Appendix B

Education, Implementation, and Teams – 2025 Evidence Updates
TABLE OF CONTENTS

2025 Evidence Update
EIT 6102 – Disparity in Layperson Resuscitation Education

Worksheet Author(s): Ying-Chih Ko; Evidence Reviewers: Ming-Ju Hsieh, Robert Greif
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: 12 January 2024
SAC Representative: Joyce Yeung
Conflicts of Interest: none

PICOST / Research Question:
Population: Laypersons (non-health care professional)
Intervention (Exposure): Presence of any specific factor
Comparators: Absence of the specific factor
Outcomes: Likelihood of undertaking resuscitation education, including adult/pediatric basic life support (BLS), and neonatal resuscitation program.
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 Unpublished studies (e.g., conference abstracts, trial protocols), letters, editorials, comments, case reports are excluded. All relevant publications in any language are included as long as there is an English abstract.
Timeframe: All years and all languages are included as long as there is an English abstract or translation available after last update.

Year of last full review: Dec 2022
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST: There was no prior treatment recommendation addressing disparities in layperson resuscitation education. This scoping review has not identified sufficient evidence to prompt a systematic review or a meta-analysis. However, on the basis of expert opinion from the ILCOR EIT Task Force, significant gaps in knowledge and open research questions were highlighted, specifically to include under-resourced populations.

Current Search Strategy:
PubMed:
("laypeople*"[Title/Abstract] OR "layperson*"[Title/Abstract] OR "bystander*"[Title/Abstract] OR "communit*"[Title/Abstract]) AND ("healthcare disparities"[MeSH Terms] OR "healthcare disparities"[All Fields] OR "healthcare disparity"[All Fields] OR ("sex factors"[MeSH Terms] OR "sex factors"[All Fields] OR "gender"[All Fields]) OR ("risk factors"[MeSH Terms] OR "risk factors"[All Fields]) OR ("socioeconomic factors"[MeSH Terms] OR "socioeconomic factors"[All Fields] OR "socioeconomics"[All Fields] OR "socioeconomic"[All Fields]) OR ("Race Factors"[MeSH Terms] OR "race"[All Fields] OR "racial"[All Fields] OR "ethnic"[All Fields]) OR ("disabilities"[All Fields] OR "disability"[All Fields] OR "disabled persons"[MeSH Terms] OR "disabled persons"[All Fields] OR "disabled"[All Fields]) OR ("educates"[All Fields] OR "education"[All Fields] OR "educational status"[MeSH Terms] OR "educational status"[All Fields] OR "education"[MeSH Terms] OR "education s"[All Fields] OR "teaching"[MeSH Terms] OR "teaching"[All Fields] OR "educate"[All Fields] OR "educated"[All Fields] OR "educating"[All Fields] OR "educations"[All Fields]) OR ("wealth"[All Fields] OR "wealths"[All Fields]) OR ("income"[MeSH Terms] OR "income"[All Fields] OR "incomes"[All Fields]) OR ("language"[MeSH Terms] OR "language"[All Fields] OR "languages"[All Fields] OR "language's"[All Fields]) OR "barrier*"[All Fields] OR "facilitator*"[All Fields] OR ("age factors"[MeSH Terms] OR "age factors"[All Fields]) OR ("communication barriers"[MeSH Terms] OR "communication barriers"[All Fields]) OR ("disparities"[All Fields] OR "disparity"[All Fields]) OR ("demographic factors"[All Fields] OR "demographic variables"[All Fields]) OR (("geographic"[All Fields] OR "geographical"[All Fields] OR "geographically"[All Fields] OR "geographics"[All Fields]) AND ("disparities"[All Fields] OR "disparity"[All Fields])) OR "Individual factors"[All Fields] OR ("neighborhood characteristics"[MeSH Terms] OR "neighborhood characteristics"[All Fields]) OR ("residence characteristics"[MeSH Terms] OR "residence characteristics"[All Fields]) OR "regional variation"[All Fields] OR ("social class"[MeSH Terms] OR "social class"[All Fields])) OR ("religion"[MeSH Terms] OR "religion"[All Fields] OR "religions"[All Fields] OR "religion s"[All Fields]) AND ("CPR"[All Fields] OR "BCPR"[All Fields] OR "BLS"[All Fields] OR "AED"[All Fields] OR "OHCA"[All Fields] OR ("cardiopulmonary resuscitation"[MeSH Terms] OR "cardiopulmonary resuscitation"[All Fields]) OR "Basic life support"[All Fields] OR "Neonatal resuscitation"[All Fields] OR ("defibrillators"[MeSH Terms] OR "defibrillators"[All Fields] OR "automated external defibrillators"[All Fields] OR "automated external defibrillator"[All Fields]) OR ("resuscitate"[All Fields] OR "resuscitated"[All Fields] OR "resuscitation"[MeSH Terms] OR "resuscitation"[All Fields] OR "resuscitations"[All Fields]) OR ("out of hospital cardiac arrest"[MeSH Terms] OR "out of hospital cardiac arrest"[All Fields])) AND ("certificate"[All Fields] OR "certification"[MeSH Terms] OR "certification"[All Fields] OR "certifications"[All Fields] OR "certified"[All Fields] OR "certify"[All Fields] OR ("training"[All Fields] OR "education"[MeSH Terms] OR "train"[All Fields] OR "trained"[All Fields] OR "trainings"[All Fields] OR "trains"[All Fields]) OR ("educates"[All Fields] OR "education"[All Fields] OR "education"[MeSH Terms] OR "teaching"[MeSH Terms] OR "teaching"[All Fields] OR "educate"[All Fields]

OR "educated"[All Fields] OR "educating"[All Fields] OR "educations"[All Fields]) OR ("course"[All Fields] OR "courses"[All Fields]) OR ("learning"[MeSH Terms] OR "learn*"[All Fields]))

EMBASE:

('layperson'/exp OR 'lay people':ti,ab,kw OR 'lay person':ti,ab,kw OR 'lay persons':ti,ab,kw OR 'laypeople':ti,ab,kw OR 'layperson':ti,ab,kw OR 'laypersons':ti,ab,kw OR 'bystander'/exp OR bystander:ti,ab OR bystanders:ti,ab OR 'community'/exp OR 'community':ti,ab,kw OR communit*:ti,ab) AND ('health care disparity'/exp OR 'health care disparities' OR 'health care disparity' OR 'healthcare disparities' OR 'healthcare disparity' OR 'sex factor'/exp OR 'sex factor' OR 'sex factors' OR 'gender'/exp OR 'gender' OR 'risk factor'/exp OR 'risk factor' OR 'risk factors' OR 'socioeconomics'/exp OR 'social economic aspect' OR 'social economics' OR 'social-economic factor' OR 'socio-economic aspect' OR 'socio-economic factor' OR 'socio-economics' OR 'socioeconomic aspect' OR 'socioeconomic factor' OR 'socioeconomic factors' OR 'socioeconomics' OR socioeconomic OR 'race'/exp OR 'race' OR 'race factors' OR 'racial factor' OR 'racial factors' OR racial OR 'ethnic or racial aspects'/exp OR 'ethnic or racial aspects' OR ethnic OR 'disability'/exp OR 'disability' OR 'disablement' OR disabilities OR 'disabled person'/exp OR 'disabled' OR 'disabled person' OR 'disabled persons' OR 'people with disabilities' OR 'people with disability' OR 'person with disability' OR 'persons with disabilities' OR 'education'/exp OR 'education' OR 'education, nonprofessional' OR 'training support' OR educates OR 'educational status'/exp OR 'educational status' OR 'teaching'/exp OR 'teaching' OR educate OR educated OR educating OR educations OR 'wealth'/exp OR wealth OR wealths OR 'income'/exp OR 'income' OR incomes OR 'language'/exp OR 'language' OR languages OR 'barrier'/exp OR barrier OR barriers OR 'barriers'/exp OR 'facilitator'/exp OR facilitator OR facilitators OR 'age factors' OR 'communication barrier'/exp OR 'communication barrier' OR 'communication barriers' OR 'language barrier' OR 'disparity'/exp OR disparity OR 'disparities'/exp OR disparities OR 'demographic factors'/exp OR 'demographic factors' OR 'demographic variables' OR 'geographic disparity'/exp OR 'geographic disparity' OR 'geographic disparities' OR 'individual factors' OR 'neighborhood characteristic'/exp OR 'neighborhood characteristic' OR 'neighborhood characteristics' OR 'neighbourhood characteristic' OR 'residence characteristics'/exp OR 'place of residence' OR 'residence characteristics' OR 'residential characteristics' OR 'residential place' OR 'regional variation'/exp OR 'regional variation' OR 'social class'/exp OR 'class, social' OR 'social class' OR 'sociocultural class' OR 'socioeconomic class' OR 'religion') AND (cpr OR bcpr OR bls OR aed OR ohca OR 'resuscitation'/exp OR 'bystander cpr' OR 'bystander-initiated cpr' OR 'cardio pulmonary resuscitation' OR 'cardiopulmonary resuscitation' OR 'chest compression' OR 'resuscitation' OR 'basic life support'/exp OR 'basic life support' OR 'neonatal resuscitation' OR 'defibrillator'/exp OR 'defibrillator' OR 'defibrillators' OR 'automated external defibrillator'/exp OR 'automated external defibrillator' OR 'automated external defibrillators' OR resuscitate OR resuscitated OR resuscitations OR 'out of hospital cardiac arrest'/exp OR 'ohca' OR 'out of hospital cardiac arrest' OR 'out of hospital cardiac arrests' OR 'out of hospital cardiopulmonary arrest' OR 'out of hospital cardiopulmonary arrests' OR 'out of hospital heart arrest' OR 'out-of-hospital cardiac arrest') AND ('certification'/exp OR 'certification' OR certificate OR certifications OR certified OR certify OR 'training'/exp OR 'training' OR 'training course' OR 'training program' OR 'training programme' OR train OR trained OR trainings OR trains OR 'education'/exp OR 'education' OR 'education, nonprofessional' OR 'training support' OR educates OR 'teaching'/exp OR educate OR educated OR educating OR educations OR course OR courses OR 'learning'/exp OR 'learning' OR learn*) AND [embase]/lim

CINAHL:

((TX laypeople*) OR (TX layperson*) OR (TX bystander*) OR (TX communit*) OR (MH communities)) AND ((MH healthcare disparities) OR (TX ("healthcare disparities" OR "healthcare disparity")) OR (MH sex factors) OR (TX (sex AND factors)) OR (TX gender) OR (MH risk factors) OR (TX "risk factors") OR (MH socioeconomic factors) OR (TX ("socioeconomic factors" OR socioeconomics OR socioeconomic)) OR (MH race factors) OR (TX (race OR racial OR ethnic)) OR (TX ((disability OR disabilities OR disabled))) OR (MH "Persons with Disabilities") OR (MH education) OR (TX (educates OR education OR ("educational status" AND or educate) OR educated OR educating OR (educations AND or teaching))) OR (MH teaching) OR (TX ((wealth OR wealths))) OR (MH income) OR (TX (income OR incomes)) OR ((MH language) AND ORS27) OR (TX barrier*) OR (TX facilitator*) OR (MH age factors) OR (TX "age factors") OR (MH communication barriers) OR (TX "communication barriers") OR (TX (disparities OR disparity)) OR (TX ("demographic factors" OR "demographic variables")) OR (TX "geographic disparities") OR (TX "individual factors") OR (MH neighborhood characteristics) OR (TX "neighborhood characteristics") OR (MH residence characteristics) OR (TX "residence characteristics") OR (TX "regional variation") OR (MH social class) OR (TX "social class") OR (TX"religion")) AND ((TX (CPR OR BCPR OR BLS OR AED OR OHCA)) OR ((MH "Resuscitation, Cardiopulmonary")) OR (TX "cardiopulmonary resuscitation") OR (TX "basic life support") OR (TX "Neonatal resuscitation") OR (MH defibrillators) OR ((MH "Defibrillators, Automated External")) OR (TX ("defibrillators" or "automated external defibrillators" or "automated external defibrillator")) OR (MH resuscitation) OR (TX ("resuscitation" or "resuscitations" or"resuscitate" or "resuscitated") OR (TX "out of hospital cardiac arrest")) AND ((TX (certificate or certification or certifications or certified or certify) OR (MH certification) OR (MH education) OR (TX (training or train or trained or trainings or trains)) OR (TX (educates or education or teaching or educate or educated or educating or educations)) OR (MH teaching) OR (TX (course or courses)) OR (MH learning) OR (TX learn*))

Cochrane:

#1   (laypeople)
#2   (layperson or laypersons)

#3   (bystander or bystanders)
#4   communit*
#5   #1 or #2 or #3 or #4
#6   MeSH descriptor: [Healthcare Disparities] 2 tree(s) exploded
#7   (("healthcare disparities") or ("healthcare disparity"))
#8   MeSH descriptor: [Sex Factors] explode all trees
#9   ("sex factors" or "gender")
#10   MeSH descriptor: [Risk Factors] explode all trees
#11   ("risk-factor" or "risk factors")
#12   MeSH descriptor: [Socioeconomic Factors] explode all trees
#13   ("socioeconomic factors" or "socioeconomics" or "socioeconomic")
#14   MeSH descriptor: [Race Factors] explode all trees
#15   ("Race Factors" or race or racial or ethnic)
#16   (disability or disabilities or "disabled persons" or disabled)
#17   MeSH descriptor: [Disabled Persons] explode all trees
#18   MeSH descriptor: [Education] explode all trees
#19   MeSH descriptor: [Educational Status] explode all trees
#20   MeSH descriptor: [Teaching] explode all trees
#21   ("educates" or "education" or "educational status" or "education's" or "teaching" or "educate" or "educated" or "educating" or "educations")
#22   ("wealth" or "wealths")
#23   MeSH descriptor: [Income] explode all trees
#24   ("income" or "incomes")
#25   MeSH descriptor: [Language] explode all trees
#26   ("language" or "languages" or "language's")
#27   (barrier or barriers)
#28   (facilitator or facilitators)
#29   MeSH descriptor: [Age Factors] explode all trees
#30   ("age factors")
#31   MeSH descriptor: [Communication Barriers] explode all trees
#32   ("communication barriers")
#33   ("disparities" or "disparity")
#34   ("demographic factors" or "demographic variables")
#35   ("geographic disparities" or "geographic disparity")
#36   ("Individual factors")
#37   MeSH descriptor: [Neighborhood Characteristics] explode all trees
#38   ("neighborhood characteristics")
#39   MeSH descriptor: [Residence Characteristics] explode all trees
#40   ("residence characteristics")
#41   ("regional variation")
#42   MeSH descriptor: [Social Class] explode all trees
#43   ("social class")
#44   MeSH descriptor: [Religion] explode all trees
#45   ("religion")
#46   #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45
#47   ("CPR" OR "BCPR" OR "BLS" OR "AED" OR "OHCA")
#48   MeSH descriptor: [Cardiopulmonary Resuscitation] explode all trees
#49   ("cardiopulmonary resuscitation")
#50   ("basic life support")
#51   ("Neonatal resuscitation")
#52   MeSH descriptor: [Defibrillators] explode all trees
#53   ("defibrillators" or "automated external defibrillators" or "automated external defibrillator")
#54   MeSH descriptor: [Resuscitation] explode all trees
#55   ("resuscitate" or "resuscitated" or "resuscitation" or "resuscitations")

#56	MeSH descriptor: [Out-of-Hospital Cardiac Arrest] explode all trees
#57	("out of hospital cardiac arrest")
#58	#47 or #48 or #49 or #50 or #52 or #53 or #54 or #55 or #56 or #57
#59	MeSH descriptor: [Certification] explode all trees
#60	("certificate" or "certification" or "certifications" or "certified" or "certify")
#61	MeSH descriptor: [Education] explode all trees
#62	("training" or "train" or "trained" or "trainings" or "trains")
#63	MeSH descriptor: [Teaching] explode all trees
#64	("educates" or "education" or "teaching" or "educate" or "educated" or "educating" or "educations")
#65	("course" or "courses")
#66	MeSH descriptor: [Learning] explode all trees
#67	(learn*)
#68	#59 or #60 or #61 or #62 or #63 or #64 or #65 or #66 or #67
#69	#5 and #46 and #58 and #68

New Search strategy: None
Database searched: PubMed, EMBASE, CINAHL, Cochrane
Time Frame: Jan 1 2023 to Oct 31 2024
Date Search Completed: Nov 09 2024
Search Results: 678/2

Summary of Evidence Update: We searched PubMed, EMBASE, CINAHL and Cochrane databases to identify studies associated with disparity in layperson resuscitation education published from Jan 1, 2022 to Oct 31, 2024. After duplicates were removed, there were 678 records found, and 2 non-randomized trials were included. Among them, one study was performed in Australia (3) and the other was in China (4). Factors including sex (4), area of household registration (4), family financial situation (4), self-rated quality of life (4), history of major illness in relatives (4), relatives in the medical profession (4), and place of birth were identified (3).

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
Berg KM (2023) (1)	2023 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations	Disparities in Layperson Resuscitation Education (EIT 6102)	22	Various enablers and barriers influencing layperson participation in resuscitation education.	No treatment recommendations
Ko YC (2023) (2)	Scoping review	Disparities in layperson resuscitation education: A scoping review	23	Various enablers and barriers influencing layperson participation in resuscitation education.	No treatment recommendations

RCT (0):
Nonrandomized Trials, Observational Studies (2):

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)	Factors (higher or lower likelihood of CPR training participation)

Munot S (2023)	cross-sectional study	Residents in New South Wales, Australia. (n=1267)	A significantly greater proportion of Australian-born participants had obtained CPR training compared with those born in South Asia or East Asia (77% vs 35% and 48%, respectively).	Lower: born in South Asia or East Asia in Australia
Qin Z (2024)	cross-sectional study	First year students from three universities in Xuzhou city (n=9987)	There were significant differences in CPR training rates between respondents of different genders, household registration, family economic condition, self-rated quality of life, history of major illness in relatives, and relatives in the medical profession (p ≤ 0.05).	Higher: Female, urban household registration, relatives in the medical profession Lower: poor family financial situation, poor self-rated quality of life, history of major illness in relatives

Reviewer Comments: *(including whether this PICOST should have a systematic or scoping review)*

This evidence update included two new non-randomized studies investigating disparities in layperson resuscitation training. Factors identified in the two studies align with the categories outlined in the previous scoping review, specifically personal factors, socioeconomic status and education, and geographic factors. (1, 2) No new or unexpected information emerged beyond these established categories. This highlights the need for further research to explore overlooked aspects that may be associated with these disparities.

Knowledge gaps:
• The extent of disparities in layperson resuscitation education in populations with special needs, such as disabled people, pregnant women, schoolchildren, or kindergarten-aged children; pediatric or neonatal resuscitation is unclear.
• The influence of geographic factors (e.g. urban or rural areas, low-resource settings, remote areas), sex of laypeople, or the impact of laws requiring CPR training on the attendance of resuscitation education courses.
• The optimal strategy for implementing resuscitation educational programs to better reach underrepresented or historically marginalized populations.
• The influence of these barriers or enablers on the clinical outcome of OHCA.

Reference list:
1.   Berg KM, Bray JE, Ng KC, Liley HG, Greif R, Carlson JN, et al. 2023 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. Circulation. 2023;148(24):e187-e280.
2.   Ko YC, Hsieh MJ, Schnaubelt S, Matsuyama T, Cheng A, Greif R. Disparities in layperson resuscitation education: A scoping review. Am J Emerg Med. 2023;72:137-46.
3.   Munot S, Rugel EJ, Bray J, Redfern J, Yang G, Ngo L, et al. Examining training and attitudes to basic life support in multi-ethnic communities residing in New South Wales, Australia: A mixed-methods investigation. BMJ Open. 2023;13(7):e073481.
4.   Qin Z, Zheng S, Liu C, Ren Y, Wang R, Zhang S, et al. The knowledge, training, and willingness of first year students in Xuzhou, China to perform bystander cardiopulmonary resuscitation: a cross-sectional study. Front Public Health. 2024;12:1444970.

2025 Evidence Update
EIT 6104 – EMS Experience and Exposure

Worksheet Author(s): Kathryn Eastwood, Barbara Farquharson. Kevin Nation, Ying-Chih Ko, Robert Greif
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: June 2024
Conflicts of Interest: none

PICOST / Research Question: *(Attach SAC representative approved completed PICOST template)*
EIT 6104: Does EMS practitioner's experience or exposure to out-of-hospital cardiac arrest resuscitation impact on patient outcomes?

Population: Adults and children who are in cardiac arrest in the out-of-hospital setting
Intervention: Resuscitation by experienced emergency medical service practitioners or practitioners with higher exposure to resuscitation
Comparators: Resuscitation by less experienced or lower exposed practitioners
Outcomes: Improved patient outcomes. OHCA patient outcomes include:
　　　　1) Good neurological outcome at discharge/30days (critical);
　　　　2) Survival to hospital discharge/30days (critical);
　　　　3) Survival to hospital (event survival) (critical);
　　　　4) Return of spontaneous circulation (ROSC) (critical);
　　　　EMS personnel confidence / satisfaction with OHCA procedures / training (Important)
Study design: RCTs, nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies), original research articles (both prospective and retrospective) were included with no language restrictions. Unpublished studies (eg, conference abstracts, trial protocols) were excluded.
Time frame: All years and all languages were included if there was an English abstract up to May 6th 2024.

PROSPERO Registration: CRD42019153599 submitted to PROSPERO on 9th October 2019.

Year of last full review: 2020

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest that EMS systems (1) monitor their clinical personnel's exposure to resuscitation and (2) implement strategies, where possible, to address low exposure or ensure that treating teams have members with recent exposure (weak recommendation, very low-certainty evidence).

Current Search Strategy (for an existing PICOST) included in the attached approved PICOST
Medline, Cochrane

1	advanced trauma life support care/
2	emergency medical service*
3	EMS
4	Emergency Medical Technicians/
5	Emergency Medical Technician*
6	EMT
7	"transportation of patients"/
8	ambulance*
9	paramedic*
10	prehospital
11	pre-hospital
12	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
13	CPR
14	Heart Massage/

15	cardiopulmonary resuscitation/
16	Electric Countershock/
17	13 or 14 or 15 or 16
18	Heart Arrest/
19	Ventricular Fibrillation/
20	Tachycardia, Ventricular/
21	18 or 19 or 20
22	Intubation, Intratracheal/
23	Laryngeal Masks/
24	Noninvasive Ventilation/
25	Epinephrine/
26	Drug Therapy/
27	22 or 23 or 24 or 25 or 26
28	21 and 27
29	17 or 28
30	experien*
31	exposure*
32	Health Knowledge, Attitudes, Practice/
33	Physician's Practice Patterns/
34	professional practice/
35	Nurse's Practice Patterns/
36	"Practice (Psychology)"/
37	novice*
38	expert*
39	Workload/
40	Professional Competence/
41	Benchmarking/
42	Psychomotor Performance/
43	30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42
44	12 and 29 and 43
45	letter.pt.
46	comment.pt.
47	editorial.pt.
48	review.pt.
49	45 or 46 or 47 or 48
50	44 not 49

EMBASE

	advanced trauma life support care/
2	emergency medical service*
3	EMS
4	Emergency Medical Technician/
5	Emergency Medical Technician*

6	EMT
7	"patient transportation"/
8	ambulance*
9	paramedic*
10	prehospital
11	pre-hospital
12	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
13	CPR
14	Heart Massage/
15	cardiopulmonary resuscitation/
16	Electric Countershock/
17	13 or 14 or 15 or 16
18	Heart Arrest/
19	Ventricular Fibrillation/
20	Ventricular Tachycardia /
21	18 or 19 or 20
22	Tracheal Intubation/
23	Laryngeal Mask/
24	Noninvasive Ventilation/
25	Epinephrine/
26	Drug Therapy/
27	22 or 23 or 24 or 25 or 26
28	21 and 27
29	17 or 28
30	experien*
31	exposure*
32	Health Knowledge/
33	Physician Attitude/
34	professional practice/
35	Nursing Practice/
36	Psychological Practice/
37	novice*
38	expert*
39	Workload/
40	Professional Competence/
41	Benchmarking/
42	Psychomotor Performance/
43	30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42
44	12 and 29 and 43
45	letter.pt.
46	comment.pt.
47	editorial.pt.
48	review.pt.
49	45 or 46 or 47 or 48

50	44 not 49

CINAHL Plus (EBSCOhost)

S41	s11 and s28 and s40
S40	s29 or s30 or s31 or s32 or s33 or s34 or s35 or s36 or s37 or s38 or s39
S39	(MH "Psychomotor Performance")
S38	(MH "Benchmarking")
S37	(MH "Professional Competence")
S36	(MH "Workload")
S35	TI expert* OR AB expert*
S34	TI notice* OR AB notice*
S33	(MH "Professional Practice")
S32	(MH "Practice Patterns")
S31	(MH "Attitude of Health Personnel")
S30	TI exposure* OR AB exposure*
S29	TI experienc* OR AB experienc*
S28	s16 or s27
S27	s20 and s26
S26	s21 or s22 or s23 or s24 or s25
S25	(MH "Drug Therapy")
S24	(MH "Epinephrine")
S23	(MH "Noninvasive Procedures")
S22	(MH "Laryngeal Masks")
S21	(MH "Intubation, Intratracheal")
S20	s17 or s18 or s19
S19	(MH "Tachycardia, Ventricular")
S18	(MH "Ventricular Fibrillation")
S17	(MH "Heart Arrest")
S16	s12 or s13 or s14 or s15
S15	'electric countershock"
S14	(MH "Resuscitation, Cardiopulmonary")
S13	(MH "Heart Massage")
S12	TI CPR OR AB CPR
S11	S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10
S10	TI ((prehospital or pre-hospital)) OR AB ((prehospital or pre-hospital))
S9	TI paramedic* OR AB paramedic*
S8	TI ambulance* OR AB ambulance*
S7	(MH "Transportation of Patients")
S6	TI EMT OR AB EMT
S5	TI emergency medical technician* OR AB emergency medical technician*
S4	(MH "Emergency Medical Technicians")
S3	TI ems OR AB ems
S2	TI emergency medical service* OR AB emergency medical service*
S1	(MM "Advanced Trauma Life Support Care") OR (MM "Advanced Cardiac Life Support")

Web of Science (Clarivate Analytics)

1	TS=(Emergency Medical Services or advanced trauma life support care or advanced cardiac life support) OR ALL= (emergency medical service*) OR ALL=(EMS) OR ALL= (Emergency Medical Technician* OR EMT) OR TS= (Ambulances) OR ALL=(ambulance* OR paramedic* OR prehospital OR pre hospital)
2	ALL= (resuscitat* OR CPR OR chest compression* OR defibrillat*) OR TS= (Heart Massage OR Resuscitation, cardiopulmonary OR electric countershock)
3	ALL= ((heart or cardiac) "NEAR" arrest*) OR TS= (Ventricular Fibrillation OR Tachycardia, Ventricular)
4	TS= (Airway management OR laryngeal masks OR masks OR respiration, artificial or infusions, intraosseous or infusions, intravenous or injections, intravenous or drug therapy) OR ALL= (endotracheal intubat* OR ortracheal intubat* OR laryngeal mask* OR ventilat* OR intraosseous OR epinephrine OR adrenaline or intravenous line) OR ALL=(intravenous access)
5	3 and 4
6	5 or 2
7	ALL= (experien* or exposure* or novice* or expert* or case* or volume* or attend*) OR TS= (health knowledge, attitudes, practice or professional practice or physician's practice patterns or nurse's practice patterns or "practice (psychology)" or workload or benchmarking or "task performance and analysis" or psychomotor performance)
8	1 and 6 and 7

Database searched: Ovid MEDLINE and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) 1946 to current, EMBASE, Cochrane library, CINAHL Plus, Web of Science
Time Frame: (existing PICOST) – updated from end of last search (please specify) 10th April 2020 - 6th May 2024
Date Search Completed: May 6th 2024
Search Results: 2926/ none met the inclusion criteria

Summary of Evidence Update: No studies met the criteria, no new relevant guidelines or systematic reviews, no new RCT, and no new nonrandomized trials or observational studies were found. Therefore, no further evidence is available.
Relevant Guidelines or Systematic Reviews: none
RCT: none
Nonrandomized Trials, Observational Studies: none

Reviewer Comments: *(including whether this PICOST should have a systematic or scoping review)*
The last EvUp was conducted in May 2023. The current search for this Evidence Update was run from 10th April 2020 (the search data in the 2020 publication) to May 6th 2024 in all the databases in anticipation of an updated systematic review, however no further relevant papers were identified. Therefore, the results of this search do not meet the criteria to trigger a formal systematic review and no changes are suggested for the current CoSTR.

Knowledge gaps
How does simulation impact patient outcomes in these populations where exposure varies and experience is time and exposure dependent?
Are similar outcomes seen for clinicians responding to in-hospital cardiac arrests?
Is there any value in tracking skills exposure in EMS personnel and is there any correlation to competence and patient outcomes?
Is there a difference in skills maintenance versus full arrest scenario simulation in competence and patient outcomes (considering simple skills maintenance may be more cost effective and less resource intensive than full simulation)?
Is there a point at which experience and exposure converge (a threshold beyond which the other becomes less impactful)?

Reference list:

2025 Evidence Update
EIT 6105 – BLS Training for Likely Rescuers of High-risk Populations

Worksheet Author(s): Sabine Nabecker S, Katherine Allan K, Nation K
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative:
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults and children at high-risk of out-of-hospital cardiac arrest (OHCA)
Intervention: Targeted BLS training of likely rescuers (e.g., family members or caregivers)
Comparator: No such targeting
Outcomes:
Critical: Favorable neurological outcome at hospital discharge or to 30 days, survival at hospital discharge or to 30 days, CPR quality, correct AED use at the end of training and within 12 months of training
Important: ROSC, rates of bystander CPR, bystander CPR quality during OHCA (any available CPR metrics), rates of AED use, CPR and AED knowledge at the end of training and within 12 months after training, confidence and willingness to perform CPR at the end of training and within 12 months after training, CPR training of others.
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. Unpublished studies (e.g., conference abstracts, trial protocols) are excluded.
Timeframe: All relevant publications in any language are included as long as there is an English abstract. Literature search from 2014-2024 July 31.

Year of last full review: *2022*
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We recommend BLS training for likely rescuers of populations at high risk of OHCA (strong recommendation, low- to moderate-certainty evidence).
We recommend that healthcare professionals encourage and direct likely rescuers of populations at high risk of cardiac arrest to attend BLS training (good practice statement).

