

## Supplementary materials: The Impact of Locked Cabinets for Automated External Defibrillators (AEDs) on Cardiac Arrest and AED Outcomes: A Scoping Review

### 1. Research Question based on PICOST (Population, Intervention, Control, Outcomes, Study design and Timeframe)

PICOST	Description (with recommended text)
Population	Adults and children in out-of-hospital settings
Concept	The benefits and harms of placing automatic external defibrillators (AEDs) in locked versus unlocked cabinets.
Outcomes	Any outcome, including AED outcomes (e.g. AED use, time to AED use, AED vandalism or theft)
Study Design	Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies), case series, and case reports are eligible for inclusion. Grey literature (Google search -first 20 pages), letters to the Editor and conference abstracts are also eligible for inclusion. All relevant publications in any language are included as long as there is an English abstract.
Timeframe	All years

### 2. Review Team

#### Nodal TF PICOST

Role	Name	Notes
*Lead Task Force Content Experts (1/2):	Gavin Perkins	(preferably TF members*)
*Lead Task Force Content Experts (2/2):	Chris Smith	(preferably TF members*)
*Lead Task Force Content Expert Mentee (1)	Lawrence Oonyu	<b>(ESR assigned PICOST only, preferably TF members*)</b>
*Nodal TF Content Expert(s)	TF assigned	(when more than one TF involved, 1 per nodal TF): (preferably TF members*)
*TF Reviewer as the lead	Janet Bray	(preferably TF members*)
^KSU or ESR (1)	n/a	(assigned by SAC)
^ESR Mentee (1)	n/a	(assigned by SAC from roster for <b>ESR assigned PICOST only</b> )
^SAC representative (1)	Theresa Olasveengen	(assigned by TF chair for TF review) (assigned by SAC for ESR or KSU)

### 3. Pre-existing PICOs Related to scope of work for this PICOST:

Insert all PICOs as worded on the master document and include PICOST number

Please add the categorization and prioritization ranking by lead TF and nodal TF of the PICOs listed above

(note: This information is available in the file: ILCOR PICO List on [ilcor.org](http://ilcor.org)).

None. New Review

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4. **Definitions:** *(This should include definitions of all the relevant terms identified in the PICOST and in the body of literature related to this topic identified during task force discussion)*

A locked AED cabinet is defined as AED housing that is locked but accessible to the public via instructions on the cabinet (e.g. AED cabinet with an access code with instructions on how to access the code). The accessibility of AEDs in locked buildings will not be included.

5. **Background and Rationale for this PICOST: This section feeds directly into the introduction of the manuscript or speaks to the importance of the scope of work (Evidence Update)**

Out-of-hospital cardiac arrest (OHCA) outcomes remain poor, with most reported survival rates in treated patients less than 10%.<sup>1</sup> Rapid defibrillation is critical to improving patient outcomes, as each minute of delay in attempting defibrillation reduces the chances of survival and good functional outcomes.<sup>2,3</sup> Automated external defibrillators (AEDs) are portable, easy-to-use devices intended for use by laypersons and first responders. Patients who receive defibrillation from bystanders have the greatest chance of survival<sup>4</sup>, yet public rates of AED use are usually below 3%.<sup>1</sup> Ensuring AED accessibility to rescuers is essential for maximising their effectiveness, with a study in Denmark showing a tripling of bystander defibrillation and an almost doubling of survival when the nearest AED was accessible at the time of OHCA.<sup>5</sup>

Ensuring an AED's accessibility and 24/7 availability during emergencies poses significant challenges.<sup>6-10</sup> Concerns about theft, vandalism, and misuse of AEDs have led to the implementation of security measures, including the use of locked cabinets to house these devices in public areas.<sup>11-13</sup> Field visits to AED locations, as recorded in registries or apps, have shown high proportions of AEDs in key-locked cabinets in some regions.<sup>14</sup> While locked cabinets aim to protect AEDs, they may also cause delays in AED access during emergencies.

6. **Notes:** *(the nuances and subtleties of the task force discussion; it is important to include anything that doesn't fit in any other PICOST section but the task force feels this information is contributory to the question)* If it is anticipated by CEs and task force that there will be insufficient direct evidence, and indirect evidence will be used to answer the question the CE or Taskforce needs to document clearly what they mean by indirect and confirm indirect evidence exists.

A preliminary search did not identify any studies comparing locked and unlocked AED cabinets. Case series of adverse events and studies without comparators were found.

7. **Task Force Suggested Outcomes:** *(These may be updated/modified after the Systematic Review search is performed and the total number of **critical or important outcomes should be no more than 7**. This does not apply to Scoping Reviews which by definition map the evidence and reported outcomes. For both consistency in messaging and in approach, it is recommended to report on survival (and morbidity-free survival) preferentially over death (and death and/or disability), where the data in the literature allows this approach.*

All reported outcomes will be accepted.

