertook bench testing of 3 consumer grade oximeters and 3 hospital grade oximeters with a simulated SpO2 between 70 and 100% and a range of simulated skin tones. This study was unable to say if skin tone affects SpO2 measurements, but had high concordance for SpO2 >90 and significant variation for SpO2 <90%

Observational Study

- One study { Salton 2022 3115} looked at the collection of vital signs in 8 polycomorbid patients with remote monitoring and found 100% sensitivity and 89% specificity for detecting acute deterioration by the combination of vital signs, most often an abnormal ECG. The influence of SpO2 measurements was not started in this setting.

In summary, the studies of accuracy found that some consumer grade oximeters performed well within the normal range of SpO2 but were increasingly inaccurate below this range. Some studies found discrepancies even within the range of normal SpO2 up to a median of 2 percentage points out, usually an overestimate.
None of these studies warrant a change in the existing Good Practice Statements (above).
Relevant Guidelines or Systematic Reviews: none

RCT: none

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**
Metlay 2024 (Appears in Experimental studies as well)	**Observational (n=300)**	300 adults >20 yrs with symptoms ARI, ED and primary care clinic in Mass Gen. Av age 53, 64% female, 10% non-hispanic black, 35% ARI, MS complaint 18%, cardiac 11%	Accuracy of vital signs Sats high correlation in range 90-100%, out by up to 2 percentage points either way across this range	Collection of vital signs by patients was inaccurate, especially for heart rate, and the most accurate values required equipment (digital thermometer and pulse oximeter) that are often absent in the home. Future research should examine whether the accurate provision of vital sign information is required to generate appropriate triage and treat- ment decisions during telehealth visits for ARIs and test interventions that provide more accurate measurement

				tools for remote monitoring of high-risk individuals. **However, t**his device is accurate for clinical purposes in this population for SpO2
Salton 2022 (Appears in Experimental studies as well)	**Observational (n=42)**	42 acute respiratory patients in HDU then 8 "chronic" patients in community. Sex distribution not stated	accuracy of vital signs, then identification of conditions requiring medical attention rate in "chronic" patients SpO2 poor correlation with standard, _8 to +5 percentage points out over range of sats 94-100, even spread across Bland-Altman plots. But 100% sensitivity and 89% specificity for 7 conditions identified in 8 chronic patients	poor correlation for SpO2, Spearman's rho 0.24

Experimental Studies:

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**
Dcruz 2024	**Experimental (n=100)**	100 adults, M:F = 58:42, ethnicity not stated	Validation of Docsun Telehealth Portal on internet connected device with camera for measuring HR, RR, SpO2, BP. Correlation within 2.8SDs of reference from conventional measurement, specifically SpO2 mean was 0.6% below standard and all measurements within 2.8SDs of mean viz =/- 3 percentage points from standard (accepted as standard in UK)	This algorithm provides accurate assessment of HR, RR, SpO2 and BP

Ghaly 2022	**Experimental (n=123)**	123 patients (male 53.7%, age 63619 years)	assess accuracy of smartwatch SpO2 For detection of hypoxia, compared to ward-based PPG, the Apple Watch had a sensitivity and specificity of 30.5% and 92.9% respectively, with a positive predictive value (PPV) of 64.1% and negative predictive value (NPV) of 76.2%. The Withings ScanWatch had a sensitivity and specificity of 62.2% and 69.9% respectively with a PPV 46.4% and NPV 81.6%. Overall accuracy was 74.5% for the Apple Watch and 67.6% for the Withings watch.	While smartwatch technology is able to provide SpO2 readings, its accuracy does not appear to be sufficient to replace standard PPG technology in monitoring hypoxia in home-based COVID-19 patients. This is indirect but still applicable to first aid
Hundessa 2022	**Experimental (n=15**	15 "healthy volunteers, age and sex not stated	assess accuracy of novel consumer grade pulse oximeter Very low error, max 2% for SpO2	Experimental, in vivo, 15 healthy volunteers, sats 95-99%, single device sensor plugged into phone for power supply, good correlation with unspecified Lower grade oximeter ("standard hand held"). Significant because testing in dark pigmented skin (Ethiopia), but very limited applicability due to narrow range sats, test possibly by healthcare professional and imprecision in methods
Kosevi 2024	**Experimental (n=74)**	74 children, 54% female, 54 <30kg	Accuracy of consumer grade adult and paediatric pulse oximeters in children (<CA$40). Adult oximeter worked well on children >30 kg, but all methods for smaller children were inaccurate; Android phone app worst	Pulse ox with consumer grade oximeter inaccurate in children under 30 kg
Metlay 2024 Also in observational studies	**Experimental (n=300)**	300 adults >20 yrs with symptoms ARI, ED and primary care	Accuracy of vital signs including SpO2, HR, RR, and temperature. SpO2 high correlation in range 90-100%, off by up	Patient-collection of vital signs by patients was inaccurate, especially for heart rate, and the most accurate values required equipment (digital

		clinic in Mass Gen. Av age 53, 64% female, 10% non-hispanic black, 35% ARI, MS complaint 18%, cardiac 11%	to 2 percentage points either way across this range	thermometer and pulse oximeter) that are often absent in the home. Future research should examine whether the accurate provision of vital sign information is required to generate appropriate triage and treatment decisions during telehealth visits for ARIs and test interventions that provide more accurate measurement tools for remote monitoring of high-risk individuals. However, this device is accurate for clinical purposes in this population for SpO2.
Salton 2022 Also in observational studies above	**Experimental (n=42)**	42 acute respiratory patients in HDU then 8 "chronic" patients in community. Sex distribution not stated	Accuracy of handheld vital observations monitor including SpO2. SpO2 had poor correlation with standard, -8 to +5 percentage points out of range of sats 94-100, even spread across Bland-Altman plots. But 100% sensitivity and 89% specificity for 7 conditions identified in 8 chronic patients	poor correlation for SpO2, Spearman's rho 0.24
Swamy 2025	**Experimental**	Bench testing	Accuracy of 3 consumer grade oximeters and 3 hospital grade oximeters with different simulated skin tones and different SpO2 72-100%. Unable to say if skin tone affects SpO2 measurements, high concordance for SpO2 >90, significant variation for SpO2 <90%.	Consumer grade oximeters not accurate for SpO2<90%
Weis 2024	**Experimental (n=36)**	Children with congenital heart disease, n=36, 42% female, median age 9.2 (IQR 5.7-	Determine accuracy of Applewatch pulse oximeter. Applewatch reading median 2 percentage points higher SpO2	In children with moderate or severe cyanosis transcutaneous oxygen saturation, measurement with the Apple watch® was not reliable and cannot be recommended

		13.8), SpO2 measured before and after 6 min walk test	than Nellcor and narrower IQR, unable to read SpO2 <85%	to monitor oxygen saturation at home.

Reviewer Comments: *(including whether this PICOST should have a systematic or scoping review*)
These studies do not warrant a change in the current Good Practice Statements for this PICOST. The question of a review of accuracy of consumer grade oximeters will need to be considered by the task force.