New Search strategy: – updated search strategy
Ovid MEDLINE(R) ALL <2014 to July 31, 2024>
1   Cardiopulmonary Resuscitation/ or Resuscitation/ or Defibrillators/ or Heart massage/ or Artificial respiration/   109791
2   ((CPR or resuscitat* or cardio* or cardiac*) adj2 (certif* or train* or knowledg* or skill* or teach* or educat* or learn* or course* or class* or perform* or workshop* or demonstrat* or instruct*)).ti,ab,kf,kw.   36751
3   (CPR or BCPR or DACPR or AED).ti. 3337
4   ((chest* or rescue* or resuscitat*) adj2 (cardio* or pulmonar* or compress* or breath* or cardiac*)).ti,ab,kf,kw.   33095
5   (resuscitat* or defibrillat*).ti,ab,kf,kw.   109690
6   ((cardiac or heart) adj2 massag*).ti,ab,kf,kw.   1815
7   ((artificial* or mechanic*) adj2 (respirat* or ventilat*)).ti,ab,kf,kw.   87005
8   or/1-7   269902
9   First Aid/   8222
10   "first aid".ti,ab,kf,kw.   7503
11   bls.ti.   170
12   (BLS adj2 (certif* or train* or knowledg* or skill* or teach* or educat* or learn* or course* or class* or perform* or workshop* or demonstrate* or instruct*)).ti,ab,kf,kw.   722
13   ((basic adj2 life adj2 support*) or "basic life support*").ti,ab,kf,kw.   2740
14   or/9-13 14870
15   Education/ or Health Education/ or Teaching/ or Learning/   213082
16   (educat* or program* or train* or workshop* or class* or course* or certif* or phenomenograph* or knowledge or skill* or instruct* or learn* or "self taught" or "self led" or "self direct*" or "self instruct*").ti,ab,kf,kw.   5798467
17   15 or 16 5850203
18   14 or 17 5859187
19   Family/ or Spouses/ or exp Friends/ or Caregivers/ or exp Parents/   287371

20   (friend* or relative* or caregiv* or carer* or famil* or partner* or spouse* or bystander* or witness* or layperson* or "lay responder*" or laypeople* or "citizen responder" or "lay rescue*" or parent* or father* or mother* or "care giv*" or rescuer* or bystand*).ti,ab,kf,kw.   3957458
21   19 or 20 4006406
22   exp Coronary disease/ or exp Myocardial infarction/ or exp Heart arrest/ or Risk Factors/ or Heart disease risk factors/ or Drug users/ or Disabled persons/   1433284
23   (coronary* adj2 (disease* or condition* or aneurysm* or arterioscleros* or arter* or "left main" or occlusion* or stenos?s* or restenos?s* or thrombos?s* or vasospasm* or spasm* or subclavian*)).ti,ab,kf,kw.   327403
24   ((factor* or correlat* or score* or populat* or cardio* or cardiac*) adj2 (health* or risk*)).ti,ab,kf,kw.   1084738
25   ((person* or physical* or people*) adj2 (disabilit* or handicap* or challeng*)).ti,ab,kf,kw.   25328
26   (handicap* or disabled*).ti,ab,kf,kw.   53758
27   ((myocard* or cardiovascular* or cardiogen* or cardiac* or heart*) adj2 (infarct* or stroke* or shock* or injur* or arrest* or attack*)).ti,ab,kf,kw.   340839
28   (minoca or nstemi or stemi or ohca or pwd).ti.   3360
29   ((death or arrest* or pain*) adj2 (chest* or sudden* or cardiac* or cardio* or heart*)).ti,ab,kf,kw. 183009
30   (patient adj2 (cardiac* or cardio* or "high risk" or "at risk")).ti,ab,kf,kw.   14991
31   (handicap* or disabled* or asystole* or disabilit*).ti,ab,kf,kw. 309084
32   (drug* adj2 (user* or abuse* or addict* or people* or person*)).ti,ab,kf,kw.   67906
33   or/22-322646852
34   8 and 18 and 21 and 33   5195
35   8 or 14   281004
36   35 and 17 and 21 11808
37   34 or 36 12028
38   limit 37 to yr="2014 -Current"   6592

Database searched: Cochrane, Embase, Medline, PubMed, Web of Science
Time Frame: since 1.1.2024
Date Search Completed: 31 July 2024
Search Results (Number of articles identified and number identified as relevant):
        25,106 articles identified
        6,808 duplicates
        18,298 articles screened
        66 full-texts assessed
        5 identified as relevant

Summary of Evidence Update:
We identified 5 additional non-randomized studies. (1-5) One study was a prospective observational study(1), that studied the effect of parent/grandparent BLS training of neonates at high risk of cardiac arrest. It showed that 80.4% performed effective BLS on a manikin after the first attempt, and >90% scored >80% marks in the questionnaire to test the cognitive domain of learning. All participants confirmed awareness of the possibility of an emergency arising out of the hospital; none had increased anxiety due to the training, and all had increased confidence in handling such situations correctly.(1)
One study was a prospective pre-post intervention study(2) studying the effect of a tracheostomy CPR education intervention in caregivers of tracheostomy-dependent children. They showed that 86.4% performed all essential behaviors, and over 86% of caregivers provided appropriate CPR in the simulation. Post-simulation comfort levels were significantly higher than pre-simulation comfort levels (p=0.001).(2)
One study was a quasi-experimental study(3) studying the effect of CPR training on skill acquisition of family members of heart disease patients. There was a significant difference in the number of correct answers on the knowledge test before and after the training (p<0.05), and a significant improvement in all practical performance scores (p<0.001). (3)
One study was a retrospective interview study(4) that studied the rate of caregiver BLS training in an institution and explored post-discharge experience of caregivers of patients < 12 years of age after an apparent life-threatening event (ALTE). All caregivers described training as helpful, reported improvement in anxiety following the training, although, 46% felt less confident 6 months following training. There was a 15% re-occurrence rate of ALTE.(4)
One study was a retrospective review of all children who were issued an AED over 10.5 years(5) and studied the effect of prescribing an AED for children at increased risk of sudden arrhythmic death. Parents of children that had been issued an AED were trained in CPR with AED use. They found that 1 of 5 children had the defibrillator with them at all times, that 65% had an AED installed at

school, or were allowed to bring it to school with school staff trained in its use. 43% had symptoms after the issuance of the AED. The AED was used in 4 (9%) of children, 3 received correctly 1 or more shocks, 2 of them survived.(5)

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 summary statement; Wyckoff; 2022	SyR	BLS Training for Likely Rescuers of High-Risk Populations	12	Benefit of BLS training for likely rescuers of populations at high risk of OHCA.	We recommend BLS training for likely rescuers of populations at high risk of OHCA (strong recommendation, low- to moderate-certainty evidence). We recommend that healthcare professionals encourage and direct likely rescuers of populations at high risk of cardiac arrest to attend BLS training (good practice statement).

Nonrandomized Trials, Observational Studies

Author, Year, Country	Aim Study design	Population Data Collection	Intervention	Comparator	Main findings
Benedict, 2022, India[2]	Study effect of parent and grandparent BLS training Prospective observational study	Parents and grandparents of neonates born <32 weeks, neonatal encephalopathy, congenital airway anomaly, or brief, resolved, unexplained event requiring admission and NICU monitoring Modified standard BLS checklist Objective knowledge test	1h BLS training with hands-on session (n=46)	N/A	• All caregivers scored 5 out of 5 in the psychomotor domain checklist. • 80.4% performed effective BLS on a mannequin after the first attempt. • > 90% scored >80% marks in the questionnaire administered to test the cognitive domain of learning. • All confirmed awareness of the possibility of an emergency arising out of hospital, none had increased anxiety due to the training, all had increased confidence in handling such situations correctly.
Brooks, 2022, USA[4]	Study the effect of an evidence-based tracheostomy CPR education	Caregivers of tracheostomy dependent children (n=44) Performance assessment	Video- and instructor-assisted specialized tracheostomy CPR class, high-fidelity	N/A	• 86.4% performed all four essential behaviours (give breaths via trach with Ambu Bag, complete trach change on trach task trainer, Call 911 before compressions, place on floor for CPR) • Over 86% of caregivers provided CPR a the appropriate 30:2 compressions-to-breaths ratio.

	intervention via caregiver participation in a high-fidelity simulation of a home-based emergency scenario on the performance of essential behaviors, comfort and satisfaction. Prospective pre-post intervention	Survey	simulation performance of a home-based emergency (respiratory failure with cardiac arrest), post-simulation video debriefing.		• Only 59% performed compressions at the recommended rate of 100-200 compressions per minute. • The mean overall score for caregivers was 5.68/7 (4-7). • Post-simulation caregiver comfort levels were significantly higher than pre-simulation comfort levels (p=0.001).
Citolino Filho, 2022, Brazil[5]	Study the effect of a CPR training on the skill acquisition of family members of heart disease patients. Quasi-experimental study	Relatives of hospitalized patients with heart disease (n=60) Skill and knowledge test	Theoretical-practical 30-min CPR training	N/A	• Statistically significant difference in the number of correct answers on the knowledge test before and immediately after training (p<0.05). • Statistically significant improvement after vs. before training (p<0.001) in all practical performance scores. • 30 days after training, a reduction in the percentage of correct answers in 7/10 theoretical questions was observed, only 1 statistically significant. • In most of the evaluated actions there was no loss of practical knowledge.
Macken, 2017, Ireland[1]	Study the rate of caregiver BLS training in their institution and to explore their experience post discharge Retrospective Interview study	Caregivers following apparent life-threatening events (ALTEs) of children < 12 years of age Telephone interview 6 months post training Hospital's emergency department electronic patient record system	BLS and choking algorithm training plus handed a reminder refrigerator magnet with the BLS algorithm (n=17) 13 contacted for interview (4 lost to follow up)	N/A	• All caregivers described their experience as helpful, reported improvement in anxiety following training. • Nonetheless, 46% felt less confident 6 months following training. • 85% had kept their reminder magnet and found it re-assuring. • 15% re-occurrence rate. • All caregivers expressed interest in attending group-retraining.
McLeod, 2017, United Kingdom[3]	Effect of prescribing automated external defibrillators	Parents of children that had been prescribed an automated external	Resuscitation training including the use of automated	N/A	• Almost 1:5 children had the defibrillator with them at all times. • For 65% an AED was installed at school or the child was allowed to take it to school, with school staff trained in its use.

for children at increased risk of sudden arrhythmic death Retrospective review of all children who were issued an AED over 10.5 years	defibrillator for either long QT syndrome, broad complex tachycardia, hypertrophic cardiomyopathy or catecholaminergic polymorphic ventricular tachycardia (n=36 families of 44 children)	external defibrillator		• 43% had symptoms or events after issuing the AED. • The AED was used in 4 (9%) children, 3 received correctly 1 or more shocks for cardiac arrest, 2 kids survived, 1 died as a result of recurrent torsades de pointes. • Both survivors received an implantable cardioverter defibrillator. • There were no other deaths.

Reviewer Comments:

The five new non-randomized studies identified are consistent in supporting previous findings, however, they do not substantially change the weight of evidence. However, a comprehensive systematic review including an updated RoB assessment and GRADE process for studies before 2010 should be considered.

Reference list:

1.   Benedict AP, F.; Prithvi, A.; Nandakumar, A.; Prabhakar, J.; Jain, N. Basic life support guidance for caregivers of NICU graduates: evolution of skill transfer after training. Journal of Child Science. 2022;12(1):E119-E24.
2.   Brooks M, Jacobs L, Cazzell M. Impact of emergency management in a simulated home environment for caregivers of children who are tracheostomy dependent. J Spec Pediatr Nurs. 2022;27(2):e12366.
3.   Citolino Filho CM, Nogueira LS, Gomes VM, Polastri TF, Timerman S. Effectiveness of cardiopulmonary resuscitation training in the teaching of family members of cardiac patients. Rev Esc Enferm USP. 2022;56(spe):e20210459.
4.   Macken WL, Clarke N, Nadeem M, Coghlan D. Life After the Event: A Review of Basic Life Support Training for Parents Following Apparent Life-Threatening Events and Their Experience and Practices Following Discharge. Ir Med J. 2017;110(5):572.
5.   McLeod KA, Fern E, Clements F, McGowan R. Prescribing an automated external defibrillator for children at increased risk of sudden arrhythmic death. Cardiol Young. 2017;27(7):1271-9.

2025 Evidence Update
EIT 6106 – Patient Outcomes When a CPR Team Member Attended Previously CPR Course

Worksheet Author(s): Andrew Lockey, Cristian Abelairas-Gómez)
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: August 2024
Conflicts of Interest: none

PICO / Research Question:

Population: Patients of any age requiring in-hospital cardiac arrest (IHCA) resuscitation
Intervention: Prior participation of ≥1 members of the resuscitation team in an accredited ALS course (eg, ALS, ACLS, PALS, EPALS, EPILS, NRT [including NRP, HBB, NLS, ARNI])
Comparator: No such participation
Outcomes: Critical—ROSC, survival to hospital discharge or to 30 days, survival to 1 year, and survival with favorable neurological outcome; NRT (in addition): stillbirth rate, neonatal and perinatal mortality
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 in which n≥5) are eligible for inclusion. Unpublished studies (e.g., conference abstracts, trial protocols), letters to editor, commentary, editorials, studies looking at the impact of individual components of courses (eg, airway, drug therapy, defibrillation), studies relating to BLS and first aid courses, studies on dedicated trauma courses (eg, ATLS, ETC), and studies relating to OHCA were excluded are excluded.
Timeframe: June 2022 to July 2024
PROSPERO Registration: CRD42017081667 / CRD42021253673

Conflicts of Interest (financial/intellectual, specific to this question): None
Year of last full review: 2022

Last ILCOR Consensus on Science and Treatment Recommendation: (2022 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. Wyckoff MH, Greif R, Morley PT, et al., Resuscitation 2022;181:208-288. doi: 10.1016/j.resuscitation.2022.10.005)

We recommend the provision of accredited ALS training (ACLS, ALS) for health care providers who provide ALS care for adults (strong recommendation, very low– certainty evidence).
We recommend the provision of accredited courses in NRT (NRT, NRP) and HBB for health care providers who provide ALS care for newborns and babies (strong recommendation, very low–certainty evidence).
We have made a discordant recommendation (strong recommendation despite very low–certainty evidence)
because we have placed a very high value on an uncertain but potentially life-preserving benefit, and the intervention is not associated with prohibitive adverse effects.

2024 Search Strategy (Jun 2022 to Jul 2024): Database searched: Medline, Embase and CINAHL
Medline
1. exp Resuscitation/
2. ((advanced or adult) adj3 (life support or resuscitation)).mp.
3. ((p?ediatric or newborn or neonat*) adj3 (life support or resuscitation)).mp.
4. #1 OR #2 OR #3
5. exp Health Personnel/
6. (doctor* or medic? or physician* or clinician* or nurs* or midwi* or birth attendant* or internist* or obstetrician* or surgeon* or health care assistant* or healthcare assistant* or health care professional* or healthcare professional* or inter professional* or inter professional* or multi professional* or multiprofessional*).mp.
7. ((resus* or life support or emergenc*) adj3 (team* or unit* or department* or staff or personnel)).mp.
8. #5 OR #6 OR #7
9. exp Education/
10. (teach* or train* or learn* or program* or course* or education* or simulation*).mp.
11. #9 OR #10
12. #4 AND #8 AND #11

13. limit 13 to dt= 20220601-20240710

Embase

1. exp Resuscitation/
2. ((advanced or adult) adj3 (life support or resuscitation)).mp.
3. ((p?ediatric or newborn or neonat*) adj3 (life support or resuscitation)).mp.
4. #1 OR #2 OR #3
5. exp Health Personnel/
6. (doctor* or medic? or physician* or clinician* or nurs* or midwi* or birth attendant* or internist* or obstetrician* or surgeon* or health care assistant* or healthcare assistant* or health care professional* or healthcare professional* or inter professional* or inter professional* or multi professional* or multiprofessional*).mp.
7. ((resus* or life support or emergenc*) adj3 (team* or unit* or department* or staff or personnel)).mp.
8. #5 OR #6 OR #7
9. exp Education/
10. (teach* or train* or learn* or program* or course* or education* or simulation*).mp.
11. #9 OR #10
12. #4 AND #8 AND #11
13. limit 13 to dt= 20220601-20240710

CINAHL

1. (MH "Resuscitation+")
2. "advanced life support"
3. ((advanced OR adult) n3 (life-support OR resuscitation))
4. #1 OR #2 OR #3
5. (MH "Pediatric Advanced Life Support")
6. (MH "Resuscitation+") AND (MH "Child+")
7. ((p#ediatric OR newborn OR neonat* OR infant) N3 (life-support OR resuscitation))
8. #5 OR #6 OR #7
9. (MH "Health Personnel+")
10. (doctor* OR physician* OR nurs* OR midwif* OR midwives OR birth attendant$ OR clinician* OR internist* OR obstetrician* OR surgeon* OR health care assistant* OR healthcare assistant* OR health care professional* OR healthcare professional* OR interprofessional* OR inter professional* OR multi professional*)
11. ((resus* OR life-support OR emergenc*) N3 (team* OR unit* OR staff OR personnel*))
12. ((medical OR clinical OR health* OR health care) N3 (team* OR unit* OR staff OR personnel OR assistant* OR professional* OR consultant*))
13. #9 OR #10 OR #11 OR #12
14. (MH "Education+")
15. train* OR teach* OR educat* OR program* OR course*
16. #14 OR #15
17. #4 AND #13 AND #16
18. #17 AND (PT Journal Article OR Meta Analysis OR Systematic Review)
19. #17 AND (PT Journal Article OR Meta Analysis OR Systematic Review) Limiters - Publication Date: 20220601-20240731
20. #8 AND #13 AND #16
21. #20 AND (PT Journal Article OR Meta Analysis OR Systematic Review)
22. #20 AND (PT Journal Article OR Meta Analysis OR Systematic Review) Limiters - Publication Date: 20220601-20240731
23. #19 OR #22

Summary of 2024 search results		
Database	Date Searched	Results
Medline	Jul 2024	555
Embase	Jul 2024	171
CINAHL	Jul 2024	650
TOTAL [after removing duplicates (401)]		975
Articles meeting inclusion criteria		0

Summary of Evidence Update:

Relevant Guidelines or Systematic Reviews:

Organisation (if relevant); Author; Year Published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
Agudelo-Pérez; 2022	SyR Effect of the Helping Babies Breathe Program on Newborn Outcomes: Systematic Review and Meta-Analysis	To determine the effect of the implementation of the HBB program on newborn mortality and morbidity	11	The Helping Babies Breathe program is effective in reducing intrapartum stillbirth and early mortality (first day and first week).	-----
Patocka; 2023	SyR Impact of accredited advanced life support course participation on in-hospital cardiac arrest patient outcomes: A systematic review	In patients requiring in-hospital cardiac arrest resuscitation of any age (P), does prior participation of one or more members of the resuscitation team in an accredited advanced life support course (I), as opposed to no such participation (C), affect return of spontaneous circulation (ROSC), survival to hospital discharge or to 30 days, survival to one year, survival with favorable neurological outcome, or specifically in neonatal studies: stillbirth rate, neonatal and perinatal mortality (O)?	19	Studies demonstrate that accredited advanced life support courses, specifically advanced life support, neonatal resuscitation training and helping babies breathe, improve patient survival outcomes in both adult and neonatal cardiac arrest patients.	-----

RCT: 0
Nonrandomized Trials, Observational Studies: 0

Reviewer Comments (including whether meet criteria for formal review):
There were 975 new articles identified since the last systematic search of which none were relevant to the PICO; therefore, a systematic review is not recommended.

Reference List

Agudelo-Perez S, et al. Effect of the Helping Babies Breathe Program on Newborn Outcomes: Systematic Review and Meta-Analysis. Medicina (Kaunas). 2022;58:1567. Doi: https://doi.org/10.3390/medicina58111567
Patocka C, et al. Impact of accredited advanced life support course participation on in-hospital cardiac arrest patient outcomes: A systematic review. Resusc Plus. 2023;14:100389. Doi: https://doi.org/10.1016/j.resplu.2023.100389

2025 Evidence Update
EIT 6108 – CPR Education Tailored for Specific Populations

Worksheet Author(s): Sebastian Schnaubelt
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: 24 October 2024

Conflicts of Interest:none

PICOST / Research Question:

> *Population:* Specific adult layperson populations and/or groups *(defined below)* participating in BLS training
> *Intervention:* Tailored BLS training *(defined below)*
> *Comparators:* Non-tailored BLS training *(defined below)*
> *Outcomes:*
>
> - *Patient outcomes:* ROSC, survival to hospital discharge, 30-days survival, 12-months survival, neurological outcome
> - *Clinical outcomes*: Starting CPR in case of real cardiac arrest, performance during real CPR
> - *Educational outcomes:* knowledge and skills acquisition, willingness to perform CPR, barriers towards performing CPR, participant satisfaction and/or knowledge and skills retention at the end of the respective course and later (e.g., 3 months, 1 year), implementation success, resource implications and cost effectiveness
>
> *Study Designs:* Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, controlled before-and-after studies, cohort studies, and case series n ≥ 5), reviews, surveys in respective population groups, with at least an abstract in English were eligible for inclusion. Research aimed at teaching BLS to children; research on CPR training for different healthcare professionals (both sufficiently covered elsewhere) were excluded.
> *Timeframe:* All years. Literature search updated to 22 October 2024

Year of last full review: 2023

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST: No recommendation (ScR), but Taks Force insights and identified knowledge gaps. Task Force insights (no change to previous CoSTR):

- Tailored BLS education for specific populations is probably feasible and can include such groups into the pool of potential bystander CPR providers that may otherwise have been left out (e.g., individuals with disabilities).
- Studies should explore tailored courses for first responders with and without a duty to respond, including, but not limited to, police, firefighters, or lifeguards.
- Research should be undertaken to address knowledge gaps identified, especially studies between comparing standard vs. tailored courses in specific populations which are best conducted as randomized controlled trials.
- Research needs to address how BLS could be adapted for those with special needs, and how best to involve members of the respective specific populations in its development.

The EIT Task Force identified the following knowledge gaps (no change to previous CoSTR):

- There is too little evidence on the topic of tailored BLS training for specific population groups to perform a systematic review.
- It is unclear which specific population groups can benefit from tailored BLS training.
- It is unclear what the cost-benefit ratio is for tailored BLS training.
- It is unknown what type and amount of tailoring in BLS training is optimal.

Table 1: New studies identified in the EvUp				
Study (author, year)	**Country** (study or corresponding author)	**Publication type**	**Content description**	**Comments**
Chaleepad, 2024 [1]	Thailand	Letter	BLS training for volunteers in a prison, tailoring their approach to include the contact with the guards and transporting the patient out of the prison.	Short letter only, no detailed information
Di Marco, 2024 [2]	Sudan	Letter	The concept of "resuscitation training in low-resource countries" with "ERC methodology" is described, and it is reported that this was well-received by 104 health care workers in Sudan. There was	Short letter only, no detailed information

			high satisfaction, and content knowledge increased significantly after the course. An adaptation and tailoring of the approach to low-resource settings is mentioned, but not described in detail.	
Stephens, 2023 [3]	Australia	Scoping Review	Scoping review assessing the cultural responsiveness of resuscitation education for Aboriginal populations in Australia. None was found; instead, literature relating to First Nation community-based CPR training and first aid programs in Canada, USA, India, Europe, Asia, and Africa were identified. These highlight the need of cultural responsiveness and respective tailoring of education in collaboration with the target populations. Aligning with language, culture, and other specific needs is mentioned.	

Current Search Strategy No new search strategy; the original one was used for the EvUp.

Embase, Ovid MEDLINE(R)

1	Resuscitation/ or Cardiopulmonary Resuscitation/ or Heart Massage/ or Heart Arrest/ or "Out-of-Hospital Cardiac Arrest"/ or cardiopulmonary arrest/
2	(resuscitat* or ((cardiac or heart) adj2 (massag* or compression*)) or (chest adj2 compression*) or CPR or "basic life support" or "basic cardiac life support" or BCLS or BLS or "automated external defibrillator*" or "automatic external defibrillator*" or AED or AEDs or "cardiac arrest").ti,ab,kf,kw.
3	1 or 2 [RESUSCITATION]
4	(bystander* or by-stander* or layperson* or layman or laymen or laywoman or laywomen or "lay person*" or "lay man" or "lay men" or "lay people" or "public setting*").ti,ab,kf,kw.
5	(("non healthcare" or "non health care" or "non medical") adj3 "first responder*").ti,ab,kf,kw.
6	Police/ or "Law Enforcement"/ or Firefighters/ or "School Teachers"/ or fire fighter/ or school teacher/ or exp airplane crew/
7	("law enforcement" or police or firefighter* or fire-fighter* or "life guard*" or lifeguard* or "flight crew*" or "flight attendant*" or teacher* or "visitation service*" or "visitation program*" or "duty to attend").ti,ab,kf,kw.
8	or/4-7 [LAYPERSONS]
9	3 and 8 [RESUSCITATION + LAYPERSONS]
10	(Education/ or "Education, Nonprofessional"/ or Inservice Training/ or Teaching/ or "in service training"/) and (tailor* or conceptualiz* or conceptualis* or adapted or adaptation or adjusted or adjustment or customized or customised or "custom made" or implementation).ti,ab,kf,kw.
11	((tailor* or conceptualiz* or conceptualis* or adapted or adaptation or adjusted or adjustment or customized or customised or "custom made" or novel or specific or developed or development or implementation) and (educat* or train* or course* or ((knowledge or skill or skills) adj3 (acquisition or aquir*)))).ti,ab,kf,kw.
12	10 or 11 [TAILORED TRAINING]
13	9 and 12 [RESUSCITATION + LAYPERSONS + TAILORED TRAINING]
14	"Health Knowledge, Attitudes, Practice"/ or Socioeconomic Factors/ or Social Class/ or "attitude to health"/ or socioeconomic/
15	(barrier* or "deprived communit*" or socioeconomic or "socio economic" or SES or "low resource*" or resources or cultural or willingness or satisfaction or retention or feasibility).ti,ab,kf,kw.
16	14 or 15 [ADDITIONAL FACTORS]
17	9 and 16 [RESUSCITATION + LAYPERSONS + ADDITIONAL FACTORS]
18	13 or 17 [(RESUSCITATION + LAYPERSONS + TAILORED TRAINING) OR (RESUSCITATION + LAYPERSONS + ADDITIONAL FACTORS)]
19	(Animals/ or "Animal Experimentation"/ or "Models, Animal"/ or "Disease Models, Animal"/) not (Humans/ or "Human Experimentation"/)
20	(exp "animal model"/ or exp "animal experiment"/ or "nonhuman"/ or exp "vertebrate"/) not (exp "human"/ or exp "human experiment"/)
21	18 not (19 or 20) [ANIMAL STUDIES REMOVED]
22	(comment or editorial or "newspaper article" or news or note or lecture).pt.
23	(letter not (letter and randomized controlled trial)).pt.
24	21 not (22 or 23) [OPINION PIECES REMOVED]

25	(conference or conference abstract or "conference review" or congresses).pt.
26	24 not 25 [CONFERENCES REMOVED]
27	Case Reports.pt. or case report/ or exp case study/
28	26 not 27 [CASE REPORTS REMOVED]
29	limit 28 to english language
30	limit 28 to abstracts
31	29 or 30 [ENGLISH LANGUAGE OR ENGLISH ABSTRACTS]
32	remove duplicates from 31

Cochrane Central Register of Controlled Trials via Cochrane Library Wiley Online

#1	(resuscitat* or ((cardiac or heart) NEAR/2 (massag* or compression*)) or (chest NEAR/2 compression*) or CPR or "basic life support" or "basic cardiac life support" or BCLS or BLS or "automated external defibrillator" or "automatic external defibrillator" or "automated external defibrillators" or "automatic external defibrillators" or AED or AEDs or "cardiac arrest"):ti,ab,kw
#2	(bystander* or by-stander* or layperson* or layman or laymen or laywoman or laywomen or "lay person" or "lay persons" or "lay man" or "lay men" or "lay people" or "public setting" or "public settings"):ti,ab,kw
#3	(("non healthcare" or "non health care" or "non medical") NEAR/3 ("first responder" or "first responders")):ti,ab,kw
#4	("law enforcement" or police or firefighter* or fire-fighter* or "life guard" or "life guards" or lifeguard* or "flight crew" or "flight attendant" or "flight crews" or "flight attendants" or teacher* or "visitation service" or "visitation program" or "visitation services" or "visitation programs" or "visitation programme" or "visitation programmes" or "duty to attend"):ti,ab,kw
#5	{OR #2-#4}
#6	((tailor* or conceptualiz* or conceptualis* or adapted or adaptation or adjusted or adjustment or customized or customised or "custom made" or novel or specific or developed or development or implementation) and (educat* or train* or course* or ((knowledge or skill or skills) adj3 (acquisition or aquir*)))):ti,ab,kw
#7	#1 and #5 and #6
#8	(barrier* or "deprived community" or "deprived communities" or socioeconomic or "socio economic" or SES or "low resource" or "low resources" or resources or cultural or willingness or satisfaction or retention or feasibility):ti,ab,kw
#9	#1 and #5 and #8
#10	#7 or #9
#11	([mh ^Animals] OR [mh ^"Animal Experimentation"] OR [mh ^"Models, Animal"] OR [mh ^"Disease Models, Animal"]) NOT ([mh ^Humans] OR [mh ^"Human Experimentation"])
#12	#10 not #11
#13	conference proceeding:pt
#14	#12 not #13
#15	#12 not #13 in Trials

Database searched: Embase 01 May 2023 to 22 October 2024; MEDLINE(R) ALL 01 May 2023 to 22 October 2024 (multi-database search via Ovid); Cochrane Central Register of Controlled Trials (Cochrane Library via Wiley Online). See *Annex* for the full search strategy.

Time Frame: (existing PICOST) – updated from end of last search
Time Frame: (new PICOST) – at the discretion of the Task Force (please specify): No new PICOST, search was updated seamlessly from the end of the previous review up until now.
Date Search Completed: 22nd of October 2024
Search Results (Number of articles identified and number identified as relevant): 633
Summary of Evidence Update: Since the last search and the subsequent publication, no relevantly new information was found, only additional literature very similar to the already available one and only giving very limited information. The gaps of knowledge persist.

Relevant Guidelines or Systematic Reviews: None
RCT: None

Nonrandomized Trials, Observational Studies: None
Reviewer Comments: No systematic review is warranted.

Reference list:
[1]   Chaleepad S, Wanla N, Impool T, Nakahara S. Basic resuscitation training for prison inmates in Khon Kaen Province, Thailand. Am J Emerg Med 2024:S0735-6757(24)00528-X.
[2]   di Marco S, Rossi M, Almhmoud Sidiq Babker MA, Arlotta G, Cucino A, IRC-EMERGENCY working group. Resuscitation training in low-resources countries: A jointed project of the Italian Resuscitation Council and the NGO EMERGENCY. Resuscitation 2024;196:110132.
[3]   Stephens N, Nilson C, Reibel T, Marriott R. The availability and delivery of culturally responsive Australian Aboriginal infant resuscitation education programmes: a structured literature review. Prim Health Care Res Dev 2023;24:e51.
[4]   Schnaubelt S, Veigl C, Snijders E, Abelairas Gómez C, Neymayer M, Anderson N, et al. Tailored Basic Life Support Training for Specific Layperson Populations-A Scoping Review. J Clin Med 2024;13:4032.