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8. **Key recent studies:** (*sentinel papers that are appropriate to answer this PICO. Please insert full references*)

Peberdy MA, Ottingham LV, Groh WJ, Hedges J, Terndrup TE, Pirrallo RG, Mann NC, Sehra R, Investigators PAD. Adverse events associated with lay emergency response programs: the public access defibrillation trial experience. *Resuscitation*. 2006;70:59-65. doi: 10.1016/j.resuscitation.2005.10.030

Salerno J, Willson C, Weiss L, Salcido D. Myth of the stolen AED. *Resuscitation*. 2019;140:1. doi: 10.1016/j.resuscitation.2019.04.036

Page G, Bray J. Unlocking the key to increasing survival from out-of-hospital cardiac arrest; 24/7 accessible AEDs. *Resuscitation* 2024. doi: 10.1016/j.resuscitation.2024.110227

Cheema K, O'Connell D, Herz N, Adebayo A, Thorpe J, Benson-Clarke A, Perkins G. The influence of locked automated external defibrillators (AEDs) cabinets on the rates of vandalism and theft. *Resuscitation*. 2022;175:S80. doi: 10.1016/S0300-9572(22)00530-5

9. **Recent systematic reviews:** (*directly or indirectly addressing this PICOST. Please insert full references*)

Smith CM, Lim Choi Keung SN, Khan MO, Arvanitis TN, Fothergill R, Hartley-Sharpe C, Wilson MH, Perkins GD. Barriers and facilitators to public access defibrillation in out-of-hospital cardiac arrest: a systematic review. *Eur Heart J Qual Care Clin Outcomes*. 2017;3:264-273. doi: 10.1093/ehjqcco/qcx023

10. **Review for ongoing clinical trials or unpublished work** (*Use recommend links below*):

1. International Clinical Trials Registry Platform ([www.who.int/ictrp/en/](http://www.who.int/ictrp/en/))
2. US clinical trials registry ([www.clinicaltrials.gov](http://www.clinicaltrials.gov))
3. Cochrane CENTRAL (<http://www.cochranelibrary.com/about/central-landing-page.html>)

n/a

11. **List A priori Subgroup analyses:** (*applies to systematic reviews only and defined a priori based on expert opinion. Note: number of comparator tables in systematic review = no. of outcomes x no. of comparison x no. of subgroup, consider focusing **absolute essential subgroups only**. If paediatrics or neonatal TF are involved a neonatal and/or a paediatrics specific subgroup analysis is required*).

n/a

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### 12. Is there an existing detailed prior search strategy developed by an Information Specialist?

Yes  or No

If yes, what year and give reference to the published search strategy or if not published attach the prior search strategy to this PICOST

### 13. If no prior search, suggested specific search terms/keywords

"Automated External Defibrillator", "AED", "Locked cabinet", "Public access defibrillation", "Emergency response", "Sudden cardiac arrest".

### 14. Anticipated Workload (required to guide volume of work estimate for ESR/KSU allocation only):

Approximate number of abstracts to screen based on published SRs or prior ILCOR work	N=unknown
Approximate number of full manuscripts to review based on published SRs or prior ILCOR work	N= unknown

### 15. Target Peer Reviewed Journals for Publication (Required for ESR/KSU allocation only. This is optional for Task Force SRs and Scoping Reviews and not applicable to Evidence Updates.)

1. First choice journal	<b>Resuscitation Plus</b>
2. Second choice	
3. Third choice	

### 16. References (list references cited by author, year, first page in the Background and Rational)

1. Nishiyama C, Kiguchi T, Okubo M, Alihodzic H, Al-Araji R, Baldi E, Beganton F, Booth S, Bray J, Christensen E, et al. Three-year trends in out-of-hospital cardiac arrest across the world: Second report from the International Liaison Committee on Resuscitation (ILCOR). *Resuscitation*. 2023;186:109757. doi: 10.1016/j.resuscitation.2023.109757
2. Drennan IR, Lin S, Thorpe KE, Morrison LJ. The effect of time to defibrillation and targeted temperature management on functional survival after out-of-hospital cardiac arrest. *Resuscitation*. 2014;85:1623-1628. doi: 10.1016/j.resuscitation.2014.07.010
3. De Maio VJ, Stiell IG, Wells GA, Spaite DW. Optimal defibrillation response intervals for maximum out-of-hospital cardiac arrest survival rates. *Annals of Emergency Medicine*. 2003;42:242-250. doi: <https://doi.org/10.1067/mem.2003.266>
4. Nehme Z, Andrew E, Bernard S, Haskins B, Smith K. Trends in survival from out-of-hospital cardiac arrests defibrillated by paramedics, first responders and bystanders. *Resuscitation*. 2019;143:85-91. doi: 10.1016/j.resuscitation.2019.08.018
5. Karlsson L, Malta Hansen C, Wissenberg M, Møller Hansen S, Lippert FK, Rajan S, Kragholm K, Møller SG, Bach Søndergaard K, Gislason GH, et al. Automated external defibrillator accessibility is crucial for bystander defibrillation and survival: A registry-based study. *Resuscitation*. 2019;136:30-37. doi: 10.1016/j.resuscitation.2019.01.014
6. Smith CM, Griffiths F, Fothergill RT, Vlaev I, Perkins GD. Identifying and overcoming barriers to automated external defibrillator use by GoodSAM volunteer first responders in out-of-hospital cardiac arrest using the Theoretical Domains Framework and Behaviour Change Wheel: a qualitative study. *BMJ Open*. 2020;10:e034908. doi: 10.1136/bmjopen-2019-034908