References:

1. Dcruz G, Yeh P. The Accuracy of Pulse Oxygen Saturation, Heart Rate, Blood Pressure, and Respiratory Rate Raised by a Contactless Telehealth Portal: Validation Study. JMIR Form Res. 2024;8:e55361.
2. Ghaly A, Rajakariar K, Zhu Z, Tham S, Roberts L, Sajeev J, et al. Accuracy of Pulse Oximetry Using Smartwatch Technology in COVID-19 Patients. Heart, Lung and Circulation. 2022;31:S304.
3. Hundessa D, Hakkins R. Evaluation of a New Smartphone Powered Low-cost Pulse Oximeter Device. Ethiop J Health Sci. 2022;32(4):841-8.
4. Kosevi T, Saban J, Haddad F, Reddy D, Webster R, Udupa S. The Accuracy of Readily Available Consumer-Grade Oxygen Saturation Monitors in Pediatric Patients. Respiratory Care. 2024;69(4):387-94.
5. Metlay J, Gonzales R, Judson T, Chang Y, Margolin J, Oza S, et al. Accuracy of Patient-Collected Vital Signs. Telemedicine and e-Health. 2024;30(11):2747-51.
6. Salton F, Kette S, Confalonieri P, Fonda S, Lerda S, Hughes M, et al. Clinical Evaluation of the ButterfLife Device for Simultaneous Multiparameter Telemonitoring in Hospital and Home Settings. Diagnostics. 2022;12(12):3115.
7. Swamy S, He C, Hayes-Gill B, Clark D, Green S, Morgan S. Pulse oximeter bench tests under different simulated skin tones. Med Biol Eng Comput. 2025;63(7):1931-42.
8. Weis A, Leroy M, Jux C, Rupp S, Backhoff D. Oxygen saturation measurement in cyanotic heart disease with the Apple watch. Cardiology in the Young. 2024;34:1971-3.

2026 Evidence Update

FA 7040 – Recovery Position

Worksheet author(s): Abel Martínez-Mejias
Task Force: First Aid
Date Submitted to SAC rep for peer review and approval: November 2025
SAC rep: E.M. Singletary

PICOST / Research Question:

PICOST	**Description** *(with recommended text)*
Population	Adults and children in the first aid setting, with a reduced level of responsiveness of non-traumatic aetiology, who do not require resuscitative interventions (chest compressions, rescue breathing, defibrillation).
Intervention	Any specific positioning (recovery positioning i.e. various semi-prone, lateral recumbent, side-lying or three-quarters prone positions of the body).
Comparison	Any other positioning (Compared with supine or other position)
Outcomes	Any relevant clinical outcomes including but not limited to: **Critical** - survival - incidence of cardiac arrest - delayed detection of apnoea and cardiac arrest, - need for airway opening maneuvers (i.e. head tilt chin lift and jaw thrust), - incidence of aspiration - Hypoxia **Important** - Likelihood of cervical spine injury - complications (venous occlusion, arterial insufficiency, discomfort/pain, aspiration pneumonia)
Study Design	Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) are eligible for inclusion. Case series and case reports will also be considered for inclusion. As it is anticipated that there will be insufficient studies from which to draw a conclusion, the minimum number of cases for a case series to be included has been reduced for the default of 5 to 1 by the TFSR team.
Timeframe	All years and all languages are included as long as there is an English abstract. Literature search updated to November 18, 2025

Type (intervention, diagnosis, and prognosis):

- Recovery position in people with reduced level of responsiveness of nontraumatic origin and do not require resuscitative interventions
- The assessment and reassessment of warning signs during Recovery Position to change to supine position or maintain it.
- Different positions in infants, traumatic situations, pregnancy, greater or smaller body habitus, disabled people or others special situations
- Special considerations for:
    - Gender bias
    - Limited resource setting (LRS)

Exclusion Criteria:

- Children and adults with non-effective breathing
- Children and adults in cardiac arrest
- Children and adults with traumatic aetiology
- Neonates

Additional Evidence Reviewer(s): none

Conflicts of Interest (financial/intellectual, specific to this question): None

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:

2022 Treatment Recommendations

When providing first aid to a person with a decreased level of responsiveness of non-traumatic etiology and who does not require immediate resuscitative interventions, we suggest the use of the recovery position. (Weak recommendation, very low certainty evidence)

When the recovery position is used, monitoring should continue for signs of airway occlusion, inadequate or agonal breathing and unresponsiveness. (Good Practice Statement)

If body position, including the recovery position, is a factor impairing the first aid provider's ability to determine the presence or absence of signs of life, the person should be immediately positioned supine and re-assessed. (Good Practice Statement)

People found in positions associated with aspiration and positional asphyxia such as face down, prone, or in neck and torso flexion positions should be repositioned supine for reassessment. (Good Practice Statement)

Technical remarks:
Resuscitative interventions may include opening and maintaining an open airway, rescue breathing, chest compressions and the application of an automated external defibrillator.

Various recovery positions have been described and there remains little evidence to suggest an optimal position. The recommended recovery position, (lateral recumbent positioning with arm nearest the first aid provider at right angle to the body and elbow bent with palm up and far knee flexed), remains unchanged from the 2015 CoSTR.

Search Results: 12 relevant articles (4 SR/Guidelines + 3 Scoping Reviews + 3 RCT +1 NRCT/OS+ 1CS)

2025 Summary of Evidence Update:

The 2025 Evidence Update identified four guideline documents, three non-systematic reviews, three RCTs, one observational study and a single case report. All five studies evaluated outcomes with different types of lateral recovery positions. The largest RCT (Ye 2025), with 2143 patients, found that placing sedated adults in the lateral position significantly reduced the incidence and severity of hypoxemia and decreased the need for airway rescue interventions without compromising safety. One observational study (Li 2025) with 28 sedated children under five years of age analyzed the effect of position on the airway and reported beneficial outcomes in pediatric patients placed in the lateral recovery position. Two smaller RCTs in young adults, one with 8 volunteers analyzing the effect of the recovery position on vascular flow to the arms (De Buck 2024) and another with 20 volunteers assessed the hemodynamics of both cerebral hemispheres when placed in a lateral position (Kamiya 2022). Both studies seem to continue supporting the use of the recovery position in first aid. No complications

were observed from its use. The case report (Meena 2025) describes a case of penetrating abdominal trauma that could not be managed in the supine position, finding clear benefits in airway management, reducing the risk of aspiration, and generally improved in the lateral position.
Thus, the identified studies support the current ILCOR treatment recommendation for use of the recovery position.

Meena 2025 about Airway Management in Trauma (Non-Supine Position): This case highlights the successful airway management of an 18-year-old man with penetrating abdominal trauma (embedded metal knife) who required lateral decubitus positioning due to contraindications for the traditional supine approach, such as continuous bleeding and hemodynamic instability. The presence of a protruding foreign body precluded supine positioning, necessitating meticulous planning. Airway management was successfully achieved on the first attempt using a C-MAC® videolaryngoscope (VL) and bougie guidance in the left lateral decubitus position. The case underscores the importance of adaptability, advanced tools (VL), and multidisciplinary collaboration in complex trauma scenarios involving non-conventional positioning, in this case, the lateral position.

Kamiya 2023 about cerebral Hemodynamics in Lateral Position: A study on healthy adult volunteers found that moving from the supine position to the lateral decubitus position does not cause any difference in cerebral hemodynamic (measured by regional oxygen saturation, rSO2) between the left and right cerebral hemispheres. This suggests the existence of a specific cerebrovascular regulatory mechanism that maintains perfusion distribution despite systemic circulatory changes caused by the posture shift. Systolic blood pressure decreased significantly in the left lateral position (measured at the right upper arm), demonstrating transient systemic changes, but rSO2 remained balanced.