2025 Evidence Update
EIT 6200 – Faculty Development Approaches for Resuscitation Instructors

Worksheet Author(s): Ming-Ju Hsieh, Chih-Wei Yang, Taylor Sawyer, Tracy Kidd, Jan Breckwoldt, Robert Greif
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: 18 November 2024

Conflicts of Interest: R.G. is co-author of one of the non-RCTs. He was not involved in the assessment of that study.

PICOST / Research Question:
Population: Instructors of accredited life support courses, including basic life support (BLS), pediatric basic life support (PBLS), advanced life support (ALS), pediatric advanced life support (PALS) and neonatal resuscitation programs (NRP)
Intervention: Any faculty development approach to improve instructional competence in accredited life support courses
Comparison: No such approach or any other faculty development approach
Outcomes:
1. Clinical outcome of patients resuscitated by students of the instructors (critical), including favorable neurological outcome, survival to discharge, short-term survival, return of spontaneous circulation (ROSC), sustained ROSC, and survival to admission
2. Educational outcomes, including (1) skill performance of students of the instructors in actual resuscitation (critical); (2) knowledge, skill performance, attitudes, willingness and confidence of students of the instructors immediately at end of the provider course or at defined periods of time after course completion (important)
3. Instructors outcome: (1) knowledge, instructional skills, and attitudes of instructors at the end of instructor training course (important); (2) knowledge, instructional skills, and attitudes of instructors at defined periods of time after the end of instructor training course (important); (3) confidence of instructors to teach students at the end of instructor training course at defined periods of time after course completion (important); (4) acceptance of instructors for a faculty development approach (5) cost of faculty development
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. Grey literature and non-peer reviewed studies, unpublished studies, conference abstracts and trial protocols are eligible for inclusion.
All languages are included as long as there is an English abstract.
Timeframe: Since January 1, 2022 (after last research) until June 30, 2024.

Year of last full review:
The EIT task force of ILCOR has conducted a scoping review previously, with the latest literature search conducted up to December 31, 2021.

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
2022 ILCOR Consensus on Science and Treatment Recommendation:
 There was no treatment recommendation on faculty development programs for resuscitation course instructors previously. This ScopRev has not identified sufficient evidence to support a new SysRev, and no treatment recommendation was generated. From this ScopRev and expert opinion from the task force members, faculty development for resuscitation course instructors remains an important element contributing to improved teaching and the learners' outcomes in accredited life support courses. However, no clear picture of the most appropriate and most effective faculty development programs could be identified from the studies reviewed. Different approaches need to consider the local training environment and resource availability, as well as instructors' needs, to maximize learning outcomes of such programs. The best ways to maintain and assess instructor competency while concurrently maximizing cost-effectiveness need to be established.
 The task force encourages resuscitation councils to implement faculty development programs for their teaching staff of their accredited resuscitation courses.

Current Search Strategy
PubMed
("instructor*"[Title/Abstract] OR "coordinator*"[Title/Abstract] OR "educator*"[Title/Abstract] OR "teacher*"[Title/Abstract] OR "train the trainer*"[Title/Abstract] OR "trainer*"[Title/Abstract]) AND ("cardiopulmonary resuscitation"[MeSH Terms] OR ("cardiopulmonary"[All Fields] AND "resuscitation"[All Fields]) OR "cardiopulmonary resuscitation"[All Fields] OR ("resuscitability"[All Fields] OR "resuscitate"[All Fields] OR "resuscitated"[All Fields] OR "resuscitates"[All Fields] OR "resuscitating"[All Fields] OR

"resuscitation"[MeSH Terms] OR "resuscitation"[All Fields] OR "resuscitations"[All Fields] OR "resuscitative"[All Fields] OR "resuscitator"[All Fields] OR "resuscitators"[All Fields]) OR ("cardiopulmonary resuscitation"[MeSH Terms] OR ("cardiopulmonary"[All Fields] AND "resuscitation"[All Fields]) OR "cardiopulmonary resuscitation"[All Fields] OR "cpr"[All Fields]) OR ("heart massage"[MeSH Terms] OR ("heart"[All Fields] AND "massage"[All Fields]) OR "heart massage"[All Fields]) OR "cardiac massage"[All Fields] OR "chest compression*"[All Fields] OR ("BLS"[All Fields] OR "PBLS"[All Fields] OR "ALS"[All Fields] OR "NRP"[All Fields] OR "PALS"[All Fields] OR "ACLS"[All Fields]) OR "basic life support"[All Fields] OR "pediatric basic life support"[All Fields] OR "pediatric life support"[All Fields] OR "advanced life support"[All Fields] OR "neonatal life support"[All Fields] OR "neonatal resuscitation"[All Fields] OR "pediatric advanced life support"[All Fields] OR "advanced cardiac life support"[All Fields] OR "simulation"[All Fields]) AND ("skills"[Title/Abstract] OR "skill"[Title/Abstract] OR "clinical competence"[MeSH Terms] OR "clinical skills"[Title/Abstract] OR "teaching"[MeSH Terms] OR "teaching"[Title/Abstract] OR "training"[Title/Abstract] OR "retraining"[Title/Abstract] OR "faculty development"[Title/Abstract] OR "teaching competence*"[Title/Abstract] OR "knowledge"[Title/Abstract] OR "education"[Title/Abstract] OR "educational measurement"[MeSH Terms] OR "assessment"[Title/Abstract] OR "certification"[MeSH Terms] OR "certification"[Title/Abstract] OR "performance"[Title/Abstract] OR "retention"[Title/Abstract] OR "recertification"[Title/Abstract] OR "professional competence"[MeSH Terms] OR "attitude*"[Title/Abstract] OR "confidence*"[Title/Abstract] OR "program development"[MeSH Terms] OR "program evaluation"[MeSH Terms] OR "clinical outcome*"[All Fields] OR (("favor"[All Fields] OR "favorable"[All Fields] OR "favorables"[All Fields] OR "favorably"[All Fields] OR "favored"[All Fields] OR "favoring"[All Fields] OR "favors"[All Fields] OR "favour"[All Fields] OR "favourable"[All Fields] OR "favourably"[All Fields] OR "favoured"[All Fields] OR "favouring"[All Fields] OR "favours"[All Fields]) AND "neurologic*"[All Fields] AND "outcome*"[All Fields]) OR (("mortality"[MeSH Subheading] OR "mortality"[All Fields] OR "survival"[All Fields] OR "survival"[MeSH Terms] OR "survivability"[All Fields] OR "survivable"[All Fields] OR "survivals"[All Fields] OR "survive"[All Fields] OR "survived"[All Fields] OR "survives"[All Fields] OR "surviving"[All Fields]) AND ("discharges"[All Fields] OR "discharging"[All Fields] OR "patient discharge"[MeSH Terms] OR ("patient"[All Fields] AND "discharge"[All Fields]) OR "patient discharge"[All Fields] OR "discharge"[All Fields] OR "discharged"[All Fields])) OR ("short-term"[All Fields] AND ("mortality"[MeSH Subheading] OR "mortality"[All Fields] OR "survival"[All Fields] OR "survival"[MeSH Terms] OR "survivability"[All Fields] OR "survivable"[All Fields] OR "survivals"[All Fields] OR "survive"[All Fields] OR "survived"[All Fields] OR "survives"[All Fields] OR "surviving"[All Fields])) OR ("return of spontaneous circulation"[MeSH Terms] OR ("return"[All Fields] AND "spontaneous"[All Fields] AND "circulation"[All Fields]) OR "return of spontaneous circulation"[All Fields]) OR "ROSC"[All Fields] OR (("mortality"[MeSH Subheading] OR "mortality"[All Fields] OR "survival"[All Fields] OR "survival"[MeSH Terms] OR "survivability"[All Fields] OR "survivable"[All Fields] OR "survivals"[All Fields] OR "survive"[All Fields] OR "survived"[All Fields] OR "survives"[All Fields] OR "surviving"[All Fields]) AND ("admission"[All Fields] OR "admissions"[All Fields])) OR ("mortality"[MeSH Subheading] OR "mortality"[All Fields] OR "survival"[All Fields] OR "survival"[MeSH Terms] OR "survivability"[All Fields] OR "survivable"[All Fields] OR "survivals"[All Fields] OR "survive"[All Fields] OR "survived"[All Fields] OR "survives"[All Fields] OR "surviving"[All Fields]))

EMBASE
(instructor*:ti,ab OR coordinator*:ti,ab OR educator*:ti,ab OR 'train the trainer*':ti,ab OR trainer*:ti,ab OR 'teacher'/exp OR teacher*:ti,ab) AND ('cardiopulmonary resuscitation':ti,ab OR 'resuscitation'/exp OR resuscitation:ti,ab OR cpr:ti,ab OR 'heart massage'/exp OR 'heart massage':ti,ab OR 'cardiac massage':ti,ab OR 'chest compression*':ti,ab OR bls:ti,ab OR pbls:ti,ab OR als:ti,ab OR nrp:ti,ab OR pals:ti,ab OR acls:ti,ab OR 'basic life support'/exp OR 'basic life support':ti,ab,kw OR 'pediatric basic life support'/exp OR 'pediatric basic life support':ti,ab OR 'pediatric life support':ti,ab OR 'advanced life support'/exp OR 'als (advanced life support)':ti,ab,kw OR 'advanced life support':ti,ab,kw OR 'neonatal life support':ti,ab OR 'neonatal resuscitation':ti,ab OR 'pediatric advanced life support'/exp OR 'advanced life support, paediatric':ti,ab,kw OR 'advanced life support, pediatric':ti,ab,kw OR 'advanced paediatric life support':ti,ab,kw OR 'advanced pediatric life support':ti,ab,kw OR 'paediatric advanced life support':ti,ab,kw OR 'pediatric advanced life support':ti,ab,kw OR 'advanced cardiac life support'/exp OR 'acls (advanced cardiac life support)':ti,ab,kw OR 'acls care':ti,ab,kw OR 'acls procedure':ti,ab,kw OR 'acls protocol':ti,ab,kw OR 'advanced cardiac life support':ti,ab,kw OR 'advanced cardiovascular life support':ti,ab,kw OR 'cardiac advanced life support':ti,ab,kw OR 'simulation'/exp) AND ('skill'/exp OR skill:ti,ab OR skills:ti,ab OR 'clinical skill'/exp OR 'clinical skill':ti,ab OR 'clinical competence'/exp OR 'clinical competence':ti,ab,kw OR 'teaching'/exp OR teaching:ti,ab OR 'teacher training'/exp OR 'teacher education':ti,ab,kw OR 'teacher training':ti,ab,kw OR 'training'/exp OR training:ti,ab OR retraining:ti,ab OR knowledge:ti,ab OR education:ti,ab OR 'education measurement':ti,ab OR assessment:ti,ab OR 'certification'/exp OR certification:ti,ab OR performance:ti,ab OR retention:ti,ab OR 'recertification'/exp OR 'recertification':ti,ab,kw OR 'professional competence'/exp OR 'professional competence':ti,ab,kw OR confidence*:ti,ab OR 'program development'/exp OR 'program development':ti,ab OR 'program evaluation'/exp OR 'program evaluation':ti,ab,kw OR 'programme evaluation':ti,ab,kw OR 'faculty development'/exp OR 'faculty development':ti,ab OR 'teaching competence*':ti,ab OR attitude*:ti,ab OR 'clinical outcome'/exp OR 'clinical outcome*':ti,ab OR 'favorable neurologic* outcome*':ti,ab OR 'survival'/exp OR 'survival':ti,ab,kw OR 'survival to discharge':ti,ab OR 'survival to admission':ti,ab OR 'short term survival'/exp OR 'short term survival':ti,ab,kw OR 'shortterm survival':ti,ab,kw OR 'return of spontaneous circulation'/exp OR 'rosc':ti,ab,kw OR 'recovery of

spontaneous circulation':ti,ab,kw OR 'restoration of spontaneous circulation':ti,ab,kw OR 'return of spontaneous circulation':ti,ab,kw) AND [embase]/lim

CINAHL

http://search.ebscohost.com/login.aspx?direct=true&db=cin20&bquery=((AB+instructor*)+OR+(AB+coordinator*)+OR+(AB+educato r*)+OR+(AB+teacher*)+OR+(AB+(train+AND+the+AND+trainer))+OR+(AB+train-the-trainer*)+OR+(AB+trainer*)+OR+(AB+train+N3+the+N3+trainer))+AND+((AB+(skill+OR+skills))+OR+(TX+%26quot%3bclinical+skills%26quot%3b)+OR+(TX+%26quot%3bclinical+competence%26quot%3b)+OR+(AB+training)+OR+(AB+teaching)+OR+(MH+teaching)+OR+(TX+retraining)+OR+(TX+re-training)+OR+(MH+%26quot%3bfaculty+development%26quot%3b)+OR+(TX+%26quot%3bfaculty+development%26quot%3b)+OR+(TX+%26quot%3bteaching+competence%26quot%3b)+OR+(AB+knowledge)+OR+(AB+education)+OR+(AB+assessment)+OR+(MH+%26quot%3beducational+measurement%26quot%3b)+OR+(MH+%26quot%3bcertification%26quot%3b)+OR+(TX+certification)+OR+(AB+performance)+OR+(TX+recertification)+OR+(TX+re-certification)+OR+(MH+%26quot%3bprofessional+competence%26quot%3b)+OR+(AB+attitude)+OR+(MH+%26quot%3bprogram+development%26quot%3b)+OR+(MH+%26quot%3bprogram+evaluation%26quot%3b)+OR+(MH+%26quot%3boutcomes+of+education%26quot%3b)+OR+(TX+%26quot%3bneurologic*+outcome%26quot%3b)+OR+(AB+%26quot%3bsurvival%26quot%3b)+OR+(TX+%26quot%3bsurvival+to+discharge%26quot%3b)+OR+(TX+%26quot%3bsurvival+to+admission%26quot%3b)+OR+(TX+(%26quot%3breturn+of+spontaneous+circulation%26quot%3b+OR+ROSC)))+AND+((MH+resuscitation%2c+cardiopulmonary)+OR+(MH+resuscitation)+OR+(TX+CPR)+OR+(AB+(%26quot%3bcardiopulmonary+resuscitation%26quot%3b+OR+CPR+OR+resuscitation))+OR+(TX+%26quot%3bheart+massage%26quot%3b)+OR+(AB+%26quot%3bcardiac+arrest%26quot%3b)+OR+(TX+%26quot%3bbasic+life+support%26quot%3b)+OR+(TX+%26quot%3bpediatric+basic+life+support%26quot%3b)+OR+(TX+%26quot%3bpediatric+life+support%26quot%3b)+OR+(TX+%26quot%3bpediatric+advanced+life+support%26quot%3b)+OR+(TX+%26quot%3bneonatal+resuscitation%26quot%3b)+OR+(TX+%26quot%3bneonatal+life+support%26quot%3b)+OR+(TX+%26quot%3badvanced+life+support%26quot%3b)+OR+(TX+%26quot%3badvanced+cardiac+life+support%26quot%3b)+OR+(AB+simulation)+OR+(TX+%26quot%3bchest+compression*%26quot%3b)+OR+(TX+(BLS+OR+PBLS+OR+ALS+OR+NRP+OR+PALS+OR+ACLS)))&type=1&searchMode=And&site=ehost-live&scope=site

Cochrane

#1   (instructor*):ti,ab,kw
#2   (coordinator*):ti,ab,kw
#3   (educator*):ti,ab,kw (Word variations have been searched)
#4   (teacher*):ti,ab,kw (Word variations have been searched)
#5   (train-the-trainer*):ti,ab,kw (Word variations have been searched)
#6   (trainer*):ti,ab,kw (Word variations have been searched)
#7   #1 or #2 or #3 or #4 or #5 or #6
#8   MeSH descriptor: [Cardiopulmonary Resuscitation] explode all trees
#9   MeSH descriptor: [Resuscitation] explode all trees
#10   (resuscitation):ti,ab,kw
#11   (CPR):ti,ab,kw
#12   MeSH descriptor: [Heart Massage] explode all trees
#13   ("heart massage"):ti,ab,kw
#14   ("cardiac massage"):ti,ab,kw
#15   ("chest compression*"):ti,ab,kw
#16   ("basic life support"):ti,ab,kw
#17   ("pediatric basic life support"):ti,ab,kw
#18   ("advanced life support"):ti,ab,kw
#19   ("neonatal resuscitation"):ti,ab,kw
#20   ("neonatal life support"):ti,ab,kw
#21   ("pediatric life support"):ti,ab,kw
#22   ("pediatric advanced life support"):ti,ab,kw
#23   MeSH descriptor: [Advanced Cardiac Life Support] explode all trees
#24   ("advanced cardiac life support"):ti,ab,kw
#25   (BLS or PBLS or ALS or NRP or PALS or ACLS):ti,ab,kw
#26   (simulation):ti,ab,kw
#27   ("cardiopulmonary resuscitation"):ti,ab,kw
#28   #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27

#29   (skill or skills):ti,ab,kw
#30   MeSH descriptor: [Clinical Competence] explode all trees
#31   ("clinical skills"):ti,ab,kw
#32   ("clinical competence"):ti,ab,kw
#33   MeSH descriptor: [Teaching] explode all trees
#34   (teaching):ti,ab,kw
#35   MeSH descriptor: [Teacher Training] explode all trees
#36   ("teacher training"):ti,ab,kw
#37   (training):ti,ab,kw
#38   (retraining):ti,ab,kw
#39   ("faculty development"):ti,ab,kw
#40   ("teaching competence*"):ti,ab,kw
#41   (knowledge):ti,ab,kw
#42   (education):ti,ab,kw
#43   MeSH descriptor: [Educational Measurement] explode all trees
#44   ("educational measurement"):ti,ab,kw
#45   (assessment):ti,ab,kw
#46   MeSH descriptor: [Certification] explode all trees
#47   (certification):ti,ab,kw
#48   (recertification):ti,ab,kw
#49   (re-certification):ti,ab,kw
#50   (performance):ti,ab,kw
#51   (retention):ti,ab,kw
#52   MeSH descriptor: [] explode all trees
#53   ("professional competence"):ti,ab,kw
#54   (confidence*):ti,ab,kw
#55   (attitude*):ti,ab,kw
#56   MeSH descriptor: [Program Development] explode all trees
#57   ("program development"):ti,ab,kw
#58   MeSH descriptor: [Program Evaluation] explode all trees
#59   ("Program Evaluation"):ti,ab,kw
#60   ("survival to discharge"):ti,ab,kw
#61   ("survival to admission"):ti,ab,kw
#62   MeSH descriptor: [Survival] explode all trees
#63   MeSH descriptor: [Return of Spontaneous Circulation] explode all trees
#64   ("return of spontaneous circulation"):ti,ab,kw
#65   ("ROSC"):ti,ab,kw
#66   ("neurologic* outcome*"):ti,ab,kw
#67   ("clinical outcome*"):ti,ab,kw
#68   #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 or #49 or #50 or #51 or #52 or #53 or #54 or #55 or #56 or #57 or #58 or #59 or #60 or #61 or #62 or #63 or #64 or #65 or #66 or #67
#69   #7 and #28 and #68

Database searched:
Pubmed, Embase, CINAHL and Cochrane.

Time Frame: (existing PICOST) – updated from end of last search (January 1, 2022)
Date Search Completed: June 30, 2024.

Search Results (Number of articles identified and number identified as relevant):
Initially, 3,532 records (PubMed: 1384; Embase: 1249; CINAHL: 560; Cochrane: 339) were identified. After excluding 679 duplicates.
2,853 records were screening and 26 potentially relevant records were included in the full-text assessment.
Finally, 4 studies were included. All of them are full-length article.

Summary of Evidence Update:

In the previous scoping review (1), the task force categorized the interventions reported in the included articles into four themes:

(1) Instructor qualification/training: modifying the duration and format of the traditional instructor qualification course;

(2) Assessment tools: utilizing tools to improve the accuracy of instructors' assessment of students;

(3) Teaching skills enhancement: incorporating new teaching methods into the traditional instructor qualification course to enhance teaching skills;

(4) Additional courses for instructors: adding supplementary courses after the traditional instructor qualification course to improve instructors' teaching abilities and assessment accuracy.

In this evidence update, four studies were included. Two articles compared the impact of incorporating techniques for identifying and correcting common student mistakes on improving student BLS performance when teaching physical education teachers how to deliver BLS training (2, 3). One of the two studies used traditional teaching methods(2), while the other employed blended learning (3). Both found that incorporating techniques for identifying and correcting common student errors improved student BLS performance. The interventions in the two studies mentioned above align with the theme of teaching skills enhancement (2, 3).

One study, which was performed by Nabecker S. et al., compared an 8-hour traditional ERC Basic Instructor Course with a 4-hour blended learning course, concluding that the blended learning course enabled more instructors to teach Basic Life Support provider courses (4). The final study, which was performed by Kiyozumi T. et al., compared the learning effect of virtual reality (VR) and face-to-face instructor courses (5). It was found that the learning effect of the VR course was equivalent to that of the face-to-face course. The interventions in the two studies, conducted individually by Nabecker S. et al. and Kiyozumi T. et al., focused on the theme of instructor qualification and training.

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
Ko YC et al.; 2022 (1)	scoping review	The aim of this scoping review was to identify faculty development approaches to improve instructional competence in accredited life support courses.	20	The interventions were categorized into 4 themes: instructor qualification/training (n=9), assessment tools (n=3), teaching skills enhancement (n=3), and additional courses for instructors (n=5).	No treatment recommendation was generalized. However, because the faculty development approaches for instructors are generally associated with improved learning outcomes for participants, and also improved teaching ability and self-confidence of the instructors, the task force encourages resuscitation councils to implement faculty development programs for their teaching staff of their accredited resuscitation courses.

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
Iserbyt et al.; 2022 (Belgium) (2)	**Study Aim:** the role of content knowledge and repeated	**Inclusion Criteria:** (1) teachers agreed to participate and follow a 60-min training on BLS; (2)	**Intervention:** specialized content knowledge (SCK) training with task adaptations to	**1° endpoint:** (1) students' BLS performance:	**Study Limitations:** (1) randomization performed at school level (2) small sample

	teaching trials for improving teaching and learning BLS **Study Type:** cluster randomized controlled trial	BLS had not previously been taught to students in the first cycle; and (3) the teachers had no previous experience in teaching BLS. (Teacher N=6)	correct two common errors related to chest compressions and two related to ventilations. (Teacher n=3) **Comparison:** Common content knowledge (CCK) training without task adaptations to correct two common errors described above. (Teacher n=3)	After lesson two, BLS performance was significantly higher in the SCK (73%, CI 66%–80%) vs CCK group (63%, CI 56%–70%), *p*=0.032 (2) CPR performance After lesson one, chest compression depth was significantly deeper in the SCK (44 mm, CI 41–47) vs CCK (40 mm, CI 37–43) group, *p*=0.01 After lesson two, significant differences for amount of ventilations were found in the SCK group (4, CI 3.5–4.5) vs the CCK group (3, CI 3.2–4.8), *p*=0.004 Ventilation volume in the SCK group (552 ml, CI 490–614) was also higher compared to the CCK group (405 ml, CI 355–460), *p*=0.046 Number of Students (SCK vs CCK, 131 vs 104)	size
Madou T et al.; 2023 (Belgium) [3]	**Study Aim:** the effect of specialized content knowledge in instructor training on the teaching and learning of BLS in secondary schools **Study Type:** Cluster randomized controlled trial (Teacher N=8)	**Inclusion Criteria:** (1) teachers were willing to participate in a 60-minute blended instructor-training workshop, (2) teachers did not consider themselves experts in BLS as reported in a written questionnaire completed prior to the start of the study, (3) teachers were willing to teach BLS repeatedly while being video- and audio-recorded, (4) participating classes were enrolled in a 'general	**Intervention:** blended learning with specialized content knowledge with a focus on recognizing and addressing common errors. (Teacher n=5) **Comparison:** Blended learning with common content knowledge without a focus on recognizing and addressing common errors (Teacher n=3)	**1° endpoint:** students taught by specialized content knowledge teachers achieved significantly higher BLS scores (66% vs 61%; *p*<.05) Number of Students (SCK vs CCK, 192 vs 104)	**Study Limitations:** (1) randomization performed at school level (2) small sample size

| | | secondary education track' preparing for higher education, (5) BLS had not been part of the school curriculum for at least 2 years, and (6) the school principal approved the study. | | | |

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Study Intervention (# patients) / Study Comparator patients)	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Nabecker S et al.; 2022 (Canada) (4)	**Study Type:** prospective interventional study (N=68)	**Inclusion Criteria:** healthcare providers	**Intervention:** four-hour blended learning strategy: pre-course preparation and on-site small-group sessions (two 90-min sessions: 1) a microteaching session : "The practice of teaching BLS" (2) "Assessment and feedback during a BLS-courses" (n=31) **Comparison:** the traditional 8-hour ERC Basic Instructor Course (n=37)	**1° endpoint:** participants started to teach BLS (87% vs 24%)	The 4-hour blended learning strategy enable more instructors to teach BLS provider courses.
Kiyozumi T et al.; 2022 (Japan) (5)	**Study Type:** observational study (N=23)	**Inclusion Criteria:** advanced life support (ALS) instructor candidates	**Intervention:** the VR ALS instructor course (n=13) **Comparison:** the face-to-face ALS instructor course (n=10)	**1° endpoint:** overall evaluation score (VR vs face-to-face groups, median 3.8, IQR 3.8-4.0 vs 4.2, IQR 3.9-4.2, p=0.41)	The learning effect of the VR workshop was the same as that of the face-to-face training workshop.

Reviewer Comments: *(including whether this PICOST should have a systematic or scoping review)*

Since the search period for this evidence update took place during and after the COVID-19 pandemic, the included articles explored the use of blended learning courses and even virtual reality to reduce in-person gatherings and minimize the risk of infection. The results also showed that these instructor courses, which reduced face-to-face time, were not inferior to traditional instructor courses. Therefore, similar to provider courses, well-designed and validated modified instructor courses have the potential to become new training methods.

Additionally, two studies included in this evidence update found that incorporating techniques for identifying and correcting common student errors improved student BLS performance. This suggests that integrating techniques for recognizing common student mistakes in instructor courses may enhance the effectiveness of teaching.

Insight from EIT Task Force:

There was no treatment recommendation on faculty development programs for resuscitation course instructors previously. This evidence update has not identified sufficient evidence to support a new SysRev, and therefore no treatment recommendation can be generated.

Faculty development for resuscitation course instructors remains an important element contributing to improved teaching and the learners' outcomes in accredited life support courses.

However, the 4 new studies do not add new evidence to clarify the picture of the most appropriate and most effective faculty development programs. Different approaches with different methods and duration of courses need to consider, as well as the local training environment and resource availability, and the instructors' needs to maximize learning outcomes of such programs.

The best ways to maintain and assess instructor competency while concurrently maximizing cost-effectiveness need to be established.

As ongoing research continues to demonstrate that well-designed faculty development programs, incorporating new forms or content, can enhance teaching skills and improve learner outcomes, the task force continues to encourage resuscitation councils to implement faculty development programs for the teaching staff of their accredited resuscitation courses.

The identified knowledge gaps are as follows.
(1) The most appropriate life support instructor training strategy
(2) The best methods for objective measurement of instructor competence
(3) Optimal recertification or retraining program intervals and most effective skill maintenance program for life support course instructors
(4) More innovative and effective faculty development methods
(5) The difference between faculty development for those that teach lay rescuers and those that teach healthcare professionals

Reference list: *(List by ILCOR ref standard (last name first author, year of publication, first page number) and insert hyperlink to all articles identified as relevant (if available on PubMed)*

1.   Ko YC, Hsieh M, Cheng A, Lauridsen KG, Sawyer TL, Bhanji F, et al. Faculty Development Approaches for Life Support Courses: A Scoping Review. J Am Heart Assoc. 2022;11(11):e025661.
2.   Iserbyt P, Madou T. The effect of content knowledge and repeated teaching on teaching and learning basic life support: a cluster randomised controlled trial. Acta Cardiol. 2022;77(7):616-25.
3.   Madou T, Depaepe F, Ward P, Iserbyt P. The role of specialised content knowledge in teaching basic life support. Health Education Journal. 2023;82(5):555–68.
4.   Nabecker S, Balmer Y, van Goor S, Greif R. Piloting a Basic Life Support instructor course: A short report. Resusc Plus. 2022;12:100325.
5.   Kiyozumi T, Ishigami N, Tatsushima D, Araki Y, Yoshimura Y, Saitoh D. Instructor Development Workshops for Advanced Life Support Training Courses Held in a Fully Virtual Space: Observational Study. JMIR Serious Games. 2022;10(2):e38952.

2025 Evidence Update
EIT 6300 – Family Presence in Adult Resuscitation

Worksheet Author(s): Alexander Olaussen, Kathryn Eastwood, Julie Considine, Kevin Nation, Sabine Nabecker
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: June 2024
Conflicts of Interest: none

PICO / Research Question: EIT 6300 *Family presence in adult resuscitation*
Population: Adults requiring resuscitation in any setting.
Intervention: Does family presence during resuscitation.
Comparators: Compared to no family presence during resuscitation.
Outcomes: Result in improved patient outcomes (short and long term), family-centered outcomes (short and long term psychological stress, perception of the resuscitation), and health care provider-centered outcomes (psychological stress, perception of the resuscitation).
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 are included as long as there is an English abstract.