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7. Brooks SC, Clegg GR, Bray J, Deakin CD, Perkins GD, Ringh M, Smith CM, Link MS, Merchant RM, Pezo-Morales J, et al. Optimizing outcomes after out-of-hospital cardiac arrest with innovative approaches to public-access defibrillation: A scientific statement from the International Liaison Committee on Resuscitation. *Resuscitation*. 2022;172:204-228. doi: 10.1016/j.resuscitation.2021.11.032

8. Brooks SC, Clegg GR, Bray J, Deakin CD, Perkins GD, Ringh M, Smith CM, Link MS, Merchant RM, Pezo-Morales J, et al. Optimizing outcomes after out-of-hospital cardiac arrest with innovative approaches to public-access defibrillation: A scientific statement from the International Liaison Committee on Resuscitation. *Resuscitation*. 2022;172:204-228. doi: 10.1016/j.resuscitation.2021.11.032

9. Smith CM, Lim Choi Keung SN, Khan MO, Arvanitis TN, Fothergill R, Hartley-Sharpe C, Wilson MH, Perkins GD. Barriers and facilitators to public access defibrillation in out-of-hospital cardiac arrest: a systematic review. *Eur Heart J Qual Care Clin Outcomes*. 2017;3:264-273. doi: 10.1093/ehjqcco/qcx023

10. Dainty KN, Yng Ng Y, Pin Pek P, Koster RW, Eng Hock Ong M. Wolf creek XVII part 4: Amplifying lay-rescuer response. *Resusc Plus*. 2024;17:100547. doi: 10.1016/j.resplu.2023.100547

11. O'Callaghan PA, Swampillai J, Stiles MK. Availability of automated external defibrillators in Hamilton, New Zealand. *N Z Med J*. 2019;132:75-82.

12. Lac D, Wolters MK, Leung KHB, MacInnes L, Clegg GR. Factors affecting public access defibrillator placement decisions in the United Kingdom: A survey study. *Resusc Plus*. 2023;13:100348. doi: 10.1016/j.resplu.2022.100348

13. Fortington LV, Bekker S, Finch CF. Integrating and maintaining automated external defibrillators and emergency planning in community sport settings: a qualitative case study. *Emerg Med J*. 2020;37:617-622. doi: 10.1136/emermed-2019-208781

14. Zhang L, Li B, Zhao X, Zhang Y, Deng Y, Zhao A, Li W, Dong X, Zheng ZJ. Public access of automated external defibrillators in a metropolitan city of China. *Resuscitation*. 2019;140:120-126. doi: 10.1016/j.resuscitation.2019.05.015

**17. Confirmation of approval steps (completed by SAC)**

Steps	Insert Date (day/month/year)
Submission to SAC chair	Completed by SAC
Approved by SAC (KSU or ESR)	Completed by SAC
Acknowledged by SAC chair (TF Systematic or Scoping Review and Evidence Update)	Completed by SAC

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### Ovid MEDLINE(R) Search Strategy

1	Defibrillators/
2	Automated External Defibrillat*.mp.
3	(AED or AEDs).mp.
4	1 or 2 or 3
5	Architectural Accessibility/
6	crime/ or theft/
7	(vandalis* or theft* or stolen).mp.
8	5 or 6 or 7
9	4 and 8
10	(public adj (location* or access* or place* or setting*)).mp.
11	((place* or location* or locate* or setting* or cabinet*) adj5 (access* or inaccess* or lock* or unlock* or barrier*)).mp.
12	10 or 11
13	4 and 12
14	((Automated External Defibrillat* or AED or AEDs) adj4 (availab* or unavailab* or inaccessib* or accessib* or Lock* or Unlock* or barrier* or difficult* or impeded* or hinder or hindrance* or obstruct* or facilitat* or enabl* or help* or aid* or assist*)).mp.
15	14 not epilep*.mp.
16	Public access defibrillat*.mp.
17	public automated external defibrillator*.mp.
18	9 or 13 or 15 or 16 or 17