Birkun 2025: About the controversy in Seizure Positioning: Guidelines present conflicting recommendations regarding the use of the recovery position (RP) for generalized seizures. Some advised placement during the convulsion, others only after it stops. This review concludes that placing a person with continuing seizures in the RP should be avoided and actively discouraged due to the lack of confirmed benefits (like reducing respiratory disturbances or aspiration risk) and the risks of severe skeletal trauma (e.g., shoulder dislocations) and delayed recognition of cardiac arrest, But RP is advisable in the postictal period for unresponsive, normally breathing individuals.

Hui Ye 2025 about Hypoxemia Prevention in Sedated Adults: This large multicenter randomized controlled trial found that placing sedated adults in the lateral position significantly reduces the incidence and severity of hypoxaemia (defined as SpO2 ≤90%) compared with conventional supine positioning. The incidence of hypoxaemia was significantly lower in the lateral group (5.4%) versus the supine group (15.0%). Lateral positioning also decreased the need for airway rescue interventions (6.3% vs 13.8%) and severe hypoxaemia (SpO2 ≤85%: 0.7% vs 4.8%). Given its simplicity and low cost, lateral positioning is a promising respiratory management strategy for sedated adults, potentially by mitigating gravitational effects on the upper airway.

Hui Li 2025 about Airway Patency in Sedated Children: This retrospective study utilizing 3D MRI reconstructions found that lateral positioning significantly enlarges the upper airway morphology in sedated children under five compared to the supine position. Specifically, lateral positioning increased the narrowest cross-sectional area by 49.21% and airway volume by 65.64%. These findings provide clinical evidence supporting the use of the lateral position to enhance airway patency in younger, sedated patients who are at high risk for upper airway obstruction due to unique anatomical characteristics.

De Buck 2024 about Comparison of Recovery Arm Positions: This study compared two variations of the lateral recovery position in healthy volunteers: one with the dependent arm bent (traditional) and one with the arm extended (newer recommendation). It found no statistically significant difference between the two positions concerning perfusion indicators in the dependent arm (systolic peripheral arterial pressure, venous pressure, oxygen saturation) or subjective pain and discomfort. The conclusion is that, since perfusion was similar, both recovery positions can be used.

Hewett-Brumberg (2024) advocates for the benefits of the recovery position but also warns of its dangers in its recommendations. The position of a sick or injured person is an important first aid intervention that can affect their safety, airway patency, and the extent of their injuries. The recovery position, also known as semi-prone, lateral decubitus, and three-quarter prone, has long been recommended for people with a decreased level of consciousness. Its expected benefits are maintaining an open airway, preventing aspiration, and providing stability and comfort. In addition, in certain circumstances, the lateral decubitus position may be preferable to the supine position for comfort (pregnant women, obese individuals, etc.). However, the recovery position is associated with a delay in recognizing respiratory arrest and in initiating chest compressions. Therefore, it must be carefully monitored.

Djärv in ERC 2025 recommends placing adults and children with decreased responsiveness who do NOT meet CPR criteria in the lateral recovery position (lying on their side), warning that in cases of agonal breathing or trauma, this position should NOT be used.

Djakow 2025 recommends that an unresponsive child who is clearly breathing effectively keep the airway open by continued head tilt chin lift or positioning the child in a recovery position, but not in trauma. In RP providers must check the breathing continuously or at least every minute. If in doubt about the stability of the position or the quality of the breathing, turn the child onto their back and open the airway with the head tilt chin lift maneuver.

Habibi 2022 in this scoping review evaluated prehospital care for potential traumatic spinal cord injury (TSCI), noting that there is no uniform opinion on spinal immobilization. Regarding positioning, the novel lateral trauma position (LTP) and one of the two High Arm IN Endangered Spine (HAINES) methods are preferred for unconscious patients. These lateral positions are considered superior to the standard recovery position and suitable for airway management in unconscious, non-intubated trauma patients. The study also suggests avoiding the log-roll maneuver as it causes significantly more motion in the unstable spine than alternatives.

Shaw 2024, in this article details changes to the Tactical Combat Casualty Care (TCCC) guidelines regarding airway management for battlefield trauma. The new guidelines recommend placing casualties who are unconscious but do not have a traumatic airway obstruction in the recovery position with the chin tilted away from the chest. Furthermore, the "jaw thrust" maneuver is no longer recommended. The guidelines retain the recommendation for the "Sit-Up and Lean-Forward" positioning for conscious casualties with direct maxillofacial trauma.

Steinberg 2025 in this review addresses the risk of sudden death associated with in-custody prone restraint, where a subject is placed face-down and controlled. The estimated mortality rate is approximately one death per 4.4 million people per year, primarily attributed to prone restraint cardiac arrest. The authors argue that prospective studies reporting no deaths were underpowered, while retrospective data consistently indicate substantial risk, as prone positioning decreases ventilation and cardiac output. It is recommended that prone restraint be used only when necessary and discontinued as quickly as possible.

There are no studies about:

- There are no clinical studies that include children and especially infants.
- No studies describe movement-related adverse effects.
- Additional data is needed from out-of-hospital studies.
- There are no recommendations on how to transition from prone to RP.

Relevant Guidelines or Systematic Reviews

Organization (if relevant); Author; Year Published	**Guideline or systematic review**	**Topic addressed or PICO(S)T**	**Number of articles identified**	**Key findings**	**Treatment recommendations**

Hewett-Brumberg 2024 Doi: 10.1161/CIR.0000000000001281	2024 American Heart Association and American Red Cross Guidelines for First Aid. Circulation	Positioning of the Ill or Injured Person	N/A	The positioning of the ill or injured person is an important first aid intervention that may affect their safety, airway patency, and sustained injuries. The recovery position, also described as semiprone, lateral recumbent, side lying, and three-quarters prone, has long been recommended for individuals with decreased level of consciousness.	Although the recovery position has been the subject of little formal study, its anticipated benefits are to maintain an open airway, prevent aspiration, and provide stability and comfort. (Douma 2022) However, the recovery position may not be ideal if there are injuries to the spine, hip, or pelvis; if breathing is abnormal; or if CPR is needed. The recovery position may reduce the risk for airway obstruction, facilitate drainage of airway secretions, and reduce the risk of aspiration in a person with a decreased level of responsiveness, particularly if the airway cannot be closely monitored by a first aid provider. In addition, a side-lying position may be preferred for comfort over the supine position by individuals in certain circumstances such as pregnant individuals, those with respiratory difficulties, or those with a greater or smaller body habitus.(Douma 2022) A left-side lying position improves blood circulation for people in the later stages of pregnancy (hankins 1996; Sommers 2011) However, the recovery position is associated with delayed recognition of respiratory arrest and delayed initiation of chest compressions. (Freire Tellado 2017)
Djärv 2025 DOI: 10.1016/j.resuscitation.2025.110752	Practice Guidelines ERC	First Aid Recovery position	N/A	Based on the ILCOR scoping review, the ERC recommends positioning the person in a lateral, side-lying recovery (lateral recumbent)	Place adults and children with decreased level of responsiveness who do NOT meet the criteria for CPR into a lateral (side-lying) recovery position.

				position as opposed to leaving the person supine. A person placed in the recovery position should be monitored for continued airway patency, breathing and their level of responsiveness. If these critical signs deteriorate th e person should be repositioned into a supine position and, if required, CPR initiated. For a person with agonal breathing or who has suffered trauma, you should not use the recovery position. Persons with a known trauma should be kept in supine position.	In cases of agonal breathing or trauma, do NOT move the person into a recovery position.
Djakow 2025 Doi: 10.1016/j.resuscitation.2025.110767	Practice Guideline European Resuscitation Council Guidelines 2025 Paediatric L ife Support	Recovery position in pediatric populatio n	5		In an unresponsive child who is clearly breathing effectively, keep the airway open by continued head tilt- chin lift or positioning the child in a recovery position, especially if there is a risk of vomiting, but not in trauma. Check breathing continuously or at least every minute if the child is placed in a recovery position. If in doubt about the stability of the position or the quality of the breathing, turn the child onto their back and open the airway with the head tilt chin lift manoeuvre.