PROSPERO Registration: submitted to PROSPERO on 23/03/2021. PROSPERO ID CRD42021242384.
Year of last full review: 2022

Current ILCOR Consensus on Science and Treatment Recommendation:
We suggest that family members be provided with the option to be present during in-hospital adult resuscitation from cardiac arrest. (weak recommendation; very low certainty of evidence)
We suggest that family members be provided with the option to be present during out-of-hospital adult resuscitation from cardiac arrest acknowledging that providers are often not able to control this. (weak recommendation; very low certainty of evidence)
Policies or protocols about family presence during resuscitation should be developed to guide and support healthcare professional decision-making. (Good Practice Statement)
When implementing family presence procedures, healthcare providers should receive education about family presence during adult cardiac arrest resuscitation, including how to manage these stressful situations, family distress and their own responses to these situations. (good practice statement)

Search strategy: previous search strategy was used

#	Query	Results from 28 April 2024 Medline search
1	first aid/ or resuscitation/ or cardiopulmonary resuscitation/ or heart massage/ or Defibrillators/	60695
2	(cpr or cardiopulmonary resus* or chest compression* or (bls or basic life support) or first aid or aed).mp.	58376
3	1 or 2	85730
4	family/ or adult children/ or grandparents/ or nuclear family/ or parents/ or fathers/ or mothers/ or single parent/ or siblings/ or spouses/	254351
5	3 and 4	1314
6	Visitors to Patients/	2298
7	(visit* adj2 patient*).mp.	29692
8	6 or 7	29692
9	3 and 8	287

10	((family or families or "next of kin*" or relatives or significant other* or spouse* or husband* or wife or wives or partner* or parent* or sibling* or friend* or companion* or children or grandparent* or grandmother* or grandfather* or mother* or father* or brother* or sister* or son or sons or daughter*) adj3 (presence or present or attend* or observ* or witness* or perception* or participat* or visit*)).mp.	125306
11	3 and 10	846
12	5 or 9 or 11	1776
13	limit 12 to dt=20220510-20240428	103

Database searched: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions. CINAHL Database
Time Frame for original search: From inception – May 10, 2022
Time Frame for Evidence Update: May 10, 2022 – 28th April 2024
Date Search Completed: 28th April 2024
Search Results (Number of articles identified and number identified as relevant): 298/7

Date Search Completed: Medline & CINAHL: 28th April 2024
Inclusion/Exclusion Criteria: The inclusion criteria were studies: (i) of adults in cardiac arrest in any setting, (ii) with family presence during resuscitation, (iii) with or without a comparator of family absence during resuscitation, and (iv) that reported one or more of patient, family, or provider outcomes. All study designs were eligible for inclusion. Studies of hypothetical situations or opinions were excluded as were unpublished studies, conference abstracts, trial protocols, and theses. All years and languages were included if there was an English abstract. There was no universal definition of family so for the purposes of this systematic review, 'family' was defined according to each individual study.

Relevant Guidelines or Systematic Reviews:
Considine J, Eastwood K, Webster H, Smyth M, Nation K, Greif R, Dainty K, Finn J, Bray J, Education I, Support BL. Family presence during adult resuscitation from cardiac arrest: a systematic review. Resuscitation. 2022 Nov 1;180:11-23.

Summary of Evidence Update:
Link to Article Titles and Abstracts (if available on PubMed):
New primary studies (n=7)

First Author and Link PMID or URL	Title/Citation	Journal	Country
Saifan	Health professionals and family members during cardiopulmonary resuscitation: A qualitative study on the experience of witnessing resuscitation in Jordanian critical care units.	Heart Lung	Jordan
Rahmawati	Factors associated with nurses' perceptions and self-confidence in relation to family presence during resuscitation: a cross-sectional study in Indonesia	Journal of nursing and social sciences related to health and illness	Indonesia
Waldemar	Experiences of family-witnessed cardiopulmonary resuscitation in hospital and its impact on life: An interview study with cardiac arrest survivors and their family members.	Journal of clinical nursing	Sweden
Powers	Family support person role during resuscitation: A qualitative exploration	Journal of clinical nursing	USA
Waldemar	Family presence during in-hospital cardiopulmonary resuscitation: effects of an educational online intervention on self-confidence and attitudes of healthcare professionals.	Eur J Cardiovasc Nurs	Sweden
Risson	Paramedic interactions with significant others during and after resuscitation and death of a patient	Australas Emerg Care	

Choi		Emergency Nurses' Perceptions of Family Presence during Resuscitation: A Thematic Analysis.	J Korean Acad Fundam Nurs	Korea

Relevant Guidelines or new Systematic Reviews: 2

Organisation (if relevant); Author, Year published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
Rubin 2023, Cochrane	Cochrane Review	Adults (>13 years old) requiring resuscitation (P), family presence facilitation (I) vs usual care (C), PTSD (O)	3	The electronic searches yielded a total of 7292 records after deduplication. We included 2 trials (3 papers) involving a total of 595 participants: a cluster-randomized trial from 2013 involving pre-hospital emergency medical services units in France, comparing systematic offer for a relative to witness CPR with the traditional practice, and its 1-year assessment; and a small pilot study from 1998 of FPDR in an emergency department in the UK. Participants were 19 to 78 years old, and between 56% and 64% were women. PTSD was measured with the Impact of Event Scale, and the median score ranged from 0 to 21 (range 0 to 75; higher scores correspond to more severe disease). In the trial that accounted for most of the included participants (570/595), the frequency of PTSD-related symptoms was significantly higher in the control group after 3 and 12 months, and in the per-protocol analyses a significant statistical difference was found in favor of FPDR when looking at PTSD, anxiety and depression, and complicated grief after 1 year. One of the included studies also measured duration of patient resuscitation and personal stress in healthcare professionals during FPDR and found no difference between groups. Both studies had high risk of bias, and the evidence for all outcomes except one was assessed as very low certainty.	There was insufficient evidence to draw any firm conclusions on the effects of FPDR on relatives' psychological outcomes. Sufficiently powered and well-designed randomized controlled trials may change the conclusions of the review in future.
Rubin 2023	A qualitative evidence synthesis	The primary aim of this qualitative evidence synthesis (QES) review was to synthesize current qualitative evidence regarding HCP	9	We identified 8241 articles suitable for screening, 141 articles were full text screened, and nine studies included from Australia, UK and USA. In total, 134 HCP participated, between 2005 and 2019. Most studies lacked sufficiently rigorous data analysis and findings were appraised to have moderate GRADE CERQual confidence.	The evidence on HCP perspectives is of low to moderate confidence. The interviewed consent that FPDR is the "right thing to do", and an ethical principle of beneficence is dominant, especially regarding children.

| | | perspectives on factors which influence FPDR, as well as how they experience the potential impact of FPDR on work performance in the emergency department setting. | | We identified three analytical themes ("Facilitating factors for FPDR", "Barriers for FPDR" and "How staff are affected by FPDR") with eight descriptive subthemes. One finding was of high GRADE CERQual confidence: a belief that FPDR is "the right thing to do" which was a "Facilitating factor of FPDR." | |

Reviewer Comments: The evidence update identified 7 new primary studies and 2 systematic reviews. Patient outcomes were lacking; healthcare professional outcomes were qualitative and did not impact previous recommendations. A dedicated family support role leads to a more positive view of family presence. Family member outcomes demonstrated mixed responses (positive and negative).

Overall, the knowledge gaps remain the same as previously, and the new evidence is very unlikely to change the existing ILCOR recommendations from 2022. Given the number of new primary studies, the decision was made to escalate this review to a systematic review during the next round.

Reference list:

1.   Saifan AR, Elshatarat RA, Saleh ZT, Elhefnawy KA, Elneblawi NH, Al-Sayaghi KM, et al. Health professionals and family members during cardiopulmonary resuscitation: A qualitative study on the experience of witnessing resuscitation in Jordanian critical care units. Heart & lung : the journal of critical care. 2023;62:101-7https://dx.doi.org/10.1016/j.hrtlng.2023.06.020

2.   Rahmawati I, Dilaruri A, Rosmalinda, Palupi LM, Widiani E. Factors associated with nurses' perceptions and self-confidence in relation to family presence during resuscitation: a cross-sectional study in Indonesia. Journal of Nursing & Social Sciences related to Health & Illness. 2021;23(4):256-62http://doi.org/10.32725/kont.2021.050

3.   Waldemar A, Stromberg A, Thylen I, Bremer A. Experiences of family-witnessed cardiopulmonary resuscitation in hospital and its impact on life: An interview study with cardiac arrest survivors and their family members. Journal of clinical nursing. 2023;32(19-20):7412-24https://dx.doi.org/10.1111/jocn.16788

4.   Powers K, Duncan JM, Renee Twibell K. Family support person role during resuscitation: A qualitative exploration. Journal of Clinical Nursing (John Wiley & Sons, Inc). 2023;32(3/4):409-2110.1111/jocn.16248

5.   Waldemar A, Bremer A, Stromberg A, Thylen I. Family presence during in-hospital cardiopulmonary resuscitation: effects of an educational online intervention on self-confidence and attitudes of healthcare professionals. European journal of cardiovascular nursing. 2024https://dx.doi.org/10.1093/eurjcn/zvad111

6.   Risson H, Beovich B, Bowles K-A. Paramedic interactions with significant others during and after resuscitation and death of a patient. Australasian Emergency Care. 2023;26(2):113-8https://doi.org/10.1016/j.auec.2022.08.007

7.   Choi Y, Yi Y. Emergency Nurses' Perceptions of Family Presence during Resuscitation: A Thematic Analysis. Journal of Korean Academy of Fundamentals of Nursing. 2023;30(4):519-29https://doi.org/10.7739/jkafn.2023.30.4.519

8.   Afzali Rubin M, Svensson TL, Herling SF, Jabre P, Moller AM. Family presence during resuscitation. The Cochrane database of systematic reviews. 2023;5:CD013619https://dx.doi.org/10.1002/14651858.CD013619.pub2

9.   Afzali Rubin M, Meulengracht SES, Frederiksen KAP, Thomsen T, Moller AM. The healthcare professionals' perspectives and experiences with family presence during resuscitation: A qualitative evidence synthesis. Acta anaesthesiologica Scandinavica. 2024;68(1):101-21https://dx.doi.org/10.1111/aas.14323

2025 Evidence Update
EIT 6301 – Cardiac Arrest Centers

Worksheet Author(s): Adam J Boulton, Joyce Yeung
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: June 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults with attempted resuscitation after non-traumatic in-hospital (IHCA) or out-of-hospital cardiac arrest (OHCA).
Intervention: Care at a specialized cardiac arrest centre.
Comparator: Care in an institute not designated as a specialized cardiac arrest centre.
Outcomes: Primary outcomes were Survival at 30 days with favorable neurological outcome (CRITICAL) and
Survival at hospital discharge with favorable neurological outcome (CRITICAL). Secondary outcomes were: Return of spontaneous circulation (ROSC) post hospital admission for patients with ongoing CPR (IMPORTANT), Survival at 30 days (CRITICAL) and Survival at hospital discharge (CRITICAL)
Study Designs: Randomised controlled trials (RCTs) and non-randomised studies (non-randomised controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion. Unpublished studies (e.g., conference abstracts, trial protocols) were excluded. Studies reporting paediatric cardiac arrests (≤18 years old) and cardiac arrest secondary to trauma were excluded.
Timeframe:
All years and all languages were included provided there was an English abstract. The literature search was updated on 31st December 2023 to 18th November 2024

Year of last full review: 2024
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest adults with OHCA should be cared for in cardiac arrest centers (weak recommendation, very-low certainty evidence).

Current Search Strategy
Ovid MEDLINE(R) ALL <1946 to November 18, 2024>
1   Cardiac Care Facilities/
2   Cardiology Service, Hospital/
3   Regional Medical Programs/
4   (Heart attack Centre* or Heart Attack Center* or cardiac arrest centre* or cardiac arrest center*).ab,kf,ti.
5   fifth link.ab,kf,ti.
6   (cardiac resuscitation center* or cardiac resuscitation centre* or regional cardiac resuscitation).ab,kf,ti.
7   (CRC or CRC*).ab,kf,ti.
8   (regional system* or network or hospital volume or patient volume).ab,kf,ti.
9   (Cardiac Receiving Center* or Cardiac Receiving Centre*).ab,kf,ti.
10   (post cardiac arrest adj1 (care or treatment)).ab,kf,ti.
11   (postcardiac arrest adj1 (care or treatment)).ab,kf,ti.
12   (post resuscitation adj1 (care or treatment)).ab,kf,ti.
13   (postresuscitation adj1 (care or treatment)).ab,kf,ti.
14   "Cardiac Care Facilit*".ab,kf,ti.
15   (Cardiac adj2 (Centre* or Center*)).ab,kf,ti.
16   (Cardiology adj1 (Service or care) adj2 Hospital).ab,kf,ti.
17   (Cardiovascular adj1 (Centre or Center)).ab,kf,ti.
18   cardiac catheterisation laboratory.ab,kf,ti.
19   (CAC or CACs).ab,kf,ti.
20   Tertiary Care Centers/
21   (Tertiary adj1 (care or Center* or Centre*)).ab,kf,ti.
22   Cardiac Arrest Registry.ab,kf,ti.
23   ("Critical care medical center*" or "Critical care medical centre*").ab,kf,ti.
24   ("critical care centre*" or "critical care center*").ab,kf,ti.
25   or/1-2
26   heart arrest/ or out-of-hospital cardiac arrest/

27   cardiopulmonary resuscitation/ or advanced cardiac life support/
28   Death, Sudden, Cardiac/
29   Out of Hospital Cardiac Arrest.ab,kf,ti.
30   OHCA.ab,kf,ti.
31   return of spontaneous circulation.ab,kf,ti.
32   ROSC.ab,kf,ti.
33   ((heart or cardiac or cardiovascular) adj1 arrest).ab,kf,ti.
34   asystole.ab,kf,ti.
35   pulseless electrical activity.ab,kf,ti.
36   Advanced Cardiac Life Support.ab,kf,ti.
37   ACLS.ab,kf,ti.
38   Ventricular Fibrillation/
39   (cardiopulmonary arrest or cardiopulmonary resuscitation).ab,kf,ti.
40   (Cardio-pulmonary arrest or cardio-pulmonary resuscitation or CPR).ab,kf,ti.
41   code blue.ab,kf,ti.
42   or/26-41
43   25 and 42
44   Animals/ not (Animals/ and Humans/)
45   43 not 44
46   (letter or comment or editorial).pt.
47   45 not 46
48   limit 47 to yr="2018 -Current"

Embase <1980 to 2024 Week 46>
1   heart center/
2   cardiology service/
3   "Regional Medical Program*".ab,hw,ti.
4   (Heart attack Centre* or Heart Attack Center* or cardiac arrest centre* or cardiac arrest center*).ab,hw,ti.
5   "Cardiology Service*".ab,hw,ti.
6   fifth link.ab,hw,ti.
7   (cardiac resuscitation center* or cardiac resuscitation centre* or regional cardiac resuscitation).ab,hw,ti.
8   (CRC or CRC*).ab,hw,ti.
9   (regional system* or network or hospital volume or patient volume).ab,hw,ti.
10   (Cardiac Receiving Center* or Cardiac Receiving Centre*).ab,hw,ti.
11   (post cardiac arrest adj1 (care or treatment)).ab,hw,ti.
12   (postcardiac arrest adj1 (care or treatment)).ab,hw,ti.
13   (post resuscitation adj1 (care or treatment)).ab,hw,ti.
14   (postresuscitation adj1 (care or treatment)).ab,hw,ti.
15   "Cardiac Care Facilit* ".ab,hw,ti.
16   (Cardiac adj2 (Centre* or Center*)).ab,hw,ti.
17   (Cardiology adj1 (Service or care) adj2 Hospital).ab,hw,ti.
18   (Cardiovascular adj1 (Centre or Center)).ab,hw,ti.
19   cardiac catheterisation laboratory.ab,hw,ti.
20   (CAC or CACs).ab,hw,ti.
21   tertiary care center/
22   (Tertiary adj1 (care or Center* or Centre*)).ab,hw,ti.
23   Cardiac Arrest Registry.ab,hw,ti.
24   ("Critical care medical center*" or "Critical care medical centre*").ab,hw,ti.
25   ("critical care centre*" or "critical care center*").ab,hw,ti.
26   or/1-2
27   heart arrest/ or cardiopulmonary arrest/ or "out of hospital cardiac arrest"/ or sudden cardiac death/
28   cardiac life support.ab,hw,ti.
29   OHCA.ab,hw,ti.
30   "return of spontaneous circulation"/
31   ((heart or cardiac or cardiovascular) adj1 arrest).ab,hw,ti.
32   asystole.ab,hw,ti.

33   pulseless electrical activity.ab,hw,ti.
34   ACLS.ab,hw,ti.
35   heart ventricle fibrillation/
36   (cardiopulmonary arrest or cardiopulmonary resuscitation).ab,hw,ti.
37   (Cardio-pulmonary arrest or cardio-pulmonary resuscitation or CPR).ab,hw,ti.
38   code blue.ab,hw,ti.
39   or/27-38
40   26 and 39
41   exp animal/ not (exp animal/ and human/)
42   40 not 41
43   (Conference abstract or conference paper or conference review or book or editorial or letter).pt.
44   42 not 43
45   limit 44 to yr="2018 -Current"

Cochrane:
ID   Search   Hits
#1   MeSH descriptor: [Cardiac Care Facilities] explode all trees
#2   MeSH descriptor: [Cardiology Service, Hospital] explode all trees
#3   ((Heart attack Centre* or Heart Attack Center* or cardiac arrest centre* or cardiac arrest center*)):ti,ab,kw
#4   MeSH descriptor: [Regional Medical Programs] explode all trees
#5   (fifth link):ti,ab,kw
#6   ((cardiac resuscitation center* or cardiac resuscitation centre* or regional cardiac resuscitation)):ti,ab,kw
#7   ((regional system* or network or hospital volume or patient volume or Cardiac Receiving Center* or Cardiac Receiving Centre*)):ti,ab,kw
#8   (("post cardiac arrest care" or "post cardiac arrest treatment")):ti,ab,kw
#9   ((postcardiac arrest care or postcardiac arrest treatment)):ti,ab,kw
#10   (("post resuscitation care" or "post resuscitation treatment")):ti,ab,kw
#11   ((postresuscitation care or postresuscitation treatment)):ti,ab,kw
#12   ((Cardiac Care Facilit*)):ti,ab,kw
#13   ((Cardiac centre* or Cardiac center*)):ti,ab,kw
#14   ((Cardiovascular centre* or Cardiovascular center*)):ti,ab,kw
#15   ((cardiac catheterisation laboratory)):ti,ab,kw
#16   MeSH descriptor: [Tertiary Care Centers] explode all trees
#17   ((Tertiary care or Tertiary center* or Tertiary centre*)):ti,ab,kw
#18   ((Cardiac Arrest Registry)):ti,ab,kw
#19   ((Critical care medical center* or Critical care medical centre* or critical care centre* or critical care center*)):ti,ab,kw
#20   #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19
#21   MeSH descriptor: [Heart Arrest] explode all trees
#22   MeSH descriptor: [Cardiopulmonary Resuscitation] explode all trees
#23   ((Hospital Cardiac Arrest or OHCA or return of spontaneous circulation or ROSC or asystole)):ti,ab,kw
#24   (("heart arrest" or "cardiac arrest" or "cardiovascular arrest")):ti,ab,kw
#25   ((pulseless electrical activity or cardiopulmonary arrest or cardiopulmonary resuscitation or Cardio-pulmonary arrest or cardio-pulmonary resuscitation or CPR or ACLS)):ti,ab,kw
#26   MeSH descriptor: [Ventricular Fibrillation] explode all trees
#27   #21 or #22 or #23 or #24 or #25 or #26
#28   #20 and #27

Database searched: MEDLINE, EMBASE, Cochrane
Time Frame: (existing PICOST) – updated from end of last search 31st December 2023 to 18th November 2024
Date Search Completed: 18th November 2024
Search Results: 1083 results. 831 de-duplicated results. 3 articles meeting included.

Summary of Evidence Update:
Relevant Guidelines or Systematic Reviews: None found
RCT: None found
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)
Dicker 2024	Study Type: Retrospective cohort. N = 2297 Propensity score matching (N = 1108)	Inclusion Criteria: Adults with treated OHCA of presumed cardiac etiology 1st July 2018 to 30th June 2023	1° endpoint: 30-day survival. Adjusted Odds Ratio 0.78 95%CI 0.54, 1.13, p = 0.19	"This study found no statistically significant difference in outcomes for OHCA patients transferred to a cardiac arrest compared to a non-cardiac arrest center. However, the odds ratio of 0.78, equivalent to a 22% decrease in 30-day mortality, is consistent with benefit associated with management by a cardiac arrest center."
Price 2024	Retrospective cohort. N = 1151. Multivariate logistic regression	Adult OHCA witnessed collapse and initial shockable rhythm with resuscitation attempted by EEAST and successful (in ROSC at hospital arrival); 2018–2022 inclusive.	Survival to discharge. Adjusted OR 1.44 (95%CI 1.07–1.94), p = 0.017	"Direct transport to a cardiac arrest centre was associated with a 44% increase in the odds of survival compared to conveyance to a non-specialist centre for resuscitated adult patients presenting with witnessed collapse and initial shockable OHCA rhythm."
Voss 2024	Retrospective cohort. Before and after CAC accreditation. N = 784.	Adults admitted to participating hospitals post OHCA (Berlin: 05/19–06/20 [before CAC] and 01/21–10/22 [after CAC]; Cologne: 01/18–02/19 and 03/19–12/21; Duesseldorf: 07/17–06/19 and 07/19–06/21). Unadjusted analysis.	Likelihood of favorable neurological status at discharge was higher after CAC accreditation (71 vs. 87%, p < 0.01), whereas overall survival remained similar (35 vs. 35%, p > 0.99).	"CAC accreditation is linked to higher rates of favorable neurological outcome and unchanged overall survival."

Reviewer Comments: Three new observational studies found. The new evidence will not change our current ILCOR Consensus on Science and Treatment Recommendation. New systematic review not indicated

Reference list:

1. Dicker B, Garrett N, Howie G, Brett A, Scott T, Stewart R, Perkins GD, Smith T, Garcia E, Todd VF. Association between direct transport to a cardiac arrest centre and survival following out-of-hospital cardiac arrest: A propensity-matched Aotearoa New Zealand study. Resusc Plus. 2024 Apr 6;18:100625. doi: 10.1016/j.resplu.2024.100625. PMID: 38601710; PMCID: PMC11004390.
2. Price J, Rees P, Lachowycz K, Starr Z, Pareek N, Keeble TR, Major R, Barnard EBG. Increased survival for resuscitated Utstein-comparator group patients conveyed directly to cardiac arrest centres in a large rural and suburban population in England. Resuscitation. 2024 Aug;201:110280. doi: 10.1016/j.resuscitation.2024.110280. Epub 2024 Jun 14. PMID: 38880470.
3. Voß F, Thevathasan T, Scholz KH, Böttiger BW, Scheiber D, Kabiri P, Bernhard M, Kienbaum P, Jung C, Westenfeld R, Skurk C, Adler C, Kelm M. Accredited cardiac arrest centers facilitate eCPR and improve neurological outcome. Resuscitation. 2024 Jan;194:110069. doi: 10.1016/j.resuscitation.2023.110069. Epub 2023 Dec 5. PMID: 38061578.

2025 Evidence Update
EIT 6302 – Technology to Summon Providers

Worksheet Author(s): Chih-Wei Yang, Cheng-Heng Liu, Ming-Ju Hsieh, Alexander Olaussen, Federico Semararo, Robert Greif
Task Force: Education, Implementation, and Teams
Conflicts of Interest: none

PICOST / Research Question:

PICOST	Description (with recommended text)
Population	Adults and children with out-of-hospital cardiac arrest.
Intervention	Having a citizen CPR responder notified of the event via mobile technology or social medial.
Comparison	No such notification
Outcomes	Patient outcomes: (1) Survival to hospital discharge with good neurological function; (2) 30-day survival; (3) Survival to hospital discharge; (4) Hospital admission; (5) Return of spontaneous circulation (ROSC); Non-patient outcomes: (1) Bystander CPR rates; (2) Time to first compression; (3) Response time; (4) Activation rate; (5) System reliability; (6) User satisfaction; (7) Cost-effectiveness.
Study Design	Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies and case series where n>5) are eligible for inclusion. Unpublished studies (e.g., conference abstracts, trial protocols), commentary and editorial papers, reviews and animal studies were excluded.
Timeframe	Since Oct. 21, 2021 (one year before last research) to 27 Oct 2024 and all languages are included as long as there is an English abstract.

Year of last full review:

The EIT task force of ILCOR has conducted a systematic review with CoSTR (EIT878 in 2020) and an evidence update (EIT6302 in 2022) previously, with the latest literature search conducted up to 20th October 2022.

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

We recommend that citizen/individuals who are in close proximity to a suspected Out-of-hospital Cardiac Arrest (OHCA) event and willing to be engaged/notified by a smartphone app with mobile positioning system (MPS) or Text Message (TM)-alert system should be notified (strong recommendation, very low-certainty evidence)

Search Strategy

Pubmed

(((("Heart Arrest"[Mesh] OR "Out-of-Hospital Cardiac Arrest"[Mesh] OR "heart arrest*"[TIAB] OR "cardiac arrest*"[TIAB] OR "cardiovascular arrest*"[TIAB] OR "cardiopulmonary arrest*"[TIAB] OR "cardio-pulmonary arrest*"[TIAB] OR OHCA OR "Out of Hospital Cardiac Arrest*"[TIAB] OR "Out-of-Hospital Cardiac Arrest*"[TIAB] OR outside of hospital Cardiac Arrest OR asystole*[TIAB]) OR (resuscitation [Mesh] OR "cardiopulmonary resuscitation"[Mesh] OR "Life Support Care"[Mesh] OR "Heart Massage"[Mesh] OR resuscitation* [TIAB] OR "cardiopulmonary resuscitation"[TIAB] OR "Cardio-Pulmonary Resuscitation" OR "Cardio Pulmonary Resuscitation" OR CPR [TIAB] OR "Basic Cardiac Life Support" OR "basic life support" OR "Cardiac Life Support" [TIAB] OR "cardiorespiratory resuscitation"[TIAB] OR heart massage*[TIAB] OR cardiac massage*[TIAB] OR chest compression*[TIAB] OR cardiac compression*[TIAB]) OR (defibrillators[MeSH] OR "automated external defibrillator*"[TIAB] OR "AED" [TIAB] OR defibrillator*[TIAB] OR defibrillation[TIAB])) AND (volunteers[Mesh] OR "Police"[Mesh] OR public[TIAB] OR bystander*[TIAB] OR "first responder*"[TIAB] OR "first-responder*"[TIAB] OR layperson*[TIAB] OR "lay people"[TIAB] OR laypeople*[TIAB] OR "lay public"[TIAB] OR "lay rescuer*"[TIAB] OR citizen*[TIAB] OR volunteer*[TIAB] OR "volunteer responder*"[TIAB] OR witness*[TIAB] OR Police[TIAB] OR "untrained personnel"[TIAB] OR "non-healthcare professional*"[TIAB] OR "non-healthcare personnel"[TIAB] OR "non-healthcare worker*"[TIAB]) AND (((internet [Mesh] OR web) AND (technology OR app OR application OR alert)) OR "geographic information systems"[Mesh] OR "Social Media"[Mesh] OR "telecommunications"[Mesh] OR communication[Mesh] OR technology[Mesh] OR "social networking"[Mesh] OR "text messaging"[Mesh] OR smartphone[Mesh] OR "cell phone"[Mesh] OR "mobile applications"[Mesh] OR "global positioning system" OR "positioning system" OR "geographic information systems" OR "GIS" OR "Social Media" OR "telecommunication*" OR communication OR technologies OR "streaming video" OR "video streaming" OR twitter OR Tweet OR "social web" OR "social network" OR "social networking" OR "social software" OR "social medium" OR "instant messaging" OR "instant message" OR "IM"[TIAB] OR "text message*" OR screencast* OR "video-sharing" OR "smart phone" OR "smart phones" OR "smartphones" OR "Phone app" OR "Phone application" OR "cell phone" OR "cell phones" OR "cellular phone" OR "mobile application" OR "mobile app" OR "mobile apps" OR "mobile phone" OR "mobile phones" OR "mobile telephone" OR "mobile telephones" OR "mobile technology" OR "VIMEO" OR "PulsePoint" OR "push technology" OR web[TIAB] OR network[TIAB] OR computer-generated phone call* OR facebook OR instagram OR geolocalization OR geolocation OR whatsapp OR Geofencing OR "Global Navigation Satellite System" OR GNSS OR "taxi driver" OR "virtual reality" OR "Recruitment system" OR GoodSam OR "DAE RespondER" OR "smart watch" OR AEDMAP OR apps OR Lebensretter OR "Local Response" OR Evapp OR Reanim OR "Staying Alive" OR "O2 SOS" OR Záchranka OR Hjerteløber OR Heartrunner OR FirstAED OR Sauvlife OR "AFPR-Premiers Répondants" OR "Mobile Retter" OR "Mobile Rescuer" OR "Meine Stadt Rettet" OR "Region der Lebensretter" OR Corhelper OR "Land|Retter" OR KATRETTER

OR CFR.ie OR DAEDove OR HartslagNu OR HeartbeatNow OR SMSLivräddare OR "Fondazione Ticino Cuore" OR "1st Responder Kanton Bern" OR "CH Responder"))
Filters(publication date): from 2021/10/21 - 2024/10/21

Embase
('heart arrest'/exp OR ('heart arrest*' OR 'cardiac arrest*' OR 'cardiovascular arrest*' OR 'cardiopulmonary arrest*' OR 'cardio-pulmonary arrest' OR asystole*):ti,ab,kw OR 'out of hospital cardiac arrest'/exp OR (ohca OR 'out-of-hospital cardiac arrest*' OR 'outside-of-hospital cardiac arrest'):ti,ab,kw OR 'heart massage'/exp OR 'resuscitation'/exp OR (resuscitation OR 'cardiopulmonary resuscitation' OR 'cardio-pulmonary resuscitation' OR 'cardio pulmonary resuscitation' OR cpr OR 'basic life support' OR 'basic cardiac life support' OR 'cardiac life support' OR 'life support care' OR 'cardiorespiratory resuscitation' OR 'heart massage*' OR 'cardiac massage*' OR 'chest compression*' OR 'cardiac compression*'):ti,ab,kw OR 'automated external defibrillator'/exp OR ('automated external defibrillator' OR AED OR 'defibrillator*' OR 'defibrillation'):ti,ab,kw) AND ('layperson'/exp OR 'volunteer'/exp OR 'police'/exp OR (bystander* OR 'first responder*' OR 'first-responder*' OR layperson* OR 'lay people' OR 'laypeople*' OR 'lay rescuer*' OR 'lay public' OR volunteer* OR 'volunteer responder*' OR witness* OR 'non-healthcare professional' OR public OR police OR citizen* OR 'untrained personnel' OR 'non-healthcare personnel' OR 'non-healthcare worker*'):ti,ab,kw) AND ((('internet'/exp OR web) AND (technology OR app OR application OR alert)) OR ('geographic information system'/exp OR 'technology'/exp OR 'mobile technology'/exp OR 'telecommunication'/exp OR 'social media'/exp OR social network'/exp OR 'text messaging'/exp OR 'smartphone'/exp OR 'mobile application'/exp OR 'mobile phone'/exp OR 'geographic information system' OR 'GIS' OR 'global positioning system' OR 'positioning system' OR 'social media' OR technologies OR 'mobile technology' OR 'telecommunication*' OR 'communication' OR 'streaming video' OR 'video streaming' OR twitter OR tweet OR 'social web' OR 'social network' OR 'social networking' OR 'social software' OR 'social medium' OR 'instant messaging' OR 'instant message' OR 'im' OR 'text message*' OR screencast* OR 'video-sharing' OR 'smart phone' OR 'smart phones' OR 'smartphones' OR 'mobile application' OR 'mobile app' OR 'mobile apps' OR 'mobile phone' OR 'mobile phones' OR 'mobile telephone' OR 'mobile telephones' OR 'phone app' OR 'phone application' OR 'cell phone' OR 'cell phones' OR 'cellular phone' OR vimeo OR 'pulsepoint' OR 'push technology' OR web OR network OR 'computer-generated phone call*' OR facebook OR instagram OR geolocalization OR geolocation OR whatsapp OR geofencing OR 'global navigation satellite system' OR gnss OR 'taxi driver' OR 'virtual reality' OR 'recruitment system' OR 'goodsam' OR 'DAE RespondER' OR 'smart watch' OR 'aedmap' OR apps OR Lebensretter OR 'Local Response' OR Evapp OR Reanim OR 'Staying Alive' OR 'O2 SOS' OR Záchranka OR Hjerteløber OR Heartrunner OR FirstAED OR Sauvlife OR 'AFPR-Premiers Répondants' OR 'Mobile Retter' OR 'Mobile Rescuer' OR 'Meine Stadt Rettet' OR 'Region der Lebensretter' OR Corhelper OR 'Land Retter' OR KATRETTER OR CFR.ie OR DAEDove OR HartslagNu OR HeartbeatNow OR SMSLivräddare OR 'Fondazione Ticino Cuore' OR '1st Responder Kanton Bern' OR 'CH Responder')) AND [21-10-2021]/sd NOT [01-07-2024]/sd

Cochrane
(((([mh "heart arrest"] OR [mh "out-of-hospital cardiac arrest"] OR ((heart NEXT arrest*) OR (cardiac NEXT arrest*) OR (cardiovascular NEXT arrest*) OR (cardiopulmonary NEXT arrest*) OR (cardio-pulmonary NEXT arrest*) OR OHCA OR "Out of Hospital Cardiac Arrest" OR "Out of Hospital Cardiac Arrests" OR "outside of hospital Cardiac Arrest" OR asystole*):ti,ab,kw) OR ([mh "resuscitation"] OR [mh "cardiopulmonary resuscitation"] OR [mh "life support care"] OR [mh "heart massage"] OR (resuscitation* OR "cardiopulmonary resuscitation" OR "Cardio-Pulmonary Resuscitation" OR "Cardio Pulmonary Resuscitation" OR CPR OR "Basic Cardiac Life Support" OR "basic life support" OR "Cardiac Life Support" OR "cardiorespiratory resuscitation" OR (heart NEXT massage*) OR (cardiac NEXT massage*) OR (chest NEXT compression*) OR (cardiac NEXT compression*)):ti,ab,kw) OR ([mh "defibrillators"] OR ("automated external defibrillator" OR "automated external defibrillators" OR "AED" OR defibrillator* OR defibrillation):ti,ab,kw)) AND ([mh "volunteers"] OR [mh "police"] OR (public OR bystander* OR (first NEXT responder*) OR layperson* OR "lay people" OR laypeople* OR "lay public" OR (lay NEXT rescuer*) OR citizen* OR volunteer* OR (volunteer NEXT responder*) OR witness* OR police OR "untrained personnel" OR "non-healthcare professional" OR "non-healthcare personnel" OR "non-healthcare worker"):ti,ab,kw) AND (((([mh "internet"] OR web) AND (technology OR app OR application OR alert)) OR ([mh "geographic information systems"] OR [mh "social media"] OR [mh "telecommunications"] OR [mh "communication"] OR [mh "technology"] OR [mh "social networking"] or [mh "text messaging"] or [mh "smartphone"] OR [mh "cell phone"] OR [mh "mobile applications"]) OR "global positioning system" OR "positioning system" OR "geographic information systems" OR "GIS" OR "Social Media" OR telecommunication* OR communication OR technologies OR "streaming video" OR "video streaming" OR twitter OR Tweet OR "social web" OR "social network" OR "social networking" OR "social software" OR "social medium" OR "instant messaging" OR "instant message" OR "IM" OR "text message" OR screencast* OR "video-sharing" OR "smart phone" OR "smart phones" OR smartphones OR "Phone app" OR "Phone application" OR "cell phone" OR "cell phones" OR "cellular phone" OR "mobile application" OR "mobile app" OR "mobile apps" OR "mobile phone" OR "mobile phones" OR "mobile telephone" OR "mobile telephones" OR "mobile technology" OR "VIMEO" OR "PulsePoint" OR "push technology" OR web OR network OR "computer-generated phone call" OR facebook OR instagram OR geolocalization OR geolocation OR whatsapp OR Geofencing OR "Global Navigation Satellite System" OR GNSS OR "taxi driver" OR "virtual reality" OR "Recruitment system" OR "GoodSam" OR "DAE RespondER" OR "smart watch" OR "AEDMAP" OR apps OR Lebensretter OR "Local Response" OR

Evapp OR Reanim OR "Staying Alive" OR "O2 SOS" OR Záchranka OR Hjerteløber OR Heartrunner OR FirstAED OR Sauvlife OR "AFPR-Premiers Répondants" OR "Mobile Retter" OR "Mobile Rescuer" OR "Meine Stadt Rettet" OR "Region der Lebensretter" OR Corhelper OR "Land|Retter" OR KATRETTER OR CFR.ie OR DAEDove OR HartslagNu OR HeartbeatNow OR SMSLivräddare OR "Fondazione Ticino Cuore" OR "1st Responder Kanton Bern" OR "CH Responder"))
Limit with Cochrane Library publication date from Oct 2021 to Oct 2024, in Trials

CINAHL
(((MH "Heart Arrest+" OR TI ("heart arrest*" OR "cardiac arrest*" OR "cardiovascular arrest*" OR "cardiopulmonary arrest*" OR "cardio-pulmonary arrest*" OR OHCA OR "Out of Hospital Cardiac Arrest" OR "Out of Hospital Cardiac Arrests" OR "outside of hospital Cardiac Arrest" OR asystole*) OR AB ("heart arrest*" OR "cardiac arrest*" OR "cardiovascular arrest*" OR "cardiopulmonary arrest*" OR "cardio-pulmonary arrest*" OR OHCA OR "Out of Hospital Cardiac Arrest" OR "Out of Hospital Cardiac Arrests" OR "outside of hospital Cardiac Arrest" OR asystole*)) OR (MH "Resuscitation+" OR MH "Resuscitation, Cardiopulmonary+" OR MH "Life Support Care+" OR MH "Heart Massage" OR TI (resuscitation* OR "cardiopulmonary resuscitation" OR "Cardio-Pulmonary Resuscitation" OR "Cardio Pulmonary Resuscitation" OR CPR OR "Basic Cardiac Life Support" OR "basic life support" OR "Cardiac Life Support" OR "cardiorespiratory resuscitation" OR "heart massage*" OR "cardiac massage*" OR " chest compression*" OR "cardiac compression*") OR AB (resuscitation* OR "cardiopulmonary resuscitation" OR "Cardio-Pulmonary Resuscitation" OR "Cardio Pulmonary Resuscitation" OR CPR OR "Basic Cardiac Life Support" OR "basic life support" OR "Cardiac Life Support" OR "cardiorespiratory resuscitation" OR "heart massage*" OR "cardiac massage*" OR " chest compression*" OR "cardiac compression*")) OR (MH "Defibrillators+" OR TI ("automated external defibrillator" OR "automated external defibrillators" OR "AED" OR defibrillator* OR defibrillation) OR AB ("automated external defibrillator" OR "automated external defibrillators" OR "AED" OR defibrillator* OR defibrillation))) AND (MH "Volunteer Workers" OR MH "Police" OR TI (public OR bystander* OR "first responder*" OR layperson* OR "lay people" OR laypeople* OR "lay public" OR "lay rescuer*" OR citizen* OR volunteer* OR "volunteer responder*" OR witness* OR police OR "untrained personnel" OR "non-healthcare professional" OR "non-healthcare personnel" OR "non-healthcare worker") OR AB (public OR bystander* OR "first responder*" OR layperson* OR "lay people" OR laypeople* OR "lay public" OR "lay rescuer*" OR citizen* OR volunteer* OR "volunteer responder*" OR witness* OR police OR "untrained personnel" OR "non-healthcare professional" OR "non-healthcare personnel" OR "non-healthcare worker")) AND (((MH "Internet+" OR web) AND (technology OR app OR application OR alert)) OR (MH "Geographic Information Systems+" OR MH "Social Media+" OR MH "Telecommunications+" OR MH "Communication+" OR MH "Technology+" OR MH "Social Networking+" or MH "Text Messaging+" or MH "Smartphone" OR MH "Cellular Phone+" OR MH "Mobile Applications") OR TX ("global positioning system" OR "positioning system" OR "geographic information systems" OR "GIS" OR "Social Media" OR telecommunication* OR communication OR technologies OR "streaming video" OR "video streaming" OR twitter OR Tweet OR "social web" OR "social network" OR "social networking" OR "social software" OR "social medium" OR "instant messaging" OR "instant message" OR "IM" OR "text message" OR screencast* OR "video-sharing" OR "smart phone" OR "smart phones" OR smartphones OR "Phone app" OR "Phone application" OR "cell phone" OR "cell phones" OR "cellular phone" OR "mobile application" OR "mobile app" OR "mobile apps" OR "mobile phone" OR "mobile phones" OR "mobile telephone" OR "mobile telephones" OR "mobile technology" OR "VIMEO" OR "PulsePoint" OR "push technology" OR web OR network OR "computer-generated phone call" OR facebook OR instagram OR geolocalization OR geolocation OR whatsapp OR Geofencing OR "Global Navigation Satellite System" OR GNSS OR "taxi driver" OR "virtual reality" OR "Recruitment system" OR "GoodSam" OR "DAE RespondER" OR "smart watch" OR "AEDMAP" OR apps OR Lebensretter OR "Local Response" OR Evapp OR Reanim OR "Staying Alive" OR "O2 SOS" OR Záchranka OR Hjerteløber OR Heartrunner OR FirstAED OR Sauvlife OR "AFPR-Premiers Répondants" OR "Mobile Retter" OR "Mobile Rescuer" OR "Meine Stadt Rettet" OR "Region der Lebensretter" OR Corhelper OR "Land|Retter" OR KATRETTER OR CFR.ie OR DAEDove OR HartslagNu OR HeartbeatNow OR SMSLivräddare OR "Fondazione Ticino Cuore" OR "1st Responder Kanton Bern" OR "CH Responder")))
Limit publication date from Oct 2021 to Oct 2024

Database searched: eg Medline Embase Cochrane: Pubmed, Embase, Cochrane and CINAHL
Time Frame: (existing PICOST) All years and all languages were screened if there is an English abstract. The search strategy was performed on the same day (27 Oct 2024) for the databases (MEDLINE via PubMed, CINAHL, EMBASE, and Cochrane Library).
Search Results: 4 articles

Summary of Evidence Update:
The cumulative evidence included in the EIT 878 and EIT 6302 updates in 2022 has been expanded with the addition of four new studies. These studies are: Linn Andelius (2022), Gregers (2023), Jonsson (2023), and Siddiqui (2023).

1.   For the critical outcome of "survival with favorable neurologic outcome at discharge," early evidence indicated no significant benefits from notifying a citizen CPR responder via technology (Lee, 2019; Stroop, 2019). In 2021, Stieglis et al. reported an increase in neurologically favorable survival to discharge from 24% to 36% in residences following the

implementation of a text-message notification system. However, this increase did not reach statistical significance (adjusted RR: 1.4, 95% CI: 0.99-2.0).

The four articles included in this evidence update primarily focused on 30-day survival rates and lacked direct data on neurologically favorable discharge outcomes, leaving the conclusions inconclusive.

2.   For the critical outcome of "survival to hospital discharge/30-day survival," a previous meta-analysis of adjusted data, including 2,905 out-of-hospital cardiac arrests (OHCAs) from four studies, demonstrated a benefit in survival when a citizen CPR responder was notified via a smartphone app with a mobile positioning system (MPS) or a text message (TM) alert system. The adjusted pooled relative risk (RR) was 1.70 (95% CI: 1.16-2.48; I^2 = 69%, P = 0.02), indicating that 98 more patients per 1,000 benefited from the intervention (95% CI: 22 to 208 more patients per 1,000) compared to no notification system. These results were supported by the relative risks reported in three of the four studies: Caputo (2017) RR 1.7 (95% CI: 1.17-2.5), Pijls (2016) RR 2.23 (95% CI: 1.41-3.23), and Stroop (2019) RR 2.37 (95% CI: 1.07-4.55). One study, Lee (2019), did not report a significant benefit [RR 1.06 (95% CI: 0.72-1.51)].

Four articles from the evidence update examined the impact of volunteer responders (VRs) on 30-day survival rates following out-of-hospital cardiac arrest (OHCA). Gregers (2023) analyzed these rates and found no significant differences among groups: 17% for emergency medical services (EMS) arriving first, 16% for 1 VR, 18% for 2 VRs, and 14% for 3 VRs arriving before EMS. Jonsson (2023) reported that activation of a VR system was associated with a higher chance of 30-day survival compared to non-activation, with a risk ratio (RR) of 1.22 (95% CI: 1.07-1.39), though the observational nature of the study limits causal conclusions. Andelius (2022) found no significant increase in survival rates when VRs arrived before EMS in private homes (9.2% vs. 7.7%, P = 0.41), but noted a slight increase in public locations (40.5% with VRs first vs. 35.4% with EMS first, P = 0.44), although the impact was not statistically significant. In contrast, Siddiqui (2023) showed that implementing a Community First Responder (CFR) program significantly increased the odds of survival to hospital discharge, with an odds ratio (OR) of 3.10 (95% CI: 1.53–6.26) compared to no intervention.

3.   For the critical outcome of "survival to hospital admission," no studies have been identified. Despite a search for new evidence, the absence of relevant studies remains unchanged.

4.   For the important outcome of "return of spontaneous circulation" (ROSC), we identified moderate-certainty evidence from one randomized controlled trial (RCT) involving 667 out-of-hospital cardiac arrests (OHCAs). This study, which was downgraded for serious risk of bias, showed no significant benefit from notifying a citizen CPR responder via technology or social media, with a 0.3 percentage point difference in favor of the intervention group (95% CI: 6.5 lower to 7.3 higher) [Unadjusted RR 1.01, 95% CI: 0.79-1.28] (Ringh, 2015). Additionally, very low-certainty evidence from three observational cohort studies (enrolling 2,571 OHCAs) also indicated no benefit from such notifications [Unadjusted pooled RR 0.97, 95% CI: 0.60-1.57] (Pijls, 2016; Lee, 2019; Stroop, 2019). Furthermore, Gregers (2023) found no significant differences in ROSC outcomes based on the arrival times of volunteer responders, with rates generally unaffected by the number of responders arriving before emergency medical services.

5.   For the important outcome of "bystander CPR," high-certainty evidence was identified from one randomized controlled trial (RCT) and one before-after study. The RCT, involving 667 out-of-hospital cardiac arrests (OHCAs), demonstrated a 14 percentage point absolute increase in bystander CPR for the intervention group compared to the control (Adjusted RR 1.27, 95% CI: 1.10-1.46), translating to 129 more patients per 1,000 benefiting from the intervention (95% CI: 48 to 219 more patients per 1,000) when compared to no smartphone app or text message alert system (Ringh, 2015). The second study, with 1,696 OHCAs, showed benefits from notifying a citizen CPR responder via technology or social media (Adjusted RR 1.29, 95% CI: 1.20-1.37), resulting in 160 more patients per 1,000 benefiting from the intervention (95% CI: 110 to 204 more patients per 1,000) compared to no intervention (Lee, 2019).

Updates: Gregers (2023) found that the odds ratio for bystander CPR increased with the number of volunteer responders present: 2.40 for one responder, 3.18 for two, and 2.70 for three or more, compared to no responders. Jonsson (2023) reported a pooled random effect weighted risk ratio of 2.41 for bystander CPR across all study sites, indicating a strong association with system activation. Site-specific data revealed higher proportions of bystander CPR in alerted groups versus non-alerted groups, with regional variations. Andelius (2022) demonstrated that among patients with an initial shockable rhythm at home, 93.7% received bystander CPR when volunteer responders arrived first, compared to 75.4% when EMS arrived first. Siddiqui (2023) highlighted that the introduction of a Community First Responder program in Singapore significantly increased the odds of receiving bystander CPR, with odds rising from 6.16 to 7.66 times when the program was added to existing dispatcher-assisted CPR and CPR training initiatives.

6.   For the outcome of "time to first compression/shock delivery," very low-certainty evidence was identified from four observational studies involving 1,833 out-of-hospital cardiac arrests (OHCAs). These studies, which were downgraded due to serious risk of bias, inconsistency, and study design, showed that notifying a citizen CPR responder via technology or social media significantly reduced response times compared to no technology. Specifically, the median response time was 6 minutes and 17 seconds (IQR 4:49–7:57) versus 9 minutes and 38 seconds (IQR 7:14–12:51), with a Z score of −14.498 and p < 0.0001 (Berglund, 2018). Similarly, the median time to defibrillation was 8 minutes (IQR 6:35–9:49) compared to 10

minutes and 39 seconds (IQR 8:18–13:23), p < 0.001 (Zijlstra, 2014). Another study reported a significant difference in median response times between Mobile-Rescuers at 4 minutes (IQR 3-6) and EMS teams at 7 minutes (IQR 6-10), p < 0.001 (Stroop, 2019). When comparing an app-based system to an SMS-based system, the app showed more benefit, with responders' median time at 3.5 minutes (IQR 2.8–5.2) compared to 5.6 minutes (IQR 4:2–8:5) for the SMS system, p = 0.0001 (Caputo, 2017).

Studies from the evidence update this time further highlight the impact of responder density on response times. Gregers (2023) documented decreased EMS defibrillation rates when more volunteer responders (VRs) arrived first, with an increased proportion of initial defibrillation attempts conducted by bystanders, suggesting faster response times with a higher number of VRs. Similarly, Siddiqui (2023) observed improvements in time to defibrillation as more Community First Responders (CFRs) arrived at the scene, indicating quicker intervention with increased responder density. These findings underscore the potential benefits of leveraging technology and increasing responder presence to improve emergency response times.

Overall, Community First Responder (CFR) programs have positive effects on bystander CPR rates, shortened time to defibrillation and higher 30-day survival. However, the effects on Return of Spontaneous Circulation (ROSC) rates seem insignificant, and there is insufficient direct evidence linking these programs to improved favorable neurologic outcomes at discharge. This synthesized data aligns with the latest ILCOR consensus, which strongly recommends that citizens or individuals near a suspected out-of-hospital cardiac arrest (OHCA) event, who are willing to engage, should be notified via a smartphone app with a mobile positioning system (MPS) or a text message (TM) alert system (strong recommendation, very low-certainty evidence).

This evidence update does not meet the criteria to trigger a new systematic review.

Relevant Guidelines or Systematic Reviews: 0 newly found
RCT: 0 newly found
Nonrandomized Trials, Observational Studies: 4 newly found

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Study Intervention (# patients) / Study Comparator patients)	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Smartphone-activated volunteer responders and bystander defibrillation; Andelius et al.; 2023[14]	Retrospective observational study conducted from 2017 to 2019 in the Stockholm Region of Sweden and the Capital Region of Denmark	Adults (18+) with EMS-treated OHCA where volunteer responders were activated, excluding EMS-witnessed cases	Volunteer responder arrival before EMS (381 home, 84 public); EMS arrival first (648 home, 158 public)	Bystander defibrillation higher when responders arrived first (15.5% vs. 2.2% at home, 32.1% vs. 19.6% in public; p < 0.001 and p = 0.030)	Volunteer responders' early arrival increased bystander defibrillation significantly, supporting the activation of responders for OHCA
Volunteer Response for Cardiac Arrest; Gregers et al.; 2023[15]	Retrospective observational study examining out-of-hospital cardiac arrests (OHCAs) in Denmark's Capital and Central Regions from 2017 to 2019	OHCA cases in Denmark with volunteer responder (VR) activation; 906 OHCAs included after exclusions	Arrival of 1, 2, or 3+ VRs before EMS / No VRs arriving before EMS; No VRs before EMS (n=376), 1 VR before EMS (n=259), 2 VRs before EMS (n=109), ≥3 VRs before EMS (n=162)	- Adjusted OR for bystander CPR when 1 VR arrived: 2.40 (95% CI: 1.42-4.05), 2 VRs: 3.18 (95% CI: 1.39-7.26), 3+ VRs: 2.70 (95% CI: 1.32-5.52). - Adjusted OR for bystander defibrillation when 1 VR arrived: 1.97 (95% CI: 1.12-3.52), 2 VRs: 2.88 (95% CI: 1.48-5.58), 3+ VRs: 3.85 (95% CI: 2.11-7.01). - No significant difference in ROSC or 30-day survival across groups.	An increased number of VRs arriving first was associated with higher bystander defibrillation rates but did not affect ROSC or 30-day survival. Recommendations to optimize VR deployment were discussed.
Volunteer Responder Dispatch; Jonsson et al.; 2023[16]	Retrospective observational study utilizing the ESCAPE-NET database,	OHCAs in 5 European sites with VR systems	VR system activation (4,696 cases) / No activation (4,857 cases)	Bystander CPR: 73.8% with VR activation vs. 61.9% without. RR 2.4 (95% CI: 2.05-2.83),	Activation of VR systems was associated with significantly higher bystander CPR,

	analyzing out-of-hospital cardiac arrest (OHCA) cases across five European regions (North Holland North, Stockholm, Västra Götaland, Capital Region of Denmark, and Ticino) from 2015 to 2019.			Bystander Defibrillation: 7.9% with VR activation vs. 4.6% without. RR 1.86 (95% CI: 1.35-2.55), 30-day survival: 12.4% with VR activation vs. 10.0% without. RR 1.22 (95% CI: 1.07-1.39)	bystander defibrillation, and improved 30-day survival.
Technology Activated CFR in Singapore; Siddiqui et al.; 2023[17]	Retrospective observational study using Singapore's Pan Asian Resuscitation Outcomes Study (PAROS) registry, analyzing OHCA cases managed by the Singapore Civil Defence Force's Emergency Medical Services (EMS) from 2016 to 2020.	OHCAs managed through Singapore's EMS, aged ≥18	myResponder app alert (6,577 cases)/ CFR arrived before EMS (n=997), CFR arrived after EMS (n=410)/no CFRs arriving(n=5,170)	- Bystander CPR: Significant increase with CFR arrival before EMS (89.2%) vs. no arrival (85%), p=0.001 Bystander AED: Higher AED use when CFR arrived before EMS (15.1%) vs. no arrival (5.8%), p<0.001 - 30-day survival: No significant difference.	myResponder app activation increased bystander intervention rates, especially CPR and AED use. However, no significant impact on ROSC or 30-day survival was observed.

Reviewer Comments: *(including whether this PICOST should have a systematic or scoping review)*
This evidence update has not identified sufficient evidence to support a new SysRev.

Reference list:
1. Mattias R, Mårten R, Jacob H, Martin J, David F, Per N, et al. Mobile-Phone Dispatch of Laypersons for CPR in Out-of-Hospital Cardiac Arrest. N Engl J Med. 2015;372:2316–25.
2. Pijls RW, Nelemans PJ, Rahel BM, Gorgels AP. Factors modifying performance of a novel citizen text message alert system in improving survival of out-of-hospital cardiac arrest. Eur Hear J: Acute Cardiovasc Care. 2017;7:397–404.
3. Caputo ML, Muschietti S, Burkart R, Benvenuti C, Conte G, Regoli F, et al. Lay persons alerted by mobile application system initiate earlier cardio-pulmonary resuscitation: A comparison with SMS-based system notification. Resuscitation. 2017;114:73–8.
4. Berglund E, Claesson A, Nordberg P, Djärv T, Lundgren P, Folke F, et al. A smartphone application for dispatch of lay responders to out-of-hospital cardiac arrests. Resuscitation. 2018;126:160–5.
5. Lee SY, Shin SD, Lee YJ, Song KJ, Hong KJ, Ro YS, et al. Text message alert system and resuscitation outcomes after out-of-hospital cardiac arrest: A before-and-after population-based study. Resuscitation. 2019;138:198–207.
6. Stroop R, Kerner T, Strickmann B, Hensel M. Mobile phone-based alerting of CPR-trained volunteers simultaneously with the ambulance can reduce the resuscitation-free interval and improve outcome after out-of-hospital cardiac arrest: A German, population-based cohort study. Resuscitation. 2020;147:57–64.
7. Zijlstra JA, Stieglis R, Riedijk F, Smeekes M, Worp WE van der, Koster RW. Local lay rescuers with AEDs, alerted by text messages, contribute to early defibrillation in a Dutch out-of-hospital cardiac arrest dispatch system. Resuscitation. 2014;85:1444–9.
8. Stieglis R, Zijlstra JA, Riedijk F, Smeekes M, Worp WE van der, Tijssen JGP, et al. Alert system-supported lay defibrillation and basic life-support for cardiac arrest at home. Eur Hear J. 2021;43:1465–74.
9. Sarkisian L, Mickley H, Schakow H, Gerke O, Jørgensen G, Larsen ML, et al. Global positioning system alerted volunteer first responders arrive before emergency medical services in more than four out of five emergency calls. Resuscitation. 2020;152:170–6.
10. Oosterveer DM, Visser M de, Heringhaus C. Improved ROSC rates in out-of-hospital cardiac arrest patients after introduction of a text message alert system for trained volunteers. Neth Hear J. 2023;31:36–41.
11. Derkenne C, Jost D, Roquet F, Dardel P, Kedzierewicz R, Mignon A, et al. Mobile Smartphone Technology Is Associated With Out-of-hospital Cardiac Arrest Survival Improvement: The First Year "Greater Paris Fire Brigade" Experience. Acad Emerg Med. 2020;27:951–62.
12. Smida T, Salerno J, Weiss L, Martin-Gill C, Salcido DD. PulsePoint dispatch associated patient characteristics and prehospital outcomes in a mid-sized metropolitan area. Resuscitation. 2022;170:36–43.

13. Smith CM, Lall R, Fothergill RT, Spaight R, Perkins GD. The effect of the GoodSAM volunteer first-responder app on survival to hospital discharge following out-of-hospital cardiac arrest. Eur Hear J Acute Cardiovasc Care. 2021;11:20–31.

14. Andelius L, Hansen CM, Jonsson M, Gerds TA, Rajan S, Torp-Pedersen C, et al. Smartphone-activated volunteer responders and bystander defibrillation for out-of-hospital cardiac arrest in private homes and public locations. Eur Hear J: Acute Cardiovasc Care. 2022;12:87–95.

15. Gregers MCT, Andelius L, Kjoelbye JS, Grabmayr AJ, Jakobsen LK, Christensen NB, et al. Association Between Number of Volunteer Responders and Interventions Before Ambulance Arrival for Cardiac Arrest. J Am Coll Cardiol. 2023;81:668–80.

16. Jonsson M, Berglund E, Baldi E, Caputo ML, Auricchio A, Blom MT, et al. Dispatch of Volunteer Responders to Out-of-Hospital Cardiac Arrests. J Am Coll Cardiol. 2023;82:200–10.

17. Siddiqui FJ, Fook-Chong S, Shahidah N, Tan CK, Poh JY, Ng WM, et al. Technology activated community first responders in Singapore: Real-world care delivery & outcome trends. Resusc Plus. 2023;16:100486.

2025 Evidence Update
EIT 6304 – Willingness to Provide CPR and/or Defibrillation

Worksheet Author(s): Ying-Chih Ko; Evidence Reviewer(s): Aaron Donoghue, Tasuku Matsuyama, Devita Stallings, Kai-Wei Lin
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: 25 June 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Bystanders (laypersons) in actual situation of adult or pediatric patients with out-of-hospital cardiac arrest
Intervention (Exposure): Factors (barriers or facilitators) that affected the willingness of bystanders to perform cardiopulmonary resuscitation (CPR) and/or use an automated external defibrillator (AED)
Comparators: No such factor or any other factor that affected the willingness of bystanders to perform CPR and/or use an AED
Outcomes: Bystander CPR rate; rate of bystander defibrillation with an AED; willingness to provide CPR in actual situation; willingness to provide defibrillation with an AED in actual situation
Study Designs: Randomized controlled trials (RCTs) and nonrandomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies, and questionnaire surveys) over all years were eligible for inclusion. Simulation studies, survey data not from actual experience, unpublished studies (e.g., conference abstracts, trial protocols), letters, editorials, comments, case reports, systematic reviews, and grey literature, as well as studies that overlap with other ILCOR systematic reviews or scoping reviews were excluded from this scoping review.
Timeframe: All years and all languages are included as long as there is an English abstract or translation available for last update.

Year of last full review: Aug 2023
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:

To increase willingness to perform CPR, laypeople should receive training in CPR. This training should include recognizing gasping or abnormal breathing as a sign of cardiac arrest when other signs of life are absent. Laypeople should be trained to start resuscitation with chest compressions in adult and pediatric victims. If unwilling or unable to perform ventilation, rescuers should be instructed to continue compression-only CPR. EMS dispatchers should provide CPR instructions to callers who report cardiac arrest. When providing CPR instructions, EMS dispatchers should include recognition of gasping and abnormal breathing.