Shaw 2024 DOI: 10.55460/C0YI-YZNK	Airway Management in Tactical Combat Casualty Care: TCCC Change 24-1	In 2024, the Committee on TCCC approved a change to the recommended management of the airway in TCCC			Continues the recommendation for use of the "Sit-Up and Lean-Forward" positioning to keep the airway clear in casualties with direct maxillofacial trauma when conscious and able to do so.

					Recommends that casualties who are unconscious without traumatic airway obstruction be placed in the recovery position with the chin tilted away from the chest. There is no longer a recommendation to use a "jaw thrust."

Non Systematic Reviews

Organization (if relevant); Author; Year Published	No Systematic Review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
Birkun 2025 DOI:10.1016/j.ajem.2025.08.031	Recovery position for generalised seizures: A focused scoping review of guidelines and original research	To explore corresponding recommendations presented in first aid guidelines and to review original research that may support or refute the application of this manoeuvre for seizures.	26 guidelines	13 provided recommendations on first aid for seizures. The recommendations for the use of the RP were conflicting. Five guidelines advised putting the person on their side during the convulsion; 5 recommended positioning only after the seizure stops. There is no evidence confirming that lateral positioning of a person with continuing seizures reduces the severity of respiratory disturbances or the likelihood of aspiration. Putting the person with ongoing convulsions on their side can result in shoulder dislocations and hinder recognition of cardiac arrest.	Unless compelling new evidence proves otherwise, recommending the placement of a person with continuing seizures in the RP should be avoided and actively discouraged. In the postictal period, the use of the RP for an unresponsive, normally breathing person is advisable as it can prevent life-threatening respiratory disturbances.
Steinberg 2025 DOI: 10.1016/j.forsciint.2025.112652	Mortality associated with in-custody prone restraint: A review.	Sudden and unexpected arrest-related deaths. The use of prone restraint, wherein a subject is placed face-down and controlled in this position.		They estimate the mortality rate with use of in-custody prone restraint is at approximately 1 per 4.4 million individuals per year, or 0.023 per 100,000 population annually.	These findings underscore the need for more rigorous, large-scale, and transparent epidemiologic

					al studies. The potential lethality of prone restraint must be recognized, and its use re-evaluated.
Habibi Arejan 2022 DOI: 10.1007/s00586-022-07164-4	Evaluating prehospital care of patients with potential traumatic spinal cord injury: scoping review	Purpose To gain insight into current research regarding prehospital care (PHC) in patients with potential traumatic spinal cord injury (TSCI) and to disseminate the findings to the research community	42 studies: 18 articles on immobilization; 12 on movement, positioning, transport; 4 on spinal clearance; 3 on airway protection; 2 on role of PHC providers	There was no uniform opinion about spinal immobilization of patients with suspected TSCI. The novel lateral trauma position and one of two High Arm IN Endangered Spine (HAINES) methods are preferred methods for unconscious patients. Controlled self-extrication for patients with stable hemodynamic status is recommended.	Future prospective studies with a large sample size in real-life settings are needed to provide clear and evidence-based data in PHC of patients with suspected TSCI

RCT:

Study Acronym; Author; Year Published	**Aim of Study; Study Type; Study Size (N)**	**Patient Population**	**Study Intervention (# patients) / Study Comparator (# patients)**	**Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)**	**Relevant 2° Endpoint (if any); Study Limitations; Adverse Events**
De Buck 2024 DOI: 10.1016/j.resplu.2024.100722	The impact of different recovery positions on the perfusion of the lower forearm and comfort: A cross-over randomized controlled trial Aim: to evaluate the effect of recovery positions with bent or extended arm on perfusion of the lower forearm and comfort. Study size: 18	18 healthy volunteers aged >18 years and <65 years	In random order, with an interval of 15 min in supine position. Various perfusion indices of the dependent arm were assessed, as well as discomfort, pain and skin discoloration. One of the recovery positions tested extended the dependent arm aligned next to the upper lying arm supporting the head.	The study found no statistically significant difference in systolic peripheral arterial pressure in the radial artery, peripheral venous pressure at the back of the hand, oxygen saturation, heart rate, subjective pain and discomfort, when comparing both postures. Participants slightly experienced more skin discoloration in the position with extended arm. The study concluded that since perfusion of the dependent arm was shown to be similar in both positions, both recovery positions can be used.	Regarding pain and discomfort no statistically significant difference was found between the two positions. Several limitations complicate the interpretation of data.

			The other recovery position was the lateral side-lying recovery position with bent arms.		
Kamiya 2022 DOI: 10.14814/phy2.15685	Lateral position does not cause an interhemicerebral difference of cerebral hemodynamic in healthy adult volunteers	20 healthy volunteers (7 males and 13 females). Mean age 28.9 ± 8.9 years.	The effects of the lateral decubitus position on heart rate, blood pressure, and hemodynamic in the left and right cerebral hemispheres were investigated in healthy adults tested in three postures: 1. Sitting position: supine (control)- sitting position- supine. (2) Right lateral position: supine (control)- right lateral position- supine. (3) Left lateral position: supine (control)- left lateral position- supine.	Although the lateral decubitus position causes systemic circulatory changes, it may not cause any difference in hemodynamics between the left and right cerebral hemispheres. Cerebral hemodynamics are maintained during postural changes among the sitting, supine, and lateral decubitus position	Whether the lateral decubitus position causes differences in cerebral hemodynamic between the left and right cerebral hemispheres was investigated by measuring rSO2. It was not possible to demonstrate that the lateral decubitus position causes any difference in cerebral hemodynamic between the two cerebral hemispheres.
Ye 2025 DOI: 10.1136/bmj-2025-084539	Effect of lateral versus supine positioning on hypoxaemia in sedated adults: multicentre randomised controlled trial DESIGN Prospective, multicentre, randomised controlled trial 2143 patients were included in the primary analysis.	SETTING: 14 tertiary hospitals in China, July to November 2024. Of 2143 patients, mean age was 53.1 years, mean body mass index was 23.9, and 53.7% (1150/2143) were women.	Sedated patients were randomly assigned (1:1) to receive either lateral positioning or conventional supine positioning. Analyses were performed on an intention-to-treat basis.	The incidence of hypoxaemia was significantly lower in the lateral position group compared with supine group (5.4% (58/1073) v 15.0% (161/1070); adjusted risk ratio 0.36, 95% confidence interval (CI) 0.27 to 0.49; P<0.001). Patients in the lateral group required fewer airway rescue interventions (6.3% (68/1073) v 13.8% (148/1070); adjusted risk ratio 0.46, 0.34 to 0.61; P<0.001), had a lower incidence of severe hypoxaemia (0.7% (8/1073) v 4.8% (51/1070); adjusted risk ratio 0.16, 0.07 to 0.33; P<0.001), and had a	Placing sedated adults in the lateral position significantly reduces the incidence and severity of hypoxaemia and decreases the need for airway rescue interventions without compromising safety. Given its simplicity and low cost, lateral positioning could offer advantages in remote or resource constrained clinical settings. Further

				higher mean lowest SpO2 level (96.9% v 95.7%, absolute adjusted mean difference 1.20%, 95% CI 0.87% to 1.54%; P<0.001). Safety outcomes were comparable between the groups, but tachycardia was less frequent in the lateral group.	replication studies targeting patients with advanced age and high body mass index are needed to improve the generalisability of the findings