Current Search Strategy:

Pubmed

("Out-of-Hospital Cardiac Arrest"[MeSH Terms] OR ("out of hospital"[All Fields] AND "cardiac"[All Fields] AND "arrest"[All Fields]) OR "Out-of-Hospital Cardiac Arrest"[All Fields] OR ("out"[All Fields] AND "hospital"[All Fields] AND "cardiac"[All Fields] AND "arrest"[All Fields]) OR "Out-of-Hospital Cardiac Arrest"[All Fields] OR "OHCA"[All Fields] OR ("Heart Arrest"[MeSH Terms] OR ("heart"[All Fields] AND "arrest"[All Fields]) OR "Heart Arrest"[All Fields] OR ("cardiac"[All Fields] AND "arrest"[All Fields]) OR "cardiac arrest"[All Fields]) OR "Out-of-Hospital Cardiac Arrest"[MeSH Terms] OR "Heart Arrest"[MeSH Terms]) AND ((("bystander"[All Fields] OR "bystander s"[All Fields] OR "bystanders"[All Fields] OR "bystanding"[All Fields]) AND ("Cardiopulmonary Resuscitation"[MeSH Terms] OR ("cardiopulmonary"[All Fields] AND "resuscitation"[All Fields]) OR "Cardiopulmonary Resuscitation"[All Fields] OR "cpr"[All Fields])) OR "BCPR"[All Fields] OR (("public"[All Fields] OR "public s"[All Fields] OR "publically"[All Fields] OR "publication s"[All Fields] OR "publications"[MeSH Terms] OR "publications"[All Fields] OR "publicity"[All Fields] OR "publicize"[All Fields] OR "publicized"[All Fields] OR "publicizing"[All Fields] OR "publics"[All Fields] OR "publishing"[MeSH Terms] OR "publishing"[All Fields] OR "publication"[All Fields]) AND ("access"[All Fields] OR "accessed"[All Fields] OR "accesses"[All Fields] OR "accessibilities"[All Fields] OR "accessibility"[All Fields] OR "accessible"[All Fields] OR "accessing"[All Fields]) AND ("defibrilator"[All Fields] OR "defibrillate"[All Fields] OR "defibrillated"[All Fields] OR "defibrillates"[All Fields] OR "defibrillating"[All Fields] OR "defibrillations"[All Fields] OR "defibrillator s"[All Fields] OR "Defibrillators"[MeSH Terms] OR "Defibrillators"[All Fields] OR "defibrillator"[All Fields] OR "Electric Countershock"[MeSH Terms] OR ("electric"[All Fields] AND "countershock"[All Fields]) OR "Electric Countershock"[All Fields] OR "defibrillation"[All Fields])) OR (("bystander"[All Fields] OR "bystander s"[All Fields] OR "bystanders"[All Fields] OR "bystanding"[All Fields]) AND ("defibrilator"[All Fields] OR "defibrillate"[All Fields] OR "defibrillated"[All Fields] OR "defibrillates"[All Fields] OR "defibrillating"[All Fields] OR "defibrillations"[All Fields] OR "defibrillator s"[All Fields] OR "Defibrillators"[MeSH Terms] OR "Defibrillators"[All Fields] OR "defibrillator"[All Fields] OR "Electric Countershock"[MeSH Terms] OR ("electric"[All Fields] AND "countershock"[All Fields]) OR "Electric Countershock"[All Fields] OR "defibrillation"[All Fields])) OR "AED"[All Fields] OR ("Defibrillators"[MeSH Terms] OR "Defibrillators"[All Fields] OR ("automated"[All Fields] AND "external"[All Fields] AND "defibrillator"[All Fields]) OR "automated external defibrillator"[All Fields]) OR "Cardiopulmonary Resuscitation"[MeSH Terms] OR "Defibrillators"[MeSH Terms] OR "Electric Countershock"[MeSH Terms] OR "Heart Massage"[MeSH Terms] OR "Chest compression"[All Fields]) AND ("barrier"[All Fields] OR "barrier s"[All Fields] OR "barriers"[All Fields] OR ("facilitate"[All Fields] OR "facilitated"[All Fields] OR "facilitates"[All Fields] OR "facilitating"[All Fields] OR "facilitation"[All Fields] OR "facilitations"[All Fields] OR "facilitative"[All Fields] OR "facilitator"[All Fields] OR "facilitator s"[All Fields] OR "facilitators"[All Fields]) OR ("decrease"[All Fields] OR "decreased"[All Fields] OR "decreases"[All Fields] OR "decreasing"[All Fields]) OR ("increase"[All Fields] OR "increased"[All Fields] OR "increases"[All Fields] OR "increasing"[All Fields] OR "increasings"[All Fields]) OR ("improve"[All Fields] OR "improved"[All Fields] OR "improvement"[All Fields] OR "improvements"[All Fields] OR "improves"[All Fields] OR "improving"[All Fields] OR "improvment"[All Fields]) OR ("deter"[All Fields] OR "deterred"[All Fields] OR "deterring"[All Fields] OR "deters"[All Fields]) OR ("epidemiology"[MeSH Subheading] OR "epidemiology"[All Fields] OR "frequency"[All Fields] OR "epidemiology"[MeSH Terms] OR "frequence"[All Fields] OR "frequences"[All Fields] OR "frequencies"[All Fields]) OR "rate"[All Fields] OR ("proportion"[All Fields] OR "proportions"[All Fields]) OR "willingness"[All Fields] OR ("associate"[All Fields] OR "associated"[All Fields] OR "associates"[All Fields] OR "associating"[All Fields] OR "association"[MeSH Terms] OR "association"[All Fields] OR "associations"[All Fields]))

EMBASE

('out of hospital cardiac arrest'/exp OR 'ohca' OR 'out of hospital cardiac arrest' OR 'out of hospital cardiac arrests' OR 'out of hospital cardiopulmonary arrest' OR 'out of hospital cardiopulmonary arrests' OR 'out of hospital heart arrest' OR 'out-of-hospital cardiac arrest' OR 'heart arrest'/exp OR 'cardiac arrest' OR 'heart arrest') AND ('bystander cpr':ti,ab OR bcp:ti,ab OR 'bystander defibrillation':ti,ab OR 'automated external defibrillator'/exp OR aed:ti,ab OR 'public access defibrillation':ti,ab OR 'defibrillator'/exp OR 'cardioverter defibrillator':ti,ab,kw OR 'defibrillator':ti,ab,kw OR 'defibrillator, cardioverter':ti,ab,kw OR 'defibrillators':ti,ab,kw OR 'cardioversion'/exp OR 'cardioconversion':ti,ab,kw OR 'cardioversion':ti,ab,kw OR 'cardioversion, electric':ti,ab,kw OR 'counter shock':ti,ab,kw OR 'countershock':ti,ab,kw OR 'electric cardioversion':ti,ab,kw OR 'electric conversion':ti,ab,kw OR 'electric countershock':ti,ab,kw OR 'electrical cardioversion':ti,ab,kw OR 'electrocardioversion':ti,ab,kw OR 'electroconversion':ti,ab,kw OR 'basic life support'/exp OR 'basic life support':ti,ab,kw OR 'chest compression':ti,ab OR 'cardiopulmonary resuscitation':ti,ab) AND (barrier:ti,ab OR facilitator:ti,ab OR decrease:ti,ab OR increase:ti,ab OR improve:ti,ab OR deter:ti,ab OR frequency:ti,ab OR rate:ti,ab OR proportion:ti,ab OR willingness:ti,ab OR association:ti,ab) AND [embase]/lim AND [01-08-2023]/sd NOT [29-06-2024]/sd AND [2023-2024]/py

COCHRANE
#1   (out-of-hospital cardiac arrest*) (Word variations have been searched)
#2   (OHCA) (Word variations have been searched)
#3   MeSH descriptor: [Out-of-Hospital Cardiac Arrest] explode all trees
#4   (cardiac arrest*) (Word variations have been searched)
#5   MeSH descriptor: [Heart Arrest] explode all trees
#6   #1 or #2 or #3 or #4 or #5 (Word variations have been searched)
#7   (public access defibrilla*) (Word variations have been searched)
#8   ((bystander* (defibrillat* or AED or (automated external defibrillat*)))) (Word variations have been searched)
#9   ((bystander* (CPR or (Cardiopulmonary resus*) or (chest compression*)))) (Word variations have been searched)
#10   ((BCPR)) (Word variations have been searched)
#11   ((defibrillat*)) (Word variations have been searched)
#12   (automated external defibrillat*) (Word variations have been searched)
#13   MeSH descriptor: [Cardiopulmonary Resuscitation] explode all trees
#14   MeSH descriptor: [Defibrillators] explode all trees
#15   MeSH descriptor: [Electric Countershock] explode all trees
#16   MeSH descriptor: [Heart Massage] explode all trees
#17   electric Countershock (Word variations have been searched)
#18   cardiac massage*
#19   cardiopulmonary resus*
#20   basic life support
#21   #7 or #8 or #9 or #10 or #11 or #12 #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 (Word variations have been searched)
#22   (barrier*):ti,ab,kw (Word variations have been searched)
#23   (facilitator*):ti,ab,kw
#24   (decreas*):ti,ab,kw (Word variations have been searched)
#25   (increas*):ti,ab,kw (Word variations have been searched)
#26   (improv*):ti,ab,kw (Word variations have been searched)
#27   (deter):ti,ab,kw
#28   (frequency):ti,ab,kw (Word variations have been searched)
#29   (rate*):ti,ab,kw (Word variations have been searched)
#30   (proportion):ti,ab,kw (Word variations have been searched)
#31   (willingness):ti,ab,kw (Word variations have been searched)
#32   (association):ti,ab,kw (Word variations have been searched)
#33   #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 (Word variations have been searched)
#34   #6 and #21 and #33

New Search strategy: None
Database searched: PubMed, EMBASE, Cochrane
Time Frame: Aug 1 2023 to Jun 28 2024
Date Search Completed: Jun 28 2024
Search Results (Number of articles identified/number identified as relevant): 1729/3

Summary of Evidence Update: We searched PubMed, EMBASE databases to identify studies associated with willingness to provide CPR and/or defibrillation published from Aug 1, 2023 to Jun 28, 2024. After duplicates were removed, there were 1,729 records found, and seven articles were included in full-article review. Finally, three non-randomized trials were included. (1-3) Among them, one is from Germany (2), one from Italy (3), and one from Sweden (1). There was one study related with layperson bystanders (2) and two with first responders. (1, 3) Factors such as privacy context (2), sex (3), desire to save lives and help others (1), prior experience with OHCA (3), limited support from other bystanders (2), acute stress response (2), impaired situational judgment (2), physical challenges (2) and lack of resuscitation training (3) were identified as promoting factors or barrier to bystander CPR.

Relevant Guidelines or Systematic Reviews

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

Year Published					
Greif R (2020) (4)	Education, Implementation, and Teams: 2020 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations	Willingness to perform bystander CPR (EIT626)	18	The 2010 treatment recommendation remains valid.	To increase willingness to perform CPR, laypeople should receive training in CPR. This training should include the recognition of gasping or abnormal breathing as a sign of cardiac arrest when other signs of life are absent. Laypeople should be trained to start resuscitation with chest compressions in adult and pediatric victims. If unwilling or unable to perform ventilation, rescuers should be instructed to continue compression-only CPR. EMS dispatchers should provide CPR instructions to callers who report cardiac arrest. When providing CPR instructions, EMS dispatchers should include recognition of gasping and abnormal breathing. (ILCOR 2020 CoSTR, unchanged from 2010)
Matsuyama T(2020) (5)	Scoping review	Willingness to perform bystander cardiopulmonary resuscitation: A scoping review	18	Younger bystander, previous CPR training, higher education, multiple bystanders on scene, and compression-only CPR were associated with increased willingness to perform CPR. "Personal factors", "CPR knowledge", and "procedural issues" were associated with reduced willingness to respond to cardiac arrest.	CPR training, regional and national education programs, and dispatch instructions should take these factors into consideration, to improve CPR performance of lay rescuers in the actual settings
Wyckoff MH (2022) (6)	2022 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations	Willingness to perform bystander CPR (EIT626)	12	Three of the studies identified factors identified by prior review. Nine articles depicted the impact of the COVID-19 pandemic on the attitude of bystanders toward performing CPR and AED.	The evidence triggers did not change in the wording and the treatment recommendation for willingness to provide CPR and/or defibrillation (EIT 626) published in ILCOR 2020 CoSTR.

RCT (0):

Nonrandomized Trials, Observational Studies (3):

Study Acronym; Author;	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Promote factors/ Barrier factors

Year Published				
Allert C (2024) [1]	Qualitative study N=16	Active voluntary first responders accepted a mission as a VFR to OHCA in rural areas at least twice in the last18 months.	The study describes the experiences of voluntary first responders (VFRs) and identified that VFRs have a strong desire to save lives and help others.	Promoting factor: Desire to save lives and help others
Beck S (2024) [2]	Qualitative study N=21	Layperson bystanders who had witnessed an OHCA in a home setting	Qualitative Content Analysis yielded 1347 relevant interview segments. Of these, 398 supported B-CPR, 328 hindered it, and 621 were neutral.	Promoting factor: Privacy context (higher commitment to act) Barrier factors: Limited support from other bystanders Acute stress response Impaired situational judgement Physical challenges
Gamberini L (2024) [3]	Cross-sectional web survey N=1705	First responder who had received at least one dispatch request in the past 12 months	The probability of accepting a dispatch to an OHCA event was significantly higher for male first responders (OR 2.37, 95% CI 1.83-3.11), those with previous OHCA experience (OR 2.11, 95% CI 1.59-2.80), and those who had an AED available at the time of the call (OR 1.75, 95% CI 1.31-2.33), while it was lower for those without any resuscitation certificate (OR 0.58, 95% CI 0.33-0.98).	Promoting factor: Male, prior experience with OHCA Barrier: Lack of resuscitation training

Reviewer Comments:

This evidence update revealed three new observational studies. It did not include articles addressing differences in CPR prevalence due to socioeconomic and/or circumstantial factors, focusing on "disparities" in CPR rather than willingness, based on the decision of the task force meetings. This update included two articles on the willingness of first responders. The barriers to telephone-CPR (Dispatcher-Assisted CPR) were not included, and there is one scoping review on this topic.[7] Since investigations into laypersons' willingness (personal level) to act in actual resuscitation situations are rare, further updates or a redefined PICOST are needed.

Insight from EIT Task Force:

The scoping review was initially established to investigate willingness of individuals to respond to cardiac arrest. The PICOST was about bystanders in real-life OHCA exploring factors linked to the likelihood or rate at which bystanders are engage in CPR.

In previous reviews and updates, the population of OHCA patients receiving varying levels of bystander CPR due to specific factors was included. For 2025, the task force identified that researching the prevalence of bystander CPR—whether patients with out-of-hospital cardiac arrest (OHCA) are more or less likely to receive resuscitation due to certain factors—presents a different approach than investigating the barriers and facilitators to performing CPR, which focuses on understanding why bystanders may or may not be motivated to provide resuscitation in specific circumstances.

Considering differences in CPR prevalence as a result of socioeconomic and/or circumstantial factors speaks to disparities in CPR rather than willingness to perform CPR. The majority of the articles in the previous update (2022, 2024) focused on disparities in bystander CPR rather than on the willingness of bystanders to perform it. Including such studies in past updates was acceptable as part of a broad evidence review to gather as much relevant data as possible. As more articles emerge, a revised PICOST strategy should be developed to distinguish between factors related to OHCA patients receiving CPR (such as community-level disparities) and factors associated with bystanders performing CPR and using AEDs (such as personal-level willingness).

Knowledge gaps:

- Efficacy of interventions aiming to address known barriers and enhance facilitating factors for bystanders to provide resuscitation in real world
- How to overcome barrier and motivate the laypersons to perform resuscitation
- How to evaluate individuals' barriers and enablers to performing resuscitation
- How to determine the causes of disparities and specific barriers
- Understanding factors that influence disparities
- Is willingness changing after specific intervention or campaign

Reference list:

1. Allert C, Nilsson B, Svensson A, Andersson EK. Voluntary first responders' experiences of being dispatched to suspected out-of-hospital cardiac arrest in rural areas: an interview study. BMC Cardiovasc Disord. 2024;24(1):157.
2. Beck S, Phillipps M, Degel A, Mochmann HC, Breckwoldt J. Exploring cardiac arrest in 'at-home' settings: Concepts derived from a qualitative interview study with layperson bystanders. Resuscitation. 2024;194:110076.
3. Gamberini L, Del Giudice D, Tartaglione M, Allegri D, Coniglio C, Pastori A, et al. Logistic and cognitive-emotional barriers experienced by first responders when alarmed to get dispatched to out-of-hospital cardiac arrest events: a region-wide survey. Intern Emerg Med. 2024;19(3):813-22.
4. Greif R, Bhanji F, Bigham BL, Bray J, Breckwoldt J, Cheng A, et al. Education, Implementation, and Teams: 2020 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. Resuscitation. 2020;156:A188-a239.
5. Matsuyama T, Scapigliati A, Pellis T, Greif R, Iwami T. Willingness to perform bystander cardiopulmonary resuscitation: A scoping review. Resusc Plus. 2020;4:100043.
6. Wyckoff MH, Greif R, Morley PT, Ng KC, Olasveengen TM, Singletary EM, et al. 2022 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. Circulation. 2022;146(25):e483-e557.
7. Aldridge ES, Perera N, Ball S, Finn J, Bray J. A scoping review to determine the barriers and facilitators to initiation and performance of bystander cardiopulmonary resuscitation during emergency calls. Resusc Plus. 2022;11:100290.

2025 Evidence Update
EIT 6305 – Clinical Decision Rules to Facilitate In-Hospital DNCPR

Worksheet Author(s): Kasper G. Lauridsen, Sandra Viggers, Alexander Olaussen, Jan Breckwoldt
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: 1 December 2024

Conflicts of Interest: none

PICOST / Research Question:
Population: Hospitalized adults and children experiencing an in-hospital cardiac arrest.
Intervention: Does any pre-arrest clinical prediction rule.
Comparators: Compared to no clinical prediction rule.
Outcomes: Predict return of spontaneous circulation, survival to hospital discharge/ 30-days or survival with favorable neurological 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, case series where n ≥ 5) were included.
Excluded studies: unpublished results (e.g. trial protocols), commentaries, editorials, reviews, conference abstracts.
Timeframe: All years and all languages were included.
PROSPERO Registration CRD42021268005

Year of last full review: 2022
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:

We recommend against using any currently available pre-arrest prediction rule as a sole reason to not resuscitate an adult with in-hospital cardiac arrest (strong recommendation, very low certainty evidence).

We are unable to recommend for or against any available pre-arrest prediction rule to facilitate do-not-attempt cardiopulmonary resuscitation discussions with adult patients or their next of kin as there are no studies investigating the effect of clinical implementation of such score.

New Search strategy:

Pubmed:

#13 Search: #9 AND #12

#12 Search: ("2021/01/01"[Date - Entry] : "3000"[Date - Entry])

#9 Search: #7 NOT #8

#8 Search: animal OR cadaver OR porcine

#7 Search: #5 NOT #6

#6 Search: "conference abstract" OR "letter-to-the-editor" OR editorial OR "case report"

#5 Search: #3 NOT #4

#4 Search: "pre hospital"[Ti] OR "pre-hospital"[Ti] OR prehospital[Ti] OR "out-of-hospital"[Ti] OR "out of hospital"[Ti]

#3 Search: #1 AND #2

#2 Search: GO-FAR OR "pre-arrest prediction" OR DNACPR OR DNR OR "resuscitation order*" OR "do-not-attempt-CPR" OR "do-not-attempt-resuscitation" OR Do-Not-Resuscitate OR "Do not attempt resusc*" OR "resuscitation orders"[MeSH] OR "treatment failure"[MeSH] OR "Pre-Arrest Morbidity" OR "Prognosis After Resuscitation" OR "warning score" OR "medical futility"[MeSH] OR "Decision Support Techniques"[MeSH]

#1 Search: "Heart Arrest"[MeSH Terms] OR "cardiac arrest" OR "heart arrest" OR "Cardiopulmonary Resuscitation"[MeSH Terms] OR CPR OR "cardiopulmonary arrest" OR "ventricular fibrillation"

Embase:

#10 #9 AND [2021-2025]/py

#9 #7 NOT #8

#8 'animal'

#7 #5 NOT #6

#6 [conference abstract]/lim OR [editorial]/lim OR [letter]/lim OR [book]/lim OR 'case report'/de

#5 #3 NOT #4

#4 'pre hospital':ti OR 'pre-hospital':ti OR prehospital:ti OR 'out-of-hospital':ti OR 'out of hospital':ti

#3 #1 AND #2

#2 'do not resuscitate order' OR dnr OR dnar OR dnacpr OR 'treatment failure' OR 'go far'

#1 'cardiopulmonary resuscitation':ti,ab,kw OR 'cardiac arrest':ti,ab,kw OR 'heart arrest':ti,ab,kw OR 'cardiopulmonary arrest':ti,ab,kw OR 'cardio-pulmonary arrest':ti,ab,kw OR 'arrest in hospital':ti,ab,kw OR 'in-hospital arrest$':ti,ab,kw OR ihca:ti,ab,kw OR 'ih-ca':ti,ab,kw

Database searched: PubMed, Embase, Cochrane

Time Frame for original search: From inception – January 8, 2022

Time Frame for Evidence Update: January 1, 2021 – November 27, 2024

Date Search Completed: November 27, 2024

Search Results: 4

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
ILCOR, Lauridsen KG, 2022[1]	Pre-arrest prediction of survival following in-hospital cardiac arrest: A	Identical to the PICO above.	23 studies	Very low certainty evidence was identified across 23 studies for 13 different pre-arrest prediction scores to	We recommend against using any currently available pre-arrest prediction rule as a sole reason to not resuscitate an adult with in-hospital cardiac arrest (strong

			outcome following IHCA. No score was sufficiently reliable to support its use in clinical practice.	recommendation, very low certainty evidence). We are unable to recommend for or against any available pre-arrest prediction rule to facilitate do-not-attempt cardiopulmonary resuscitation discussions with adult patients or their next of kin as there are no studies investigating the effect of clinical implementation of such score.
systematic review of diagnostic test accuracy studies				

No RCTs found

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)
Validating the GO-FAR Score; Alao; 2024[2]	Study Type: Cohort study	Inclusion Criteria: Index arrests of patients ≥18 years at a single hospital in the United Arabic Emirates from Jan 2017 to Dec 2019. Emergency department arrests and trauma patients were excluded.	Survival to hospital discharge was 8.5% and survival with favorable neurological outcome (Cerebral Performance Category (CPC)1-2) was 5.5%. The Area Under the receiver operating characteristic curve (AUC) was 0.72 (95% CI 0.6–0.84) and 0.74 (95% CI 0.59–0.88) for prediction of survival to hospital discharge and survival with favorable neurological outcome respectively. Sensitivity and specificity for survival with favorable neurological outcome was 80.0% (95% CI: 56.3- 94.3%) and 30.1% (95% CI: 25.3- 35.2%). NPV was 96.3% (95% CI: 90.8- 99.0%).	The GO-FAR was not originally validated for survival to hospital discharge or survival with favorable neurological outcome defined as CPC1-2. In spite of low survival rates, the GO-FAR score was unable to identify all those patients not surviving.
Frailty instruments for prediction of perioperative cardiac arrest survival; Chen; 2024[3]	Study Type: Cohort study	Inclusion Criteria: patients age ≥50 undergoing non-cardiac surgery with cardiac arrest intraoperatively or postoperatively on the day of surgery.	30-day survival was 41.4%. Use of age, sex, ASA physical status, preoperative sepsis/septic shock, and emergent (vs. urgent or elective) surgery provided an AUC of 0.77 (0.76, 0.79) for prediction of 30-day mortality. By adding risk analysis index, the AUC changed to 0.78 (0.76, 0.79) and by adding modified frailty index, the AUC changed to 0.77 (0.76, 0.79). False positive rates were 34-35%.	Adding frailty score did not improve prediction performance significantly. The models had a large rate of missed survivors.
Validation of the GO-FAR Score in China; Ren; 2022[4]	Study Type: Cohort study	Inclusion Criteria: In-hospital cardiac arrests in a single center in China.	Of 230 cardiac arrests, survival with CPC1 was 10.0%.The AUC of the GO-FAR score for predicting survival with CPC1 was 0.65 (95%CI: 0.53-0.78)	The full text is in Chinese and not extracted. The AUC was lower than in several of the previous studies investigating the GO-FAR score.
Validation of the GO-FAR 2 Score in Korea; Kim; 2023[5]	Study Type: Cohort study	Inclusion Criteria: Index cardiac arrests of adults >18 years of age in a single center. No exclusion criteria mentioned.	Survival to hospital discharge was 25.4% and favorable neurological outcome was 16%. A GO-FAR 2 Score suggesting very low chance of favorable outcomes had a sensitivity of 100.0% (95%CI: 97.8–100.0), a specificity of 4.6% (95%CI: 3.3–6.2), a positive predictive value of 16.7% (95%CI: 16.5–16.9), and a negative predictive value of 100.0%.	

 Reviewer Comments: The evidence update identified 4 new studies, of which two were external validation of the GO-FAR Score in historical cohorts.[2,4] These cohorts had relatively low survival rates which limits generalizability of the findings. In spite of low survival rates, the GO-FAR Score predicted death in several patients who had favorable outcomes. One study was an external validation of the GO-FAR 2 Score in a historical cohort with low survival rates.[5] The GO-FAR 2 score had excellent sensitivity but very low specify in this cohort. One study investigated prediction models including frailty among perioperative cardiac arrests having high rates of missed survivors.[3]

Overall, there are still no studies investigating the prospective implementation of prediction models why we still have no evidence to support any clinical prediction model to be used for do-not-attempt cardiopulmonary resuscitation orders. The identified four studies were all based on either highly selected cohorts not applicable to the general in-hospital cardiac arrest population or in-hospital cardiac arrest cohorts in settings with lower than average survival rates. Thus, an updated SysRev is not warranted.[6]

Reference list:

[1] Lauridsen KG, Djärv T, Breckwoldt J, Tjissen JA, Couper K, Greif R. Pre-arrest prediction of survival following in-hospital cardiac arrest: A systematic review of diagnostic test accuracy studies. Resuscitation 2022;179:141–51. doi:10.1016/j.resuscitation.2022.07.041.

[2] Alao DO, Hukan Y, Mohammed N, Moin K, Sudha RK, Cevik AA, et al. Validating the GO-FAR score: predicting in-hospital cardiac arrest outcomes in the Middle East. Int J Emerg Med 2024;17:161. doi:10.1186/s12245-024-00749-4.

[3] Chen L, Justice SA, Bader AM, Allen MB. Accuracy of frailty instruments in predicting outcomes following perioperative cardiac arrest. Resuscitation 2024;200:110244. doi:10.1016/j.resuscitation.2024.110244.

[4] Ren Y, Ye L, Huang X, Gao X, Yin G, Wu X, et al. Validation the clinical value of good outcome following attempted resuscitation scores in Chinese populations in predicting the prognosis of in-hospital cardiac arrest. Chinese Crit Care Med 2022;34:1238–42. doi:10.3760/cma.j.cn121430-20220317-00256.

[5] Kim B, Hong SI, Kim YJ, Cho YJ, Kim WY. Predicting the probability of good neurological outcome after in-hospital cardiac arrest based on prearrest factors: validation of the good outcome following attempted resuscitation 2 (GO-FAR 2) score. Intern Emerg Med 2023;18:1807–13. doi:10.1007/s11739-023-03271-2.

[6] Wyckoff MH, Greif R, Morley PT, Ng K-C, Olasveengen TM, Singletary EM, et al. 2022 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, . Circulation 2022;146:e483–557. doi:10.1161/CIR.0000000000001095.

2025 Evidence Update
EIT 6308 – Termination of Resuscitation for In-hospital Cardiac Arrest

Worksheet Author(s): Kasper G. Lauridsen
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: 21 May 2024
Conflicts of Interest: none

PICO / Research Question: *Termination of Resuscitation for In-hospital Cardiac Arrest (EIT 6308)*
Population: For adults and children with in-hospital cardiac arrest
Intervention: Does use of any clinical decision rule
Comparators: Compared to no clinical decision rule
Outcomes: Change or predict no return of spontaneous circulation, death before hospital discharge, survival with unfavorable neurological outcome, death within 30 days.
Study Designs: Randomized controlled trials and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies). We excluded editorials, commentaries, opinion papers, non-published studies, and studies not having an abstract in English.
Timeframe: 01/01/2020 to 20/05/2024.

Outcomes: As above
Type (intervention, diagnosis, prognosis): Diagnosis
Additional Evidence Reviewer(s): None
Conflicts of Interest (financial/intellectual, specific to this question): None
Year of last full review: 2019

Last ILCOR Consensus on Science and Treatment Recommendation:
We did not identify any clinical decision rule that was able to reliably predict death following in-hospital cardiac arrest. We recommend against use of the UN10 rule as a sole strategy to terminate in-hospital resuscitation (strong recommendation, very low quality of evidence).

2019 Search Strategy:
1   "Heart Arrest"/ or "Ventricular Fibrillation"/ or exp "heart ventricle fibrillation"/ or exp "Tachycardia, Ventricular"/ or "heart ventricle tachycardia"/
2   ("heart arrest" or "cardiac arrest" or "cardiopulmonary arrest" or "cardio-pulmonary arrest" or "circulatory arrest" or "cardiac standstill" or "cardiac stand still" or "ventricular fibrillation" or "ventricular tachycardi*" or asystol* or pulseless or pea or shockable or non-shockable or "non shockable" or nonshockable).ti,ab,kf,kw.
3   or/1-2 [CARDIAC ARREST]
4   "Inpatients"/ or exp "hospital patient"/ or "Hospitalization"/ or "Hospitals"/ or "Cardiac Care Facilities"/ or "Coronary Care Units"/ or "heart center"/ or "coronary care unit"/
5   (in-hospital or inhospital or inpatient* or in-patient* or hospitaliz* or hospitalis* or "hospital provider*" or ((cardiac or heart or coronary or cardiolog*) adj (facility or facilities or center or centers or centre* or unit or units))).ti,ab,kf,kw.
6   "Hospital Mortality"/ or "hospital mortality".ti,ab,kf,kw.
7   or/4-6 [IN-HOSPITAL]
8   IHCA.ti,ab,kf,kw.
9   (3 and 7) or 8 [IN-HOSPITAL CARDIAC ARREST]
10   "Resuscitation Orders"/
11   exp "Resuscitation"/ or exp "Life Support Care"/
12   (resuscitat* or "heart massag*" or "cardiac massag*" or "heart compression*" or "cardiac compression*" or "chest compression*" or CPR or "basic cardiac life support" or BCLS or "basic life support" or BLS or "advanced life support" or ALS or defibrillat*).ti,ab,kf,kw.
13   or/10-12 [RESUSCITATION]
14   "Medical Futility"/
15   "Decision Support Systems, Clinical"/ or "Decision Support Techniques"/ or exp "decision support system"/
16   exp "Prognosis"/
17   (terminat* or cease or cessation or stop or stopping or withdraw* or withhold* or withheld or TOR or DNAR or futile or futility or rule* or algorithm* or decease* or prognosis or validation or "clinical decision" or "decision process" or "decision aid" or "prediction tool*" or "prediction aid*" or (predict* adj2 (outcome* or likelihood or survival))).ti,ab,kf,kw.
18   or/14-17 [TOR]
19   9 and 13 and 18 [IN-HOSPITAL CARDIAC ARREST + RESUSCITATION + TOR]
20   (exp "animal model"/ or exp "animal experiment"/ or "nonhuman"/ or exp "vertebrate"/) not (exp "human"/ or exp "human experiment"/)
21   (exp "animal model"/ or exp "animal experiment"/ or "nonhuman"/ or exp "vertebrate"/ or "manikin"/ or "patient simulator"/) not (exp "human"/ or exp "human experiment"/)
22   19 not (20 or 21) [IN-HOSPITAL CARDIAC ARREST + RESUSCITATION + TOR, human]
23   (editorial or comment or letter or "newspaper article" or news or note or lecture or "case reports").pt.
24   (conference or "conference abstract" or "conference paper" or "conference review" or congresses).pt.
2024 Search Strategy:
Same as above

Database searched: Ovid MEDLINE(R)
Date Search Completed: May 20, 2024
Search Results: 1469 of which none were relevant.
Inclusion Criteria: We included studies on clinical decision rules defined as a set of different criteria (variables) e.g. witnessed status, presenting rhythm etc. to predict a binary outcome (death or unfavorable neurologic outcome) during resuscitation.
Exclusion: Studies utilizing pre-arrest factors (e.g. age and comorbidities) to identify patients at low risk of surviving a cardiac arrest in order to discuss do-not-resuscitate orders and studies on clinical decision rules used to predict survival after ROSC were excluded.