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Li 2025 DOI: 10.1007/s12519-025-00910-w	Impact of lateral positioning on upper airway morphology in sedated children under five A retrospective study This study aimed to analyze the impact of lateral positioning on the upper airway of sedated children under five. N = 24 (15 girls, 9 boys ages 0 to 5 years	Pediatric patients who underwent MRI in both the supine and lateral positions at Children's Hospital, Zhejiang University School of Medicine. Upper airway morphology was reconstructed using 3D Slicer software. Python was employed to estimate cross-sectional areas via pixel analysis. The narrowest cross-sectional area, minimal transverse and anteroposterior diameters, airway length, and airway volume were measured and stratified by age.	In sedated children under 5 years old and when compared to the supine position, lateral positioning increased minimal transverse diameter by 18.70% (P = 0.001), narrowest cross-sectional area by 49.21% (P < 0.001), anteroposterior diameter by 25.54% (P < 0.001), airway volume by 65.64% (P < 0.001), and airway length by 11.93% (P < 0.001). In all subgroups, lateral positioning significantly increased the narrowest cross-sectional area, airway length, and airway volume.	Lateral position significantly enlarges the upper airway in sedated children under five. These findings support using lateral position to enhance airway patency in younger patients.
Meena 2025 DOI: 10.7759/cureus.78466	Lateral Positioning and Airway Management in Penetrating Abdominal Trauma: A Case Report	An 18-year-old male was taken to the operating theater with a penetrating abdominal injury necessitating lateral positioning due to ongoing bleeding and hemodynamic instability.	The lateral approach enabled optimal management of both the penetrating injury and airway compromise, preventing further exacerbation of the injury and reducing aspiration risks.	This case highlights the challenges and considerations in managing airways in trauma patients who cannot tolerate supine positioning.

Reviewer Comments:

Studies identified for this PICOST did not question the use and indications for the recovery position, adding data on its safety in some cases. However, the current systematic review could benefit from a parallel review of airway management techniques by first responders in individuals with decreased responsiveness of any etiology, or from an updated systematic review of the techniques used to place a person in the recovery position and their impact.

Therefore, the 2022 ILCOR CoSTR conclusions on the use of the recovery position remain unchanged while the other potential revisions are discussed.

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2026 Evidence Update

FA 7442 – Resuscitation Care for Suspected Opioid-Associated Emergencies

Worksheet author(s): Jessica Rogers and Phuong Thao Nguyen
Task Force: First Aid
SAC rep: Terese Djärv

PICOST / Research Question:

PICOST (Population, Intervention, Comparator, Outcome, Study Designs and Timeframe)
Population: Adults and children with suspected opioid-associated cardio / respiratory arrest in the pre-hospital setting
Intervention: Bystander naloxone administration (intramuscular or intranasal), in addition to standard CPR
Comparators: Standard CPR only
Outcomes: Any clinical outcome
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) are eligible for inclusion. Unpublished studies (e.g., conference abstracts, trial protocols) are excluded.
Timeframe: All years and all languages were included as long as there was an English abstract. Unpublished studies (e.g., conference abstracts, trial protocols), animal studies, manikin studies, cadaver studies were excluded. Literature searched to 29 September 2025.

Year of last full review:
2023

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest that CPR be started without delay in any unconscious person not breathing normally and that naloxone be used by lay rescuers in suspected opioid related respiratory or circulatory arrest (weak recommendation based on expert consensus).

Databases searched: PubMed and Embase
Time Frame: (existing PICOST): 12 December 2023 - 29 September 2025
Date Search Completed: 29 September 2025
Search Results (Number of articles identified and number identified as relevant): 1423/3

Summary of Evidence Update:

Relevant Guidelines or Systematic Reviews

Organization (if relevant); Author; Year Published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
Grunau 2025 (ILCOR Systematic Review)	Systematic Review	In adults and children experiencing cardiac arrest (in or out of hospital) secondary to suspected opioid poisoning, do opioids	1051 studies screened, 6 observational studies met criteria for analysis (4 full	5 studies reported the association of naloxone administration with	There is currently no evidence demonstrating benefit for any advanced life support interventions specific to

		specific ALS-level therapies (e.g. naloxone, bicarbonate, or other drugs or ALS-level interventions), in comparison to standard advanced life support management, would improved outcomes at hospital discharge, at 30-days, or longer follow up?	text manuscripts and 2 conference abstracts).	outcomes, and one study reported the association of bicarbonate with outcomes. In the naloxone literature, 2 reported that naloxone was associated with improved outcomes, and 3 did not detect an association. All studies were limited by serious risk of bias and indirectness, with the certainty of evidence judged to be very low.	treating cardiac arrest from opioid toxicity.

RCT: none

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**
Strong, 2024	Retrospective observational study (n =1807)	<u>Inclusion Criteria:</u> All non-traumatic OHCA in registry in Oregon from January 1st 2018 to December 31st 2021.	<u>1° endpoint:</u> Presence of a pulse at ED arrival. Secondary outcomes: ROSC at any time, survival to admission, survival to hospital discharge, good neurologic status at discharge. <u>Results:</u>	Authors suggest that if findings could be demonstrated in a larger dataset or prospective studies, it could support a trial to evaluate the benefit of naloxone in the resuscitative algorithm for non-shockable OHCA.

		Age 18 years old or over. OHCA with non-shockable initial rhythm. Excluded: patients with DNR, cases with shockable rhythms, EMS-witnessed arrest cases, cases where ROSC achieved before naloxone given, cases where bystander CPR given with no EMS CPR. Primary exposure of interest was administration of naloxone prior to vascular access attempts.	Patients receiving naloxone prior to vascular access had higher adjusted odds (aOR [95% CI]) of ROSC at any time (2.14 [1.20 – 3.81]), pulses at ED arrival (2.14 [1.18 – 3.88]), survival to admission (2.86 [1.60 – 5.09]), survival to discharge (4.41 [1.78 – 10.97]), and good neurologic outcome (4.61 [1.74 – 12.19]). Subgroup analysis of cases of non-shockable rhythms, in cases with presumed respiratory arrest, substance use history or overdose cardiac arrest etiology, in cases with at least 10 mins of EMS resuscitation on scene before ROSC found results consistent with the main analysis.	
Quinn 2024	Retrospective observational study (n=769)	<u>Inclusion criteria</u> All patients who had an OHCA between January 1 2017 to June 30, 2022. Excluded: Under	<u>1° endpoint:</u> ROSC and survival to hospital discharge <u>Results:</u> 790 patients initially included, 21 excluded. 175/769 (23%) received naloxone; 594/769 (77%) no naloxone. Patients who received naloxone had fewer comorbidities than those who did	In this single urban EMS system with high rates of opioid overdose, there was no difference in outcomes between OHCA patients who received naloxone and those who did not. The paper concludes that it does not support the routine administration of naloxone in OHCA patients.