Link to Article Titles and Abstracts (if available on PubMed):

Summary of Evidence Update: Ovid MEDLINE® was searched to identify eligible studies providing new information between 01/01/2020 and 05/20/2024. Overall, 1469 abstracts were screened. None of these met the inclusion criteria as they were either on a wrong population (e.g. out-of-hospital cardiac arrest) or did not include a clinical decision rule for termination of resuscitation.

Reviewer Comments:
This Evidence Update did not identify any new studies. Accordingly, there is no new evidence to prompt any new systematic review.

2025 Evidence Update
EIT 6311 – Chain of Survival

Worksheet Author(s): Sebastian Schnaubelt
Task Force: Education Implementation, and Teams
Date Approved by SAC Representative: 7 December 2024

Conflicts of Interest: none

PICOST / Research Question:
    Population: Literature using the term "chain of survival" or similar terms (e.g., "survival chain", "chain of [other pathology]")
    Intervention and exposure: Adaptations of the original "chain of survival" …
    Comparators: the original "chain of survival"
    Outcomes:
- Composition of the specific variations in adapted versions
- Attitudes, rationale, and views concerning the adaptation
- Incentives to develop novel versions
- Way of implementation of adapted versions
- Way of utilization of adapted versions in education
- Variations in visualization
- Effect of the use of the chain of survival or variants on teaching, implementation, patient outcomes

    Study Designs:
- All types of studies - randomized or non-randomized (controlled) trials), non-original / narrative literature like letters, commentaries, or editorials.
- All languages.

    Timeframe: All years.

Year of last full review: 2023
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST: No recommendation (ScR), but Taks Force insights.

- As a depiction and summative term for a "systems to save lives" program, the chain of survival with six links (as currently proposed by the AHA) should be continued to be used in layperson education (= basic chain of survival) as an easy

cognitive aid and depiction of a complex system. The proposed links are: 1) Recognition & Prevention 2) Early call for help 3) High quality CPR 4) Early defibrillation 5) Post-Cardiac Arrest care 6) Recovery & Rehabilitation.

- Specific versions of the chain of survival could be used for special circumstances of cardiac arrest. However, a wide variety of chains should be avoided.
- ILCOR as the international body on resuscitation should provide the basic structure of this framework, and regional resuscitation councils can provide regional application of the chain of survival for their implementation strategies.
- Future research on the concept is warranted, as mentioned under the Knowledge Gaps.

Current Search Strategy

Ovid MEDLINE(R)

1	("chain* of survival" or "survival chain*").ti,ab,kf,kw.
2	(chain and ("saving lives" or "first aid")).ti,ab,kw,kf.
3	"formula of survival".ti,ab,kf,kw.
4	(sequenc* and (early adj2 (cpr or defibrillation or "advanced care" or "first aid"))).ti,ab,kw,kf.
5	(sequenc* and "early access").ti,ab,kw,kf.
6	((survival adj2 (cycle or cycles or chain* or formula or sequence)) and (cpr or resuscit* or "heart massage" or "cardiac arrest*" or "heart arrest*" or "cardio* arrest*" or stroke or strokes or "cerebrovascular accident*" or drown* or trauma* or "first aid")).ti,ab,kf,kw.
7	or/1-6
8	7 not 8

Embase

1	("chain* of survival" or "survival chain*").ti,ab,kf,kw.
2	(chain and ("saving lives" or "first aid")).ti,ab,kw,kf.
3	"formula of survival".ti,ab,kf,kw.
4	(sequenc* and (early adj2 (cpr or defibrillation or "advanced care" or "first aid"))).ti,ab,kw,kf.
5	(sequenc* and "early access").ti,ab,kw,kf.
6	((survival adj2 (cycle or cycles or chain* or formula or sequence)) and (cpr or resuscit* or "heart massage" or "cardiac arrest*" or "heart arrest*" or "cardio* arrest*" or stroke or strokes or "cerebrovascular accident*" or drown* or trauma* or "first aid")).ti,ab,kf,kw.
7	or/1-6

APA PsycInfo

1	("chain* of survival" or "survival chain*").ti,ab,id.
2	(chain and ("saving lives" or "first aid")).ti,ab,id.
3	"formula of survival".ti,ab,id.
4	(sequenc* and (early adj2 (cpr or defibrillation or "advanced care" or "first aid"))).ti,ab,id.
5	(sequenc* and "early access").ti,ab,id.
6	((survival adj2 (cycle or cycles or chain* or formula or sequence)) and (cpr or resuscit* or "heart massage" or "cardiac arrest*" or "heart arrest*" or "cardio* arrest*" or stroke or strokes or "cerebrovascular accident*" or drown* or trauma* or "first aid")).ti,ab,id.
7	or/1-6
8	7 not 8

CINAHL

S1	TI ("chain* of survival" OR "survival chain*") OR AB ("chain* of survival" OR "survival chain*")
S2	TI (chain AND ("saving lives" OR "first aid")) OR AB (chain AND ("saving lives" OR "first aid"))
S3	TI ("formula of survival") OR AB ("formula of survival")

S4	TI (sequenc* AND (early N2 (cpr OR defibrillation OR "advanced care" OR "first aid"))) OR AB (sequenc* AND (early N2 (cpr OR defibrillation OR "advanced care" OR "first aid")))
S5	TI (sequenc* AND "early access") OR AB (sequenc* AND "early access")
S6	TI ((survival N2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")) OR AB ((survival N2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid"))
S7	S1 OR S2 OR S3 OR S4 OR S5 OR S6
S8	S7 NOT S8

ERIC

S1	TI ("chain* of survival" OR "survival chain*") OR AB ("chain* of survival" OR "survival chain*") OR KW ("chain* of survival" OR "survival chain*")
S2	TI (chain AND ("saving lives" OR "first aid")) OR AB (chain AND ("saving lives" OR "first aid")) OR KW (chain AND ("saving lives" OR "first aid"))
S3	TI ("formula of survival") OR AB ("formula of survival") OR KW ("formula of survival")
S4	TI (sequenc* AND (early N2 (cpr OR defibrillation OR "advanced care" OR "first aid"))) OR AB (sequenc* AND (early N2 (cpr OR defibrillation OR "advanced care" OR "first aid"))) OR KW (sequenc* AND (early N2 (cpr OR defibrillation OR "advanced care" OR "first aid")))
S5	TI (sequenc* AND "early access") OR AB (sequenc* AND "early access") OR KW (sequenc* AND "early access")
S6	TI ((survival N2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")) OR AB ((survival N2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")) OR KW ((survival N2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid"))
S7	S1 OR S2 OR S3 OR S4 OR S5 OR S6

Web of Science Core Collection

1	TI=("chain* of survival" OR "survival chain*") OR AB=("chain* of survival" OR "survival chain*") OR KP=("chain* of survival" OR "survival chain*") OR TS=("chain* of survival" OR "survival chain*")
2	TI=(chain AND ("saving lives" OR "first aid")) OR AB=(chain AND ("saving lives" OR "first aid")) OR KP=(chain AND ("saving lives" OR "first aid")) OR TS=(chain AND ("saving lives" OR "first aid"))
3	TI=("formula of survival") OR AB=("formula of survival") OR KP=("formula of survival") OR TS=("formula of survival")
4	TI=(sequenc* AND (early NEAR/2 (cpr OR defibrillation OR "advanced care" OR "first aid"))) OR AB=(sequenc* AND (early NEAR/2 (cpr OR defibrillation OR "advanced care" OR "first aid"))) OR KP=(sequenc* AND (early NEAR/2 (cpr OR defibrillation OR "advanced care" OR "first aid"))) OR TS=(sequenc* AND (early NEAR/2 (cpr OR defibrillation OR "advanced care" OR "first aid")))
5	TI=(sequenc* AND "early access") OR AB=(sequenc* AND "early access") OR KP=(sequenc* AND "early access") OR TS=(sequenc* AND "early access")
6	TI=((survival NEAR/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")) OR AB=((survival NEAR/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")) OR KP=((survival NEAR/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")) OR TS=((survival NEAR/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid"))

7	#6 OR #5 OR #4 OR #3 OR #2 OR #1

Scopus

1	TITLE-ABS-KEY (("chain* of survival" OR "survival chain*"))
2	TITLE-ABS-KEY ((chain AND ("saving lives" OR "first aid")))
3	TITLE-ABS-KEY ("formula of survival")
4	TITLE-ABS-KEY ((sequenc* AND (early W/2 (cpr OR defibrillation OR "advanced care" OR "first aid"))))
5	TITLE-ABS-KEY ((sequenc* AND "early access"))
6	TITLE-ABS-KEY (((survival W/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")))
7	(TITLE-ABS-KEY (((survival W/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")))) OR (TITLE-ABS-KEY ((sequenc* AND "early access"))) OR (TITLE-ABS-KEY ((sequenc* AND (early W/2 (cpr OR defibrillation OR "advanced care" OR "first aid"))))) OR (TITLE-ABS-KEY ("formula of survival")) OR (TITLE-ABS-KEY ((chain AND ("saving lives" OR "first aid")))) OR (TITLE-ABS-KEY (("chain* of survival" OR "survival chain*")))
8	((TITLE-ABS-KEY (((survival W/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")))) OR (TITLE-ABS-KEY ((sequenc* AND "early access"))) OR (TITLE-ABS-KEY ((sequenc* AND (early W/2 (cpr OR defibrillation OR "advanced care" OR "first aid"))))) OR (TITLE-ABS-KEY ("formula of survival")) OR (TITLE-ABS-KEY ((chain AND ("saving lives" OR "first aid")))) OR (TITLE-ABS-KEY (("chain* of survival" OR "survival chain*")))) AND NOT (TITLE-ABS-KEY ((animal* AND NOT human)))
9	((TITLE-ABS-KEY (((survival W/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")))) OR (TITLE-ABS-KEY ((sequenc* AND "early access"))) OR (TITLE-ABS-KEY ((sequenc* AND (early W/2 (cpr OR defibrillation OR "advanced care" OR "first aid"))))) OR (TITLE-ABS-KEY ("formula of survival")) OR (TITLE-ABS-KEY ((chain AND ("saving lives" OR "first aid")))) OR (TITLE-ABS-KEY (("chain* of survival" OR "survival chain*")))) AND NOT (((TITLE-ABS-KEY (((survival W/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest*" OR "heart arrest*" OR "cardio* arrest*" OR stroke OR strokes OR "cerebrovascular accident*" OR drown* OR trauma* OR "first aid")))) OR (TITLE-ABS-KEY ((sequenc* AND "early access"))) OR (TITLE-ABS-KEY ((sequenc* AND (early W/2 (cpr OR defibrillation OR "advanced care" OR "first aid"))))) OR (TITLE-ABS-KEY ("formula of survival")) OR (TITLE-ABS-KEY ((chain AND ("saving lives" OR "first aid")))) OR (TITLE-ABS-KEY (("chain* of survival" OR "survival chain*"))))

Cochrane Library (Wiley)

#1	("chain of survival" OR "chains of survival" OR "chainmail of survival" OR "chainmails of survival" OR "survival chain" OR "survival chains"):ti,ab,kw
#2	(chain AND ("saving lives" OR "first aid")):ti,ab,kw
#3	("formula of survival"):ti,ab,kw
#4	(sequenc* AND (early NEAR/2 (cpr OR defibrillation OR "advanced care" OR "first aid"))):ti,ab,kw
#5	(sequenc* AND "early access"):ti,ab,kw
#6	((survival NEAR/2 (cycle OR cycles OR chain* OR formula OR sequence)) AND (cpr OR resuscit* OR "heart massage" OR "cardiac arrest" OR "cardiac arrests" OR "heart arrest" OR "heart arrests" OR (cardio* NEXT arrest*) OR stroke OR strokes OR "cerebrovascular accident" OR "cerebrovascular accidents" OR drown* OR trauma* OR "first aid")):ti,ab,kw
#7	{OR #1-#6}

Database searched: MEDLINE(R) ALL 1946 to 1974 to October 21, 2024 (Ovid); Embase 1974 to October 21, 2024 (Ovid); APA PsycINFO 1806 to October week 1, 2024 (Ovid); CINAHL 1982-present (Ebscohost); ERIC 1966-present (Ebscohost); Web of Science (Clarivate); Scopus (Elsevier); Cochrane Library (Wiley Online) – Cochrane Central Register of Controlled Trials Issue of October 21, 2024 and Cochrane Database of Systematic Reviews Issue of October 21, 2024.

Time Frame: (existing PICOST) – inception to Oct 21, 2024
Date Search Completed: 21st of October 2024
Search Results (Number of articles identified and number identified as relevant): 453/6

Summary of Evidence Update: Since the last search and the subsequent publication [11], no relevantly new information was found, only additional literature very similar to the already available one. The gaps of knowledge persist.

Relevant Guidelines or Systematic Reviews: None
RCT: None
Nonrandomized Trials, Observational Studies: 7

Table 1: New studies identified in this EvUp				
Study (author, year)	**Country** (study or corresponding author)	**Publication type**	**Content description**	**Comments**
Novel kinds of the concept <u>related</u> to resuscitation				
Nadarajan, 2024 [1]	Singapore	Letter	Description of a "frame of survival" for low-resource settings as an adaptation of the "chainmail of survival"	Reply by Schnaubelt, 2024 [2]
Novel kinds of the concept <u>not directly</u> related to resuscitation				
Ceferino, 2024 [3]	Chile, USA	Narrative review	Description of an "earthquake survival chain" as a framework for engineering, earthquake injuries, search and rescue, patient mobilizations, and medical treatment.	
Jouffroy, 2024 [4]	France	Narrative review	Suggesting the processes for sepsis treatment from the prehospital setting until rehabilitation as a "chain of survival and rehabilitation for sepsis", including: Early recognition, severity assessment, prehospital emergency medical system activation when available, early therapy (antimicrobials and hemodynamic optimization), early orientation to an adequate facility (emergency room, operating theater or intensive care unit), in-hospital organ failure resuscitation associated with source control, and a comprehensive rehabilitation program.	
Lam, 2024 [5]	Singapore	Narrative review	Description of the stroke chain of survival in Singapore, including efforts to improve stroke awareness and transport protocols, novel prehospital stroke therapeutics, and telecommunication strategies.	
Latif, 2023 [6]	USA	Narrative review	Description of a "chain of survival for severe hemorrhage", including primary prevention, prehospital interventions and hospital care with early injury recognition, resuscitation, definitive hemostasis, and achieving endpoints of resuscitation.	
Mere adaptations				
Yilmaz, 2024 [7]	Turkey	Letter	Description of environmental awareness as the first link in a chain of survival (aimed at disaster situations)	Reply by Schnaubelt, 2024 [8]
Dünser, 2024 [9]	Austria	Narrative review	Suggesting "emergency critical care" (covering the most time-sensitive phase of critical illness by delivering intensive care at the emergency department) as a missing link in the chain of survival of the critically ill patient	
Impact on outcomes				
None.				

Reviewer Comments: No indication for a new SysRev.

Reference list:

[1] Nadarajan GD, Ong MEH. The frame of survival for cardiopulmonary resuscitation in lower-resource settings. Lancet Glob Health 2024;12:e378–9. https://doi.org/10.1016/S2214-109X(24)00005-6.

[2] Schnaubelt S, Greif R, Monsieurs KG. The frame of survival for cardiopulmonary resuscitation in lower resource settings – Authors' reply. The Lancet Global Health 2024;12:e380. https://doi.org/10.1016/S2214-109X(23)00596-X.

[3] Ceferino L, Merino Y, Pizarro S, Moya L, Ozturk B. Placing engineering in the earthquake response and the survival chain. Nat Commun 2024;15:4298. https://doi.org/10.1038/s41467-024-48624-3.

[4] Jouffroy R, Djossou F, Neviere R, Jaber S, Vivien B, Heming N, et al. The chain of survival and rehabilitation for sepsis: concepts and proposals for healthcare trajectory optimization. Ann Intensive Care 2024;14:58. https://doi.org/10.1186/s13613-024-01282-6.

[5] Lam TJR, Liu Z, Tan BY-Q, Ng YY, Tan CK, Wong XY, et al. Prehospital stroke care in Singapore. Singapore Med J 2024. https://doi.org/10.4103/singaporemedj.SMJ-2023-066.

[6] Latif R, Clifford, Baker J, Lenhardt R, Haq M, Huang J, et al. Traumatic hemorrhage and chain of survival. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine 2023;31. https://doi.org/10.1186/s13049-023-01088-8.

[7] Yilmaz S, Umac GA. Can the Chain of Survival start with environment safety for special circumstances? Resusc Plus 2024;19:100717. https://doi.org/10.1016/j.resplu.2024.100717.

[8] Schnaubelt S, Eastwood K, Greif R. Author's response to Letter to the Editor "Can the chain of survival start with environment safety for special circumstances." Resusc Plus 2024;19:100744. https://doi.org/10.1016/j.resplu.2024.100744.

[9] Dünser MW, Noitz M, Tschoellitsch T, Bruckner M, Brunner M, Eichler B, et al. Emergency critical care: closing the gap between onset of critical illness and intensive care unit admission. Wien Klin Wochenschr 2024. https://doi.org/10.1007/s00508-024-02374-w.

[10] Dahan B, Jabre P, Marijon E, Jost D, Tafflet M, Misslin R, et al. Impact of a public information campaign about the chain of survival on out of hospital cardiac arrest bystander cardiopulmonary resuscitation initiation. 2014.

[11] Schnaubelt S, Monsieurs KG, Fijacko N, Veigl C, Al-Hilali Z, Atiq H, et al. International facets of the "chain of survival" for out-of-hospital and in-hospital cardiac arrest - A scoping review. Resusc Plus 2024;19:100689. https://doi.org/10.1016/j.resplu.2024.100689.

EIT 6315 – Impact of Support on Mental Health in Co-Survivors of Cardiac Arrest Patients

Worksheet Author(s): Charlotte Southern, Cristian Abelairas-Gómez. Alanowd Alghaith, Aida Carballo-Fazanes, Andrea Cortegiani
Task Force: Education Implementation, and Teams
Conflicts of Interest: none

PICOST / Research Question:
Population: Co-survivors (any age) who witnessed resuscitation of cardiac arrest (any age)
Intervention: Co-survivors who received support for their mental health, after the event
Comparison: No support or any other type of support
Outcomes: Critical outcomes of the co-survivors: mental health outcomes (e.g. anxiety, depression, post-traumatic stress disorder). Important outcomes: quality of life, socio-economic measures
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 in which n≥5) were eligible for inclusion. Unpublished studies (e.g., conference abstracts, trial protocols), letters to editor, commentary, editorials, and studies related to trauma cardiac arrest were excluded.
Timeframe: From inception to date of search. All languages were included as long as there was an English abstract.

Year of last full review: N/A
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST: N/A.
Current Search Strategy:
Medline(R) ALL 1946 to 24th October 2024
1.   Cardiac arrest.mp. or exp Heart Arrest
2.   Out of hospital cardiac arrest.mp. or exp Out-Of-Hospital Cardiac Arrest/ or exp Cardiopulmonary Resuscitation/ or exp Resuscitation
3.   ((cardiac or heart or circulatory or cardiorespiratory or cardiopulmonary or postcardiac or post-cardiac) adj1 (arrest or resuscitation)).mp.
4.   Sudden cardiac death.mp. or exp Death, Sudden, Cardiac
5.   1 or 2 or 3 or 4
6.   Exp Adult/ or exp Child/ or famil*.mp. or exp Adolescent/ or exp Family/
7.   Guardian.mp. or exp Legal Guardians/
8.   loved one*.mp.
9.   next of kin.mp.
10.   relative.mp.
11.   significant other*.mp.
12.   spouse*.mp. or exp Spouses
13.   caregiver*.mp. or exp Caregivers/
14.   unpaid carer*.mp.
15.   co-survivor*.mp.
16.   key supporter*.mp.
17.   exp Sexual Partners/ or partner*.mp.
18.   6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17
19.   (support or intervention).mp.
20.   Exp Health Education/ or education* material*.mp. or exp Teaching Materials/
21.   Health management.mp.
22.   Coping strategy.mp. or exp Coping Skills/
23.   Coaching.mp. or exp Mentoring/
24.   Shared learning.mp.
25.   Rehab* program*.mp.
26.   Exp Psychotherapy/ or exp Psychotherapy, Group/ or psychotherapy.mp.
27.   Cognitive Behavioral Therapy.mp. or exp Cognitive Behavioral Therapy/
28.   ((psychosocial and psychoeducation) adj2 intervention).mp.
29.   Exp Psychosocial Intervention/ or psychosocial.mp. or exp Psychosocial Support Systems/
30.   ((psych* or mental or social) adj2 (intervene* or training or program* or service* or treatment or outreach or support or therapy)).mp.
31.   Counsel*.mp. or exp Counseling/

32. Aftercare.mp. or exp Aftercare/
33. Evidence based practice.mp. or exp Evidence-Based Practice/
34. Digital support.mp.
35. Exp Mobile Applications/ or mental health app*.mp.
36. 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35
37. Witness*.mp.
38. Bystander*.mp
39. 37 or 38
40. Symptom*.mp. or exp Symptom Assessment/
41. Mental health.mp. or exp Mental Health/
42. Quality of life.mp. or exp "Quality of Life"/
43. Exp Depression/ or depression.mp.
44. Exp Anxiety/ or anxiety.mp.
45. Stress.mp. or exp Stress Disorders, Traumatic/ or exp Stress, Psychological/
46. Exp stress Disorders, Post-Traumatic/ or stress disorder*.mp.
47. Emotional distress.mp. or exp Psychological Distress/
48. Exp Grief/ or grief.mp.
49. Psychological symptom*.mp.
50. Trauma.mp.
51. Exp Mental Disorders/ or mental disorder*.mp.
52. 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51
53. 5 AND 18 AND 36 AND 39 AND 52

Embase Classic + Embase 1947 to 24th October 2024

1. Cardiac arrest.mp. or exp Heart Arrest
2. Out of hospital cardiac arrest.mp. or exp "Out-Of-Hospital Cardiac Arrest"/
3. Cardiopulmonary Resuscitation/ exp Resuscitation
4. ((cardiac or heart or circulatory or cardiorespiratory or cardiopulmonary or postcardiac or post-cardiac) adj1 (arrest or resuscitation)).mp.
5. 1 or 2 or 3 or 4
6. key supporter*.mp.
7. Exp Adult/ or exp Child/ or famil*.mp. or exp Family/
8. Guardian.mp. or exp Legal Guardians/
9. loved one*.mp.
10. next of kin.mp.
11. Relative*.mp.
12. significant other*.mp.
13. spouse*.mp. or exp Spouse
14. caregiver*.mp. or exp Caregiver/
15. healthcare proxy.mp. or exp proxy/
16. partner*.mp. or exp domestic partner/
17. co-survivor*.mp.
18. unpaid carer*.mp.
19. informal carer*.mp.
20. 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
21. (support or intervention).mp.
22. Exp Health Education/ or education* material*.mp.
23. Health management.mp. or exp health care management/
24. Coping strategy.mp. or exp Coping/
25. exp Mentoring/ or Coaching.mp.
26. Shared learning.mp. or exp collaborative learning/
27. Exp rehabilitation/ or Rehab* program*.mp.
28. Exp Psychotherapy/ or Psychotherapy.mp.
29. Cognitive Behavioral Therapy.mp. or exp Cognitive Behavioral Therapy/
30. ((psychosocial and psychoeducation) adj2 intervention).mp.
31. Exp Psychosocial care/ or psychosocial.mp. or exp Psychosocial rehabilitation/
32. ((Psychology or psychological) adj2 (support or treatment or therapy)).mp.

33.   ((psych* or mental or social) adj2 (intervene* or training or program* or service* or treatment or outreach or support or therapy)).mp.
34.   Counsel*.mp. or exp Counseling/
35.   Aftercare.mp. or exp Aftercare/
36.   Evidence based practice.mp. or exp Evidence-Based Practice/
37.   mental health app*.mp. or Exp mobile health applications/ or exp mobile application/
38.   21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37
39.   Exp witness/ or Witness*.mp.
40.   Bystander*.mp
41.   39 or 40
42.   exp Symptom Assessment/ or symptom*.mp. or exp symptom/
43.   Mental health.mp. or exp Mental Health/
44.   Quality of life.mp. or exp "Quality of Life"/
45.   depression.mp. or Exp Depression/
46.   Anxiety.mp. or Exp anxiety/
47.   Posttraumatic stress disorder/ or stress disorder*.mp.
48.   Stress.mp. or exp Psychological stress/
49.   Emotional distress.mp. or exp emotional stress/
50.   Grief.mp. or exp grief/
51.   Psychological symptom*.mp.
52.   mental disorder*.mp.
53.   42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52
54.   5 AND 20 AND 38 AND 41 AND 53

PsycINFO 1806 to 24th October 2024
1.   Cardiac arrest.mp. or exp Heart Disorders/
2.   Exp CPR/ or out of hospital cardiac arrest.mp.
3.   Sudden cardiac death.mp.
4.   1 or 2 or 3
5.   famil*.mp. or exp Family/ or exp Family Members/
6.   Guardian*.mp.
7.   loved one.mp.
8.   next of kin.mp.
9.   significant other.mp. or exp Significant Others/
10.   Exp Couples/ or exp Caregivers/ orexp Partners/ or exp Spouses/ or spouse*.mp.
11.   healthcare proxy.mp.
12.   co-survivor*.mp.
13.   unpaid carer.mp.
14.   informal carer.mp.
15.   key supporter*.mp.
16.   5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
17.   (support or intervention).mp.
18.   Exp Health Promotion/ or Exp Health Education/ or education* material*.mp.
19.   Health management.mp.
20.   Coping strategy.mp.
21.   Coaching.mp. or exp Coaching Psychology/ or exp Coaching/
22.   Shared learning.mp.
23.   Rehab* program*.mp.
24.   Exp Supportive Psychotherapy/ or Psychotherapy.mp. or exp Group Psychotherapy/ or exp Psychotherapy/
25.   Cognitive Behavioral Therapy.mp. or exp Cognitive Behavioral Therapy/
26.   ((psychosocial and psychoeducation) adj2 intervention).mp.
27.   Exp Psychosocial Rehabilitation/ or exp Psychosocial Interventions/ or psychosocial.mp.
28.   ((Psychology or psychological) adj2 (support or treatment or therapy)).mp.
29.   ((psych* or mental or social) adj2 (intervene* or training or program* or service* or treatment or outreach or support or therapy)).mp.
30.   Counsel*.mp. or exp Counseling/
31.   Aftercare.mp. or exp Aftercare/

32. Evidence based practice.mp. or exp Evidence-Based Practice/
33. mental health app*.mp. or exp mobile applications/
34. exp Digital Interventions/ or digital support.mp.
35. 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 26 or 27 or 28 or 29 or 30 31 or 32 or 33 or 34
36. Exp witness/ or Witness*.mp.
37. Bystander*.mp
38. 36 or 37
39. symptom*.mp.
40. Mental health.mp. or exp Mental Health/
41. Quality of life.mp.
42. depression.mp. or Exp Depression/
43. Anxiety.mp. or Exp anxiety/
44. Exp stress/ or Posttraumatic stress disorder/ or stress disorder*.mp.
45. Exp Distress/ or emotional distress.mp.
46. Grief.mp. or exp grief/
47. Psychological symptom*.mp.
48. mental disorder*.mp. or exp Mental Disorders/
49. exp Trauma/ or trauma.mp.
50. 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49
51. 4 AND 16 AND 35 AND 38 AND 50

Cochrane Library
1. [Heart Arrest] explode all trees
2. [Family] explode all trees
3. (guardian):ti,ab,kw
4. (loved one):ti,ab,kw
5. ("next-of-kin"): ti,ab,kw
6. (significant other):ti,ab,kw
7. [Proxy] explode all trees
8. (co-survivor*):ti,ab,kw
9. [Caregivers] explode all trees
10. (unpaid carer):ti,ab,kw
11. (key supporter):ti,ab,kw
12. 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
13. (witness):ti,ab,kw
14. (bystander*):ti,ab,kw
15. 13 or 14
16. [Symptom Assessment] explode all trees
17. [Mental Health] explode all trees
18. [Quality of life] explode all trees
19. [Depression] explode all trees
20. [Anxiety] explode all trees
21. [Stress Disorders, Post-Traumatic] explode all trees
22. [Stress, Psychological] explode all trees
23. [Psychological Distress] explode all trees
24. [Grief] explode all trees
25. (psychological symptom):ti,ab,kw
26. (trauma):ti,ab,kw
27. [Mental Disorders] explode all trees
28. 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27
29. (support or intervention):ti,ab,kw
30. [Health Education] explode all trees
31. [Evidence-Based Practice] explode all trees
32. [Coping Skills] explode all trees
33. [Mentoring] explode all trees
34. (shared learning):ti,ab,kw
35. (rehab* program*):ti,ab,kw

36.   [Rehabilitation] explode all trees
37.   [Psychotherapy] explode all trees
38.   [Cognitive Behavioral Therapy] explode all trees
39.   (((psychosocial and psychoeducation) adj2 intervention).mp.):ti,ab,kw
40.   [Psychosocial Intervention] explode all trees
41.   (((Psychology or psychological) adj2 (support or treatment or therapy)).mp.):ti,ab,kw
42.   (((psych* or mental or social) adj2 (intervene* or training or program* or service* or treatment or outreach or support or therapy)).mp.):ti,ab,kw
43.   [Counseling] explode all trees
44.   [Aftercare] explode all trees
45.   [Mobile Applications] explode all trees
46.   [Digital Technology] explode all trees
47.   29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46
48.   1 AND 12 AND 15 AND 28 AND 47

Database searched: Medline, Embase, PsycINFO, Cochrane
Time Frame: From inception to 24th October 2024
Date Search Completed: 24th October 2024
Search Results (Number of articles identified and number identified as relevant): 652 identified. 0 relevant articles.

Summary of 2024 search results (EvUp)		
Database	**Date Searched**	**Results**
Embase	Nov 2024	482
Medline	Nov 2024	287
PsycINFO	Nov 2024	9
Cochrane library	Nov 2024	4
TOTAL after duplicates removed		**652**
Articles meeting inclusion criteria		**0**

Summary of Evidence Update:
Relevant Guidelines or Systematic Reviews: 3

Organization (if relevant); Author; Year Published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
Considine; 2022	SyR	Family presence during adult resuscitation from CA	31	High-certainty evidence on family presence during resuscitation's impact on patient outcomes is lacking. Family experienced mixed outcomes in terms of depression, anxiety, PTSD symptoms, and their resuscitation witnessing experience. Providers noted that family support personnel and organizational guidelines facilitated family presence during resuscitation. Family presence during resuscitation varied with the resuscitation setting, provider education, and provider experience.	Test interventions such as provider training programs, use of family support persons and implementation of organizational guidelines and policies to reduce the individual decision burden, facilitate and operationalise care of families during adult resuscitation.
Dainty; 2021	SyR	Family presence during paediatric	38	Family wants to be offered the option to be present for their child's resuscitation.	Urgent need of further research for the impact of

		and neonatal resuscitation.			family presence to be fully understood.
Rubin, 2023	SyR	Family presence during resuscitation.	3	Not enough evidence to establish firm conclusion on psychological outcomes of family. Overall, appeared the presence of family reduced psychological outcomes.	Family presence during resuscitation should be investigated more by qualitative research.