		18years, traumatic OHCA, no attempted resuscitation.	not except for psychiatric disease and OUD. No significant difference in outcomes between the two groups; no naloxone group had 8.6% survival to hospital discharge rate compared to a rate of 4.6% in the naloxone group (p=0.064). No significant difference in prehospital ROSC rate, ED RSOC rate or survival to admission. There was no significantly different rate of ROSC between matched cohorts of 159 patients in each group. No naloxone group had a 45.3% ROSC rate compared to 34% in the naloxone group (p=0.09). No difference in survival to hospital discharge (p=0.23).	

Reviewer Comments: New evidence has been identified with conflicting conclusions. There is an ILCOR systematic review focusing on naloxone in ALS where the paper concludes that there is no evidence to support specific opioid toxicity treatments in ALS. Strong et al. suggest that there could be a role for naloxone in non-shockable cardiac arrest but larger studies are needed. Quinn et al. do not support naloxone in out of hospital cardiac arrest. In terms of first aid, and the difficulties posed to the first aider in recognising true cardiac arrest in the presumed opioid overdoses, the evidence here is unlikely to change current recommendations.

Reference list:

Quinn E, Murphy E, Du Pont D, Comber P, Blood M, Shah A, Kuc A, Hunter K, Carroll G. Outcomes of Out-of-Hospital Cardiac Arrest Patients Who Received Naloxone in an Emergency Medical Services System With a High Prevalence Of Opioid Overdose.The Journal of emergency medicine. 2024;.Volume 67, Issue 3, pp. e249-e258

Strong NH, Daya MR, Neth MR, Noble M, Sahni R, Jui J, Lupton JR. The association of early naloxone use with outcomes in non-shockable out-of-hospital cardiac arrest.Resuscitation. 2024; Volume 201, Issue , pp. 110263

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2026 Evidence Update

FA 7333 – Tourniquet Types in the Pediatric Population

Worksheet author(s): Jen Heng Pek, Nathan P Charlton
Task Force: First Aid
Date Submitted to SAC rep for peer review and approval: 2025-10-26
SAC rep: Therese Djarv

PICOST / Research Question:
Population: Children (less than 18 years of age) with severe, life-threatening external bleeding from an extremity
Intervention: Commercial elastic wrap tourniquet or commercial ratcheting tourniquet
Comparator: Commercial windlass-type tourniquet
Outcomes: Critical – mortality, control of bleeding; Important – blood loss, shock, hypotension, adverse events
Study Designs: Randomized controlled trials (RCTs), non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies), case series (n>20), systematic reviews and guideline publications.
Timeframe: All years and all languages were included if an English abstract was present.

Year of last full review: 2021

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:

We suggest the use of a manufactured windlass tourniquet for the management of life-threatening extremity bleeding in children. (weak recommendation, very low certainty of evidence)

We are unable to recommend for or against other tourniquet types in children due to lack of evidence.

For infants and children with extremities that are too small to allow the snug application of a tourniquet before activating the circumferential tightening mechanism, we recommend the use of direct manual pressure with or without the application of a hemostatic trauma dressing. (Good practice statement)

Technical remarks:
- In both studies included, the Combat Application Tourniquet Generation 7 was the specific brand of windlass rod tourniquet used.
- The included studies evaluated tourniquet use on children from 2 years to 16 years of age with a minimal limb circumference of 13 cm.
- For the purpose of this review, the pediatric age of 18 and younger was chosen by the First Aid and Pediatric Life SupportTask Forces and is the same as used in a previous scoping review by ILCOR.

Databases searched: Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews, Embase (Embase.com)
Time Frame: updated from end of last search: 1 January 2020 to 27 September 2025
Date Search Completed: 28 September 2025
Search Results:
Number of articles identified: 40 from Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews and 185 from Embase
Number of articles identified as relevant: 4

Summary of Evidence Update:
Since the last search done for the ILCOR systematic reviews (Charlton 2020 235 and Charlton 2021 e14474), one other systematic review,

one guideline and two observational studies were identified.
The systematic review (Starets 2025 116) and guideline (Russell 2023 S2) support the 2021 CoSTR recommendation to use a tourniquet for the management of life-threatening extremity bleeding in children. In addition, there were recommendations to consider pediatric anatomical and physiological differences, and tactical realities (Starets 2025 116), as well as training individuals (Russell 2023 S2).
One observational study (Feeney 2025 162494) reported no mortality and suggested an acceptable safety profile as there were no instances of safety outcomes including acute kidney injury, rhabdomyolysis, nerve injury, compartment syndrome, or amputation. Another observational study (Martino 2025 161955) reported early tourniquet placement, prior to EMS transport arrival, was associated with increased acuity – placement by bystanders and first responders was associated with improved acuity when adjusted for factors such as injury severity and EMS arrival time.

Relevant Guidelines or Systematic Reviews

Organization (if relevant); Author; Year Published	**Guideline or systematic review**	**Topic addressed or PICO(S)T**	**Number of articles identified**	**Key findings**	**Treatment recommendations**
Pediatric Traumatic Hemorrhage Shock Consensus Conference Russell 2023	Guideline	Use of tourniquets in pediatric traumatic hemorrhagic shock	6 – 4 from military, 2 from civilian	Studies showed decreased crystalloid administration, decreased transfusion requirements, and a survival advantage for children treated with tourniquets, particularly when applied before the onset of shock. There were no significant complications from tourniquet use.	In traumatically injured children with exsanguinating extremity hemorrhage, we recommend the use of commercially available tourniquets by individuals with training.
Starets 2025	Systematic review (Full text in Ukrainian, abstract in English)	Use of tourniquets in children of various age groups in prehospital settings	8 articles (evaluated different commercial tourniquet models on simulation models and in clinical scenarios)	Findings indicate tourniquet effectiveness is highly dependent on the child's age, limb circumference and device type.	Findings support the integration of tourniquets into pediatric trauma protocols by accounting for pediatric anatomical and physiological differences, as well as tactical realities. No further details of outcomes in PICOST.

RCT: none

Nonrandomized Trials, Observational Studies:

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**

Feeney 2025	Study Type: Retrospective cohort study (N=37 but 51 tourniquets placed, median age 14 years, 72% male)	Inclusion Criteria: Patients less than 18 years with acute traumatic limb injury and tourniquet placed from a level 1 pediatric trauma centre between 2015 and 2022	1° endpoint: 47 placed by first responders to the scene, 4 placed at hospital 12/24 in shock at scene of injury, 7/37 in shock on hospital arrival No in-hospital mortality and no instances of safety outcomes including acute kidney injury, rhabdomyolysis, nerve injury, compartment syndrome, or amputation	There were no instances of mortality or adverse events observed, suggesting an acceptable safety profile of tourniquet use in children. There was no mention on type of tourniquet. Although data on shock was available, it was inadequate to comment on tourniquet application on this outcome.
Martino 2025	Study Type: Retrospective cohort study (N=301, median age 17 years, 86.7% males)	Inclusion Criteria: Patients aged 0-19 years from the National EMS Information Systems database who received tourniquet application either by bystanders or EMS providers from 2017 to 2020	1° endpoint: 187 placed before EMS arrival, 105 placed afterward Acuity at EMS arrival was significantly different (p=0.002) as patients with tourniquet placed before EMS arrival less commonly of critical acuity (18.1% vs 36.3%) Acuity at ED arrival was significantly different (p<0.0001) with lower percentage of patients with tourniquet placed before EMS arrival having critical acuity (21.0% vs 35.2%). The improvement in acuity after tourniquet placement was not significantly different between groups (p=0.22). There was no difference between groups in proportion of patients transported to a trauma centre (before: 38.5% vs after 33.3%, p=0.67)	Tourniquets placement by EMS, bystanders and first responders is effective for pediatric patients in civilian setting. Early tourniquet placement, prior to EMS transport arrival, was associated with increased acuity. Additionally, placement by bystanders and first responders was associated with improved acuity when adjusted for factors such as injury severity and EMS arrival time. There was no mention on type of tourniquet. Although not direct outcomes of PICOST, acuity and transport to a trauma centre can be considered surrogate outcomes for control of bleeding, blood

			Tourniquet placement prior to EMS transport arrival was associated with decrease in initial acuity (OR 0.84, 95% CI 0.76-0.94, p=0.003). Tourniquet placement by bystanders and first responders after transport arrival was associated with improved acuity (OR 1.90, 95% CI 1.06-3.41, p=0.03). Failure of tourniquet placement was associated with decreased odds of improved acuity (OR 0.62, 95% CI 0.44-0.86, p=0.005).	loss, shock and hypotension.

Reviewer Comments:

Two additional observational studies (Feeney 2025 162494 and Martino 2025 161955) were identified in this evidence update. Both studies support the ability of tourniquets to reduce morbidity and mortality in the pediatric population, but neither evaluated the specific type of tourniquet used. Similarly, a systematic review (Starets 2025 116) supported the use of tourniquets in the pediatric population, but also did not specifically mention the type of tourniquet. Together, these articles further support the prior ILCOR recommendation that tourniquets can be used in the management of pediatric patients with life-threatening extremity hemorrhage. However, data regarding the most appropriate tourniquet type in pediatrics is still limited. Therefore, an update of the 2021 systematic review is currently not warranted.

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Charlton NP, Swain JM, Brozek JL, et al. Control of severe, life-threatening external bleeding in the out-of-hospital setting: A systematic review. Prehospital Emergency Care. 2021;25:(2),235-267. doi:10.1080/10903127.2020.1743801

Charlton NP, Goolsby CA, Zideman DA, et al. Appropriate tourniquet types in the pediatric population: A systematic review. Cureus. 2021;13(4):e14474. doi:10.7759/cureus.14474

Feeney EV, Harris MR, Furman LM, et al. Pediatric Tourniquet Use: Safe and effective. J Pediatr Surg. 2025;60(10):162494. doi:10.1016/j.jpedsurg.2025.162494

Martino AM, Giron A, Schomberg J, et al. Pre-hospital tourniquet use in adolescent and pediatric traumatic hemorrhage: A National Study. J Pediatr Surg. 2025;60(1):161955. doi:10.1016/j.jpedsurg.2024.161955

Russell RT, Esparaz JR, Beckwith MA, et al. Pediatric traumatic hemorrhagic shock consensus conference recommendations. J Trauma Acute Care Surg. 2023;94(1S Suppl 1):S2-S10. doi:10.1097/TA.0000000000003805

Starets OO, Khimenko TM, Vielikova MD, et al. Approaches to providing first aid to children with massive bleeding from the extremities: regulatory framework and world experience. Modern Pediatrics. Ukraine. 2025;4(148):116-127. doi:10.15574/SP.2025.4(148).116127

2026 Evidence Update

FA 7371 – Duration of Cooling for Burns

Worksheet author(s): Jen Heng Pek, Jorien Laermans, Therese Djärv
Task Force: First Aid

PICOST / Research Question:

Population: Adults and children in first aid settings with a thermal burn

Intervention: Active cooling using running water for 20 minutes or more as an immediate first aid intervention

Comparator: Active cooling using running water for any other duration as an immediate first aid intervention

Outcomes: Size of burn, defined as percentage of total body surface area at any reported time point; depth of burn, defined as any degree of deep partial or full thickness burn depth; pain, defined as any measurement of pain or administration of pain relief medications; adverse outcomes, defined as any adverse outcome, including hypothermia; wound healing, defined as time to re-epithelization in days; and complications within 24 hours, defined as organ dysfunction, ICU care, infections (within 7 days), bleeding, and rhabdomyolysis as well as the need for surgical procedures such as skin grafting, fasciotomy, or escharotomy

Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies), case series (n>20), systematic reviews and guideline publications

Timeframe: All years and all languages were included if an English abstract was present.

Year of last full review: 2021

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:

We recommend the immediate active cooling of thermal burns using running water as a first aid intervention for adults and children (strong recommendation, very low certainty evidence).

Because no difference in outcomes could be demonstrated with the different cooling durations studied, a specific duration of cooling cannot be recommended.

Young children with thermal burns that are being actively cooled with running water should be monitored for signs and/or symptoms of excessive body cooling (Good Practice Statement).

Databases searched: Ovid MEDLINE(R) and Embase (Embase.com)
Time Frame: updated from end of last search: 1 January 2020 to 15 July 2025
Date Search Completed: 15 July 2025
Search Results:

Number of articles identified: 143 from MEDLINE(R) and 306 from Embase
Number of articles identified as relevant: 6

Summary of Evidence Update:

Since the last search done for the ILCOR systematic review (Djärv 2022 251), one other systematic review, two guidelines and two observational studies were identified.

The systematic review (Griffin 2022 367) and guidelines (Zideman 2021 270 and Ji 2024 tkad061) support the 2021 CoSTR recommendation to immediately use running water to actively cool thermal burns as a first aid intervention for adults and children. Both guidelines recommend cooling with running water for at least 20 minutes, and the systematic review concludes that *'There is considerable evidence to recommend 20 minutes of cool running water within three hours of injury as the fold standard of first aid for thermal burns'*. While this intervention is easily accessible (Griffin 2022 367), the ERC guidelines acknowledge that circumstances surrounding the injury may be challenging and limit its application, therefore urging for any cooling as opposed to no cooling (Zideman 2021 270).

In addition to young children, one observational study (Olawoye 2025 107357) suggested that adults should also be monitored for signs and/or symptoms of excessive body cooling based on the statistical significant finding of lower mortality

if water application was 5 minutes compared to more than 5 minutes, though age was identified as a confounder which was not addressed adequately, thus decreasing the certainty.
Another observational study (Qu 2023 869) reported outcomes of length of stay and hospitalization cost which had no difference when cooling for less than 20 minutes and cooling for 20 minutes or more, were compared to no first aid. However, these were not direct outcomes in the PICOST, thus decreasing the directness.