RCT: 0
Non-RCT: 0

Reviewer Comments: There were 652 articles identified of which none were relevant to the PICO. We encourage further research to explore the effect of support for co-survivors who witnessed a cardiac arrest on their mental health.

Reference list:

Considine, et al. Family presence during adult resuscitation from cardiac arrest: A systematic review. Resuscitation. 2022;180:11-23. Doi: https://doi.org/10.1016/j.resuscitation.2022.08.021

Dainty, et al. Family presence during resuscitation in paediatric and neonatal cardiac arrest: A systematic review. Resuscitation. 2021;162:20-34. Doi: https://doi.org/10.1016/j.resuscitation.2021.01.017

Rubin, et al. Family presence during resuscitation. Cochrane Database Syst Rev. 2023;5:CD013619. Doi: https://doi.org/10.1002/14651858.CD013619.pub2

2025 Evidence Update
EIT 64000 – Cognitive Aids During Resuscitation

Worksheet Author(s): Kevin Nation, Sabine Nabecker
Task Force: Education, Implementation, and Teams
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults, children and neonates in any setting (in-hospital or out-of-hospital) requiring resuscitation provided by lay providers or health care professionals.
Intervention: The use of cognitive aids during resuscitation.

Comparators: No use of cognitive aids.

Outcomes: Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. Quality of performance in actual resuscitations, skill performance 1 year after course conclusion, skill performance between course conclusion and 1 year, skill performance at course conclusion, and knowledge at course conclusion were included as important outcomes. Measures of effect outcomes included adherence to resuscitation guidelines, CPR quality and test scores.

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 reports) are eligible for inclusion. Unpublished studies (e.g., conference abstracts, trial protocols) are excluded.

Timeframe: All years and all languages were included if there was an English abstract. Initial literature search was from January 1990 to 28 October 2023. The published systematic review updated the literature search from inception to 23 April 2024.

Year of last full review: 2023

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

We suggest the use of cognitive aids by health care providers in resuscitation (weak recommendation, very low certainty of evidence).

We do not recommend the use of cognitive aids for lay providers initiating CPR (weak recommendation, low certainty of evidence).

We did not examine the use of cognitive aids in health professional or lay rescuer training in resuscitation so no recommendation for or against can be issued.

Current Search Strategy (for an existing PICOST) included in the attached approved PICOST

Embase

1	Resuscitation/ or Cardiopulmonary Resuscitation/ or Advanced Cardiac Life Support/ or Heart Massage/
2	(resuscitat* or (((cardiac or heart) adj2 (massage or compression)) or "chest compression*" or CPR or "cardiac life support" or "advanced life support" or BLS)).tw,kf.
3	Heart Arrest/ or "Death, Sudden, Cardiac"/ or sudden cardiac death/
4	(((cardiac or heart or cardiopulmonary or cardio-pulmonary) adj2 (arrest or arrests)) or "sudden cardiac death" or "sudden heart death" or asystole* or asystolic).tw,kf.
5	"Anesthesia, General"/ae or "Anesthesia, Local"/ae or "Anesthetics, Local"/ae or "Anesthetics, General"/ae or anesthetic agent/ae, to, tm or local anesthetic agent/ae, to or general anesthesia/ae, to or local anesthesia/ae, to
6	((anesthesia or anaesthesia or anesthetics or anaesthetics) adj2 (adverse or complication* or "side effect*" or safety or risk or risks or harm*)).tw,kf.
7	or/1-6 [RESUSCITATION]
8	Checklist/ or Algorithms/ or algorithm/ or learning algorithm/ or Reminder Systems/ or reminder system/
9	(check list* or checklist* or mnemonic* or algorithm* or (prompt or prompts) or cognitive aid* or reminder*).tw,kf.
10	("aide memoire" or "aide memoires").mp.
11	Decision Support Techniques/ or decision support system/ or clinical decision support system/ or Decision Trees/ or decision tree/
12	(decision adj3 (support or tree* or aid*)).tw,kf.
13	Medical Errors/pc or medical error/pc or surgical error/ or "near miss (health care)"/
14	(error* adj4 (prevent* or manag* or decreas*)).tw,kf.
15	or/8-14 [COGNITIVE AIDS]
16	7 and 15 [RESUSCITATION + COGNITIVE AIDS]
17	(Animals/ or "Animal Experimentation"/ or "Models, Animal"/ or "Disease Models, Animal"/) not (Humans/ or "Human Experimentation"/)
18	(exp "animal model"/ or exp "animal experiment"/ or "nonhuman"/ or exp "vertebrate"/) not (exp "human"/ or exp "human experiment"/)
19	16 not (17 or 18) [ANIMAL STUDIES REMOVED]
20	(comment or editorial or "newspaper article" or news or note or lecture).pt.
21	(letter not (letter and randomized controlled trial)).pt.
22	19 not (20 or 21) [OPINION PIECES REMOVED]
23	(conference or conference abstract or "conference review" or congresses).pt.

24	22 not 23 [CONFERENCES REMOVED]
25	"case reports".pt.
26	24 not 25 [CASE REPORTS REMOVED]
27	limit 26 to english language
28	(systematic review or meta-analysis).pt.
29	meta-analysis/ or systematic review/ or systematic reviews as topic/ or meta-analysis as topic/ or "meta analysis (topic)"/ or "systematic review (topic)"/ or exp technology assessment, biomedical/ or network meta-analysis/
30	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab,kf.
31	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab,kf.
32	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab,kf.
33	(data synthes* or data extraction* or data abstraction*).ti,ab,kf.
34	(handsearch* or hand search*).ti,ab,kf.
35	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab,kf.
36	(met analy* or metanaly* or technology assessment* or HTA or HTAs or technology overview* or technology appraisal*).ti,ab,kf.
37	(meta regression* or metaregression*).ti,ab,kf.
38	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.
39	(medline or cochrane or pubmed or medlars or embase or cinahl).ti,ab,hw.
40	(cochrane or (health adj2 technology assessment) or evidence report).jw.
41	(comparative adj3 (efficacy or effectiveness)).ti,ab,kf.
42	(outcomes research or relative effectiveness).ti,ab,kf.
43	((indirect or indirect treatment or mixed-treatment or bayesian) adj3 comparison*).ti,ab,kf.
44	(multi* adj3 treatment adj3 comparison*).ti,ab,kf.
45	(mixed adj3 treatment adj3 (meta-analy* or metaanaly*)).ti,ab,kf.
46	umbrella review*.ti,ab,kf.
47	(multi* adj2 paramet* adj2 evidence adj2 synthesis).ti,ab,kf.
48	(multiparamet* adj2 evidence adj2 synthesis).ti,ab,kf.
49	(multi-paramet* adj2 evidence adj2 synthesis).ti,ab,kf.
50	or/28-49 [MA-SR-HTA]
51	(Randomized Controlled Trial or Controlled Clinical Trial or Pragmatic Clinical Trial or Clinical Study or Adaptive Clinical Trial or Equivalence Trial).pt.
52	(Clinical Trial or Clinical Trial, Phase I or Clinical Trial, Phase II or Clinical Trial, Phase III or Clinical Trial, Phase IV or Clinical Trial Protocol).pt.
53	Multicenter Study.pt.
54	Clinical Studies as Topic/
55	exp Clinical Trial/ or exp Clinical Trials as Topic/ or Clinical Trial Protocol/ or Clinical Trial Protocols as Topic/ or exp "Clinical Trial (topic)"/
56	Multicenter Study/ or Multicenter Studies as Topic/ or "Multicenter Study (topic)"/
57	Randomization/
58	Random Allocation/
59	Double-Blind Method/
60	Double Blind Procedure/
61	Double-Blind Studies/
62	Single-Blind Method/

63	Single Blind Procedure/
64	Single-Blind Studies/
65	Placebos/
66	Placebo/
67	Control Groups/
68	Control Group/
69	Cross-Over Studies/ or Crossover Procedure/
70	(random* or sham or placebo*).ti,ab,hw,kf.
71	((singl* or doubl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kf.
72	((tripl* or trebl*) adj (blind* or dumm* or mask*)).ti,ab,hw,kf.
73	(control* adj3 (study or studies or trial* or group*)).ti,ab,hw,kf.
74	(clinical adj3 (study or studies or trial*)).ti,ab,hw,kf.
75	(nonrandom* or non random* or non-random* or quasi-random* or quasirandom*).ti,ab,kf,kw.
76	(phase adj3 (study or studies or trial*)).ti,ab,hw,kf.
77	((crossover or cross-over) adj3 (study or studies or trial*)).ti,ab,hw,kf.
78	((multicent* or multi-cent*) adj3 (study or studies or trial*)).ti,ab,hw,kf.
79	allocated.ti,ab,hw,kf.
80	((open label or open-label) adj5 (study or studies or trial*)).ti,ab,hw,kf.
81	((equivalence or superiority or non-inferiority or noninferiority) adj3 (study or studies or trial*)).ti,ab,hw,kf.
82	(pragmatic study or pragmatic studies).ti,ab,hw,kf.
83	((pragmatic or practical) adj3 trial*).ti,ab,hw,kf.
84	((quasiexperimental or quasi-experimental) adj3 (study or studies or trial*)).ti,ab,hw,kf.
85	trial.ti,kf.
86	or/51-85 [ALL CLINICAL TRIALS]
87	interrupted time series analysis/
88	controlled before-after studies/
89	cohort studies/ or cohort analysis/
90	("interrupted time series" or "controlled before-after" or "controlled before and after" or cohort*).ti,ab,kf.
91	or/87-90 [ADDITIONAL STUDIES]
92	27 and (50 or 86 or 91) [RESUSCITATION + COGNITIVE AIDS, English, Study Types] Embase <1974 to 2022 August 12> Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations and Daily <1946 to August 12, 2022>
93	remove duplicates from 92 Embase <1974 to 2022 August 12> Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations and Daily <1946 to August 12, 2022>

Cochrane Library via Wiley Online

#1	(resuscitat* OR (((cardiac OR heart) NEAR/2 (massage OR compression)) OR (chest NEXT compression*) OR CPR OR "cardiac life support" OR "advanced life support" OR BLS)):ti,ab,kw
#2	(((cardiac OR heart OR cardiopulmonary OR cardio-pulmonary) NEAR/2 (arrest OR arrests)) OR "sudden cardiac death" OR "sudden heart death" OR asystole* OR asystolic):ti,ab,kw
#3	((anesthesia OR anaesthesia OR anesthetics OR anaesthetics) NEAR/2 (adverse OR complication* OR (side NEXT effect*) OR safety OR risk OR risks OR harm*)):ti,ab,kw
#4	#1 OR #2 OR #3
#5	((check NEXT list*) OR checklist* OR mnemonic* OR algorithm* OR (prompt OR prompts) OR (cognitive NEXT aid*) OR reminder*):ti,ab,kw

#6	("aide memoire" OR "aide memoires"):ti,ab,kw
#7	(decision NEAR/3 (support OR tree* OR aid*)):ti,ab,kw
#8	(error* NEAR/4 (prevent* OR manag* OR decreas*)):ti,ab,kw
#9	#5 OR #6 OR #7 OR #8
#10	#4 AND #9
#11	([mh ^Animals] OR [mh ^"Animal Experimentation"] OR [mh ^"Models, Animal"] OR [mh ^"Disease Models, Animal"]) not ([mh ^Humans] OR [mh ^"Human Experimentation"])
#12	#10 NOT #11
#13	(comment OR editorial OR "newspaper article" OR news OR note OR lecture):pt
#14	(letter NOT (letter AND randomized controlled trial)):pt
#15	#12 NOT (#13 OR #14)
#16	"case reports":pt
#17	#15 NOT #16
#18	(conference OR "conference abstract" OR "conference review" OR congresses):pt
#19	#17 NOT #18
#20	#17 NOT #18 in Cochrane Reviews, Trials CDSR: 7, CCRCT (Trials): 803 (287 non-PubMed/non-Embase)

Database searched: Medline, Cochrane
Time Frame: (existing PICOST) – since 1 January 2024
Date Search Completed: 10 October 2024
Search Results (Number of articles identified and number identified as relevant):

                    550 articles identified
                    263 duplicates
                    287 articles sceened
                    24 full-texts screened
                    3 identified as relevant

Summary of Evidence Update:

We identified 3 simulation studies. One randomized trial (Senter-Zapata, 2024[2]) studied the use of a mobile app compared to pocket cards during simulated adult cardiac arrest. It demonstrated improved adherence to the treatment pathway and increased code leader confidence. One randomized trial (Spencer, 2024[3]) studied the use of checklists during simulated paediatric acute events secondary to unstable dysrhythmias. It demonstrated improved team adherence to the process of care. One observational study (Nelin, 2024[1]) studied using an automated resuscitation recorder app during simulated neonatal resuscitation and demonstrated the feasibility of using application-based technology.

Relevant Guidelines or Systematic Reviews 1

Organization (if relevant); Author; Year Published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
Nabecker, 2024	Systematic review	Cognitive aids used in simulated resuscitation	n=29	Benefit to adherence to process for health care professionals managing neonatal, paediatric and adult resuscitation. Delays in initiating CPR for lay providers	We suggest that healthcare professionals should use cognitive aids during adult, paediatric and neonatal resuscitations as well as during management of other emergencies related to resuscitation. However, because of potential adverse effects (delay in starting chest compressions)

					lay providers should not use cognitive aids when initiating cardiopulmonary resuscitation.

RCT: 2

Study Acronym; Author; Year Published	Aim of Study; Study Type; Study Size (n)	Population	Study Intervention/ Study Comparator	Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)	Relevant 2° Endpoint (if any); Study Limitations; Adverse Events
Senter-Zapata, 2024[3]	**Study Aim:** to assess the efficacy of mobile app in improving subjective code leader experience and objective performance according to ACLS guidelines during simulated cardiac arrest **Study Type:** Randomised simulation study. n=46 resident physicians randomised to use of pocket cards or a guided ACLS mobile app	Resident doctors from internal and emergency medicine, general surgery and anaesthesia	**Intervention:** guided app (n= 24) **Comparator:** AHA pockets cards (n=22)	**1° endpoint:** return of spontaneous circulation (ROSC), achieved after correct administration of tPA achieved by 4 (18.2%) of pocket card users compared with 12 (50%) of app users (p=0.024) with an effect size of 0.67	**2° endpoint:** Intervention increased code leader confidence **Study Limitations:** Small group size, variable participant experience levels, reviewers unblinded
Spencer, 2024[4]	**Study Aim:** Evaluate if critical event checklists improve adherence to process during simulated acute events secondary to unstable dysrhythmias. **Study Type:** Randomised simulation study n=86 participants in 6 teams completed 24 simulations	Paediatric and anesthesia residents, registered nurses, and respiratory therapists in a cardiac ward in a tertiary care, academic children's hospital.	**Intervention:** checklists (n= 3 teams) **Comparison:** No checklists (n=3 teams)	**1° endpoint:** Team adherence to processes of care, expressed as the percentage of the total 12 completed critical steps. non-checklist group (n = 12) had a mean critical management step completion rate of 68.06% (59.38%, 76.74%), checklist group (n = 11) had a mean completion rate of 81.21% (78.96%, 83.47%) (p = 0.004)	**Study Limitations:** Simulation study with limited sample size restricted our ability to conduct a more comprehensive analysis. Clinically inexperienced participants. No team level data. No prior validity testing of checklist. Single investigator participated as embedded actor and reviewer.

Nonrandomized Trials, Observational Studies 1

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

Nelin, 2024[2]	Study Type: simulation-based feasibility study (n=50 participants, 10 mock neonatal resuscitation codes) using an automated resuscitation recorder app	Neonatal nurse practitioners, paediatric residents, respiratory therapists and NICU nurses	1° endpoint: Team performance assessed via standardized grading tool scoring algorithm adherence, median was 68% (range 60–76%). Documentation accuracy and completeness, median was 77.5% (range 55–90%). Provider comfort with the app, 47% chose "agree" (237/500) and 36% chose "strongly agree" (180/500), with only 0.6% (3/500) answering "strongly disagree"	Demonstrates the feasibility of using application-based technology during neonatal resuscitation, and of the long-term goal of minimizing the effect of human factors on algorithm adherence and code documentation

Reviewer Comments: The three new studies identified are consistent in supporting previous findings, however, they do not substantially change the weight of evidence. A further systematic review or scoping review is not currently warranted.

Reference list:

1. Nabecker S, Nation K, Gilfoyle E, Abelairas-Gomez C, Koota E, Lin YQ, et al. Cognitive aids used in simulated resuscitation: A systematic review. RESUSCITATION PLUS. 2024;19.
2. Nelin S, Karam S, Foglia E, Turk P, Peddireddy V, Desai J. Does the Use of an Automated Resuscitation Recorder Improve Adherence to NRP Algorithms and Code Documentation? Children. 2024;11(9):1137.
3. Senter-Zapata M, Neel DV, Colocci I, Alblooshi A, AlRadini FAM, Quach B, et al. An Advanced Cardiac Life Support Application Improves Performance during Simulated Cardiac Arrest. Appl Clin Inform. 2024;15(04):798-807.
4. Spencer R, Sen AI, Kessler DO, Salabay K, Compagnone T, Zhang Y, et al. Critical Event Checklists for Simulated In-Hospital Dysrhythmias in Children with Heart Disease. Pediatric Cardiology. 2024.

2025 Evidence Update
EIT 6401 – Provider Workload and Stress During Resuscitation

Worksheet Author(s): Chih-Wei Yang, Cheng-Heng Liu, Andrew Lockey, Robert Greif, Adam Cheng
Task Force: Education, Implementation, and Teams
Conflicts of Interest: none

PICOST / Research Question:
Population: Healthcare providers performing resuscitation on patients in cardiac arrest in clinical or on manikins in a simulated setting
Exposure: Presence of any factors that would possibly impact the healthcare provider's perceived workload or stress
Comparison: Absence of the specific factor
Outcomes: Objective or subjective measures of workload and/or stress experienced by healthcare providers during resuscitations.
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies), unpublished studies (e.g., conference abstracts, trial protocols), letters, editorials, comments, case reports, grey literature and social media are eligible for inclusion. All relevant publications in any language are included as long as there is an English abstract.

Timeframe: **:** 2024 Feb. 2 (last search date) to 2024 Oct. 2, and all languages are included as long as there is an English abstract
Literature search updated to 2024 Feb. 1.

Year of last full review: 2024

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST: This was a scoping review which does not issue a recommendation, but the Task Force insight summery was: A goal-directed approach or use of task-focusing questions during resuscitations can reduce perceived workload or stress for the team. External support from cognitive aids reduced stress and workload, but workload was sometimes higher with first use. Therefore, introducing new equipment could potentially impose an additional cognitive burden if the users are not adequately familiarized with it. The factors identified in this review (team composition and roles, workflows, tools, telemedicine, cognitive aids, smart apps, and socioemotional stress) represent potential modifiable elements.

Current Search Strategy (for an existing PICOST)

> 1. **Searching: APA PsycInfo**

((resuscitation OR "basic cardiac life support" OR "basic life support" OR "code blue" OR "advanced cardiac life support" OR ACLS OR CPR OR "cardiac arrest" OR "heart arrest" OR "return of circulation" OR "return of spontaneous circulation" OR ROSC OR "chest compression") OR ("emergency care" OR "emergency health service" OR "emergency medical service" OR emergicenter OR "medical emergency service" OR "prehospital emergency care")) AND ((workload OR "work load" OR "psychological impact" OR "psychological load" OR "psychological outcome" OR "psychological skill" OR "cognitive process" OR "cognitive error" OR "reasoning error" OR heuristic OR "decision fatigue" OR "problem solving" OR intuition OR distraction OR "high stakes") OR (stress* NEAR/3 (trainee OR "medical team" OR "medical staff" OR "hospital staff" OR "patient care team" OR "resuscitation team" OR "resuscitation staff" OR "code team" OR "code blue team" OR "health care professional" OR "health professional" OR "health care provider" OR "health provider" OR "health personnel" OR "health care worker" OR "health worker" OR physician OR doctor OR nurse OR occupational OR job OR work)))
Limiters - Publication Date: 20240201-20241031
Expanders - Apply equivalent subjects
Search modes - Proximity

> 2. **Searching: MEDLINE**

(("Resuscitation"[MeSH] OR "Basic Cardiac Life Support"[MeSH] OR "Advanced Cardiac Life Support"[MeSH] OR "Heart Arrest"[MeSH] OR "Cardiopulmonary Resuscitation"[MeSH] OR "Chest Compressions"[MeSH] OR ACLS OR CPR OR cardi* arrest* OR heart arrest* OR "return of circulation" OR "return of spontaneous circulation" OR ROSC OR chest compression*) OR ("Emergency Medical Services"[MeSH] OR "Emergency Medical Service, Hospital"[MeSH] OR "Emergency Health Services"[MeSH] OR emergicenter OR "Prehospital Emergency Care"[MeSH] OR "Medical Emergency Services" OR "Emergency Care"[MeSH])) AND ("Workload"[MeSH] OR "Occupational Stress"[MeSH] OR "Stress, Psychological"[MeSH] OR "Job Satisfaction"[MeSH] OR "Mental Fatigue"[MeSH] OR "Decision Making"[MeSH] OR "Cognition"[MeSH] OR "Cognitive Errors"[MeSH] OR "Problem Solving"[MeSH] OR "Burnout, Professional"[MeSH] OR "Fatigue" OR "decision fatigue" OR problem solving OR intuit* OR distraction* OR "high stakes") OR (stress* ADJ3 (trainee* OR "Medical Staff, Hospital"[MeSH] OR "Patient Care Team"[MeSH] OR "Resuscitation Team"[MeSH] OR "Health Personnel"[MeSH] OR "Healthcare Provider"[MeSH] OR physician* OR doctor* OR nurse* OR "Occupational Groups"[MeSH] OR "Health Personnel"[MeSH] OR "Health Occupations"[MeSH] OR occupational OR job OR work)))
Limiters - Publication Date: 20240201-20241031
Expanders - Apply equivalent subjects
Search modes - Proximity

> 3. **Searching: EMBASE**

((resuscitation:ti,ab,kw OR 'basic cardiac life support':ti,ab,kw OR 'basic life support':ti,ab,kw OR 'code blue':ti,ab,kw OR 'advanced cardiac life support':ti,ab,kw OR acls:ti,ab,kw OR cpr:ti,ab,kw OR 'cardiac arrest':ti,ab,kw OR 'heart arrest':ti,ab,kw OR 'return of circulation':ti,ab,kw OR 'return of spontaneous circulation':ti,ab,kw OR rosc:ti,ab,kw OR 'chest compression':ti,ab,kw OR 'emergency care':ti,ab,kw OR 'emergency health service':ti,ab,kw OR 'emergency medical service':ti,ab,kw OR emergicenter:ti,ab,kw OR 'medical emergency service':ti,ab,kw OR 'prehospital emergency care':ti,ab,kw) AND (workload:ti,ab,kw OR 'work load':ti,ab,kw OR 'psychological impact':ti,ab,kw OR 'psychological load':ti,ab,kw OR 'psychological outcome':ti,ab,kw OR 'psychological skill':ti,ab,kw OR 'cognitive process':ti,ab,kw OR 'cognitive error':ti,ab,kw OR 'reasoning error':ti,ab,kw OR heuristic:ti,ab,kw OR 'decision fatigue':ti,ab,kw OR 'problem solving':ti,ab,kw OR intuition:ti,ab,kw OR distraction:ti,ab,kw OR 'high stake':ti,ab,kw) OR (stress*:ti,ab,kw AND (trainee:ti,ab,kw OR 'medical team':ti,ab,kw OR 'medical staff':ti,ab,kw OR 'hospital staff':ti,ab,kw OR 'patient care team':ti,ab,kw OR 'resuscitation team':ti,ab,kw OR 'resuscitation staff':ti,ab,kw OR 'code team':ti,ab,kw OR 'code blue

team':ti,ab,kw OR 'health care professional':ti,ab,kw OR 'health professional':ti,ab,kw OR 'health care provider':ti,ab,kw OR 'health provider':ti,ab,kw OR 'health personnel':ti,ab,kw OR 'health care worker':ti,ab,kw OR 'health worker':ti,ab,kw OR physician:ti,ab,kw OR doctor:ti,ab,kw OR nurse:ti,ab,kw OR occupational:ti,ab,kw OR job:ti,ab,kw OR work:ti,ab,kw))) AND [02-02-2024]/sd NOT [28-10-2024]/sd

      4.   **Searching: Cochrane**

(resuscitation OR "basic cardiac life support" OR "basic life support" OR "code blue" OR "advanced cardiac life support" OR ACLS OR CPR OR "cardiac arrest" OR "heart arrest" OR "return of circulation" OR "return of spontaneous circulation" OR ROSC OR "chest compression")
OR
("emergency care" OR "emergency health service" OR "emergency medical service" OR emergicenter OR "medical emergency service" OR "prehospital emergency care")
AND
("workload" OR "work load" OR "psychological impact" OR "psychological load" OR "psychological outcome" OR "psychological skill" OR "cognitive process" OR "cognitive error" OR "reasoning error" OR heuristic OR "decision fatigue" OR "problem solving" OR intuition OR distraction OR "high stakes")
OR
(stress NEAR/3 (trainee OR "medical team" OR "medical staff" OR "hospital staff" OR "patient care team" OR "resuscitation team" OR "resuscitation staff" OR "code team" OR "code blue team" OR "health care professional" OR "health professional" OR "health care provider" OR "health provider" OR "health personnel" OR "health care worker" OR "health worker" OR physician OR doctor OR nurse OR occupational OR job OR work))
with Publication Year from 2024 to 2024, with Cochrane Library publication date from Feb 2024 to Oct 2024, in Trials

      5.   **Searching: CINAHL**

((TI (resuscitation OR "basic cardiac life support" OR "basic life support" OR "code blue" OR "advanced cardiac life support" OR ACLS OR CPR OR "cardiac arrest" OR "heart arrest" OR "return of circulation" OR "return of spontaneous circulation" OR ROSC OR "chest compression") OR AB (resuscitation OR "basic cardiac life support" OR "basic life support" OR "code blue" OR "advanced cardiac life support" OR ACLS OR CPR OR "cardiac arrest" OR "heart arrest" OR "return of circulation" OR "return of spontaneous circulation" OR ROSC OR "chest compression"))) OR ((TI ("emergency care" OR "emergency health service" OR "emergency medical service" OR emergicenter OR "medical emergency service" OR "prehospital emergency care") OR AB ("emergency care" OR "emergency health service" OR "emergency medical service" OR emergicenter OR "medical emergency service" OR "prehospital emergency care"))) AND ((TI (workload OR "work load" OR "psychological impact" OR "psychological load" OR "psychological outcome" OR "psychological skill" OR "cognitive process" OR "cognitive error" OR "reasoning error" OR heuristic OR "decision fatigue" OR "problem solving" OR intuition OR distraction OR "high stake") OR AB (workload OR "work load" OR "psychological impact" OR "psychological load" OR "psychological outcome" OR "psychological skill" OR "cognitive process" OR "cognitive error" OR "reasoning error" OR heuristic OR "decision fatigue" OR "problem solving" OR intuition OR distraction OR "high stake"))) OR (stress* N3 (trainee OR "medical team" OR "medical staff" OR "hospital staff" OR "patient care team" OR "resuscitation team" OR "resuscitation staff" OR "code team" OR "code blue team" OR "health care professional" OR "health professional" OR "health care provider" OR "health provider" OR "health personnel" OR "health care worker" OR "health worker" OR physician OR doctor OR nurse OR occupational OR job OR work)))
Limiters - Publication Date: 20240201-20241031
Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects
Search modes - Find all my search terms

Database searched: APA PsycInfo, Medline, Embase, Cochrane, CINAHL
Time Frame: 2024 Feb. 2 to 2024 Oct. 28
Date Search Completed: 2024 October 28

Search Results: 2
Summary of Evidence Update:
The two new studies investigated the effect of team leadership structure and resuscitation technique on resuscitation team workload/stress. One study examined visual attention patterns and workload differences between teams with and without dedicated team leaders during neonatal resuscitation using eye-tracking technology, finding no significant difference in visual attention but higher physical demands without dedicated leaders. The other investigated human factors comparing a new chest compression technique, chest compressions with sustained inflation(CC+SI) versus standard CPR, demonstrating equivalent workload scores but improved communication and role-switching capabilities with the new technique.

Overall, regarding these two factors, the new evidence extends previous findings in several ways:

1. Team Leadership: Provides objective measurement data (through eye-tracking) to complement subjective assessments of team leader impact, while reinforcing the importance of dedicated leadership roles for managing physical workload.
2. Resuscitation Technique: Demonstrates that novel approaches can maintain equivalent workload while potentially improving team dynamics, challenging assumptions that familiar techniques are always optimal.

The seven major categories of influencing factors (Team Composition/Roles, Telemedicine, Workflow, Tools/Devices, Cognitive Aids, Family Presence, Provider Experience) remain valid as a comprehensive framework, with these studies particularly strengthening our understanding of the Team Composition/Roles and Workflow categories through quantitative measurement approaches.

Relevant Guidelines or Systematic Reviews: none
RCT: 2

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
Chelsea M.D. Morin et al. 2024[1]	To assess the human factors (physical, cognitive, team-based) involved in chest compression with sustained inflation (CC + SI) vs. standard CPR techniques (3:1 C:V or CCaV) during neonatal and pediatric resuscitation; RCT	Licensed NICU staff with NRP or PALS certification and physical ability for CPR	Chest compression with sustained inflation (CC + SI) 20 two-person teams Standard CPR techniques (3:1 C:V or CCaV) 20 two-person teams	No significant difference in workload (NASA-TLX) or team performance (OGRS); CC + SI found to be simpler, better for transitions and communication than standard CPR	potential lack of realism due to two-person team in simulation, absence of washout period between simulations
Prakash Kannan Loganathan et al., 2024[2]	To compare visual attention of a team member acting as both team leader and airway manager vs. a dedicated team leader with an airway manager.	Neonatal healthcare providers with NLS certification and at least 6 months NICU experience	Airway management without dedicated leader; Airway management with dedicated leader	Physical demand was reported as significantly higher by participants in the group without a team leader(5 (2.5–9) v.s 10 (5–12), p= 0.039)	Limited sample size

CCaV = Chest Compressions and Ventilation, CC + SI = Chest Compression with Sustained Inflation, C:V = Compression to Ventilation ratio, NASA-TLX = NASA