Relevant Guidelines or Systematic Reviews

Organization (if relevant); Author; Year Published	**Guideline or systematic review**	**Topic addressed or PICO(S)T**	**Number of articles identified**	**Key findings**	**Treatment recommendations**
ILCOR Djärv 2022 251	Systematic review	Among adults and children with thermal burn, does active cooling using running water as an immediate first aid intervention for 20 min or more, compared with active cooling using running water for any other duration, change the outcomes of burn size, burn depth, pain, adverse outcome (hypothermia) or complications?	4 articles (cohort studies); 5391 participants (3071 children and 2320 adults)	Children and adult: - No difference in size of burn and skin grafting between burns cooled for 20 minutes or more versus burns cooled less than 20 minutes Children: - Deep dermal depth was seen less among those whose burns were cooled for less than 20 minutes - No difference in wound healing and pain, but 5/29 (14%) developed hypothermia (34-35.9°C) or were visibly cold with shivering Adult: - Deep dermal depth was more common among those whose burns were cooled less than 20 minutes)	The published scientific evidence is inconclusive regarding the optimal duration for cooling of thermal burns with running water as a first aid intervention.
Griffin 2022 367	Systematic review	What effect does the application of cool running	7 articles (3 case-control studies, 3 cohort studies, 1 randomized controlled	Children and adult: - Decreased likelihood of skin grafting	There is considerable evidence to recommend 20 minutes of cool running water within three hours of injury as the gold

		water for 20 minutes within three hours of burn injury have on patient outcomes, and is it more effective than alternative remedies, or no cool running water?	trial); 11383 participants (3661 children and 7722 adults)	- No difference in outpatient visits Children: - Decreased likelihood of hospital admission, acquiring a full thickness burn depth at first dressing change and surgical intervention - Conflicting evidence for hospital length of and time to re-epithelisation Adult: - Reduction in burn depth within 21 days after injury, ICU length of stay and burn wound temperature - No difference for healing time (presumed re-epithelisation), ICU admission and mortality - Cool running water up to 19 min was associated with significant reduction in hospital length of stay but 20 min or greater did not yield significant decrease - Higher pain among patients who received cool running water compared to Burnshield	standard of first aid for thermal burns. Cool running water for 20 minutes as first aid is mostly accessible, simple and can be applied by conscious patients, bystanders and pre-hospital responders. International consensus is required.
ERC Zideman 2021 270	Guideline	Cooling of thermal burns	-	-	Recommendation: "For thermal burns, […] commence immediate cooling of the burn with cold or cool water for 20 minutes." The guideline acknowledges this may be challenging in practice

					in some instances and urges any cooling as opposed to no cooling as circumstances allow.
Chinese Burn Association Tissue Repair of Burns and Trauma Committee, Cross-Straits Medicine Exchange Association of China Ji 2024 tkad061	Guideline	Pre-hospital first aid for thermal burn wounds	-	-	Recommendations: "Start cooling as soon as possible after the burn, and it is recommended to start no later than 3 hours after the injury, with cooling duration of no less than 20 minutes or until the pain in the wound is adequately relieved (highly recommended, high level of evidence). For the mode and temperature of cooling, the use of running water (12-25°C) appropriate for the patient's body temperature is recommended for wounds (moderately recommended, moderate level of evidence)."

RCT: none

Nonrandomized Trials, Observational Studies:

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**
Qu 2023 869	Study Type: Retrospective cohort study (N=471, hydrothermal burns 42.7%, flame burns 28.2%, contact thermal burns 6.2%, burn impact injury 0.7%)	Inclusion Criteria: (1) Patients aged ≥60 years old; (2) hospitalized in the emergency department from January 2016 to December 2020, including patients who were cured and discharged and died; (3) the first diagnosis of hospitalization was burned, scald, chemical burn, electric burn, hot crush	1° endpoint: 66.3% of patients did not receive any immediate treatment. 12.2% of patients were treated with cold water to irrigate the burn site: - 86.9% had <20 min of irrigating time (10.6% of all patients) - 13.1% had ≥20 min of irrigating time (1.6% of all patients). - *Length of* stay: Compared to no first aid, there was no difference with <20 min cold water irrigation (standardized	The study authors do not discuss or make conclusions about the duration of irrigation with cold running water as first aid. [While the outcomes reported by this study were not that in the PICOST, these may be surrogates for size and depth of burn – larger and deeper likely longer length of stay, hospitalization cost and operation duration. However, this decreases the directness.]

		injury, or low-temperature scald; and (4) medical records were complete.	regression coefficient = -0.001, p=0.972), ≥20 min cold water irrigation (standardized regression coefficient = -0.027, p=0.386), and other first aid (standardized regression coefficient =-0.034, p=0.313). - *Hospitalization costs*: Compared to no first aid, there was no difference with cold water with 20 min cold water irrigation (standardized regression coefficient = -0.001, p=0.963), ≥20 min cold water irrigation (standardized regression coefficient = -0.012, p=0.552), and other first aid (standardized regression coefficient =0.003, p=0.891). - *Total operation duration*: data not reported	
Olawoye 2025 107357	<u>Study Type:</u> Prospective cohort study (N=335, flame 60%, scald 33.1%)	<u>Inclusion Criteria:</u> All burn injury patients admitted for inpatient care were included. The admission criteria included burn injury greater than or equal to 15 % total body surface area (TBSA), burn injuries in extremes of age, burn in special areas, as well as burn injuries requiring burn wound excision and grafting.	<u>1° endpoint:</u> 143 patients (53.2%) received cool water over the burn wound as first aid: 58.3% for 5 min, 13.7% for 10 min, 5.8% for 20 min, 0.7% for more than 20 min (in 21.6% water was used just to extinguish the flames). There was a statistically significant association between the duration of water application and the rate of wound infection (lower infection rates if water was applied for 5 min compared to more than 5 min; p=0.023) and mortality (lower mortality if water was applied for 5 min; p=0.001).	The authors state that, in the Nigerian context where burn extents are larger than in developed countries, water application of no more than 5 minutes will be more beneficial to maximize cooling effect of water while reducing hypothermia and its systemic effects. However, the study data show that the median age of patients receiving 5 min of cool water is 6 years, whereas the age in the other groups lies significantly higher (10 min: 21 years, 20 min: 19 years, only to extinguish flame: 35 years). There is thus a high risk of confounding that has not been addressed

				adequately, decreasing the certainty in the results of this study.

Reviewer Comments:

Although the optimal duration of cooling with running water was inconclusive in the 2022 ILCOR systematic review (Djärv 2022 251), two guidelines (Zideman 2021 270 and Ji 2024 tkad061) recommended at least 20 minutes of cooling with running water for first aid, and another systematic review (Griffin 2022 367) concluded that '*There is considerable evidence to recommend 20 minutes of cool running water within three hours of injury as the fold standard of first aid for thermal burns*'.

Of the two new observational studies, one did not discuss the duration of cold running water as first aid (and did not provide any data on one of the outcomes of interest, i.e. total operation duration; Qu 2023 869), and the other was limited to the Nigerian context and at high risk of residual confounding (Olawoye 2025 107357), making its findings insufficiently trustworthy.

Therefore, an update of the 2022 systematic review is currently not warranted.

Reference list:

Djärv T, Douma M, Palmieri T, et al. Duration of cooling with water for thermal burns as a first aid intervention: A systematic review. Burns. 2022;48(2):251-262. doi:10.1016/j.burns.2021.10.007

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Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. *Resuscitation*. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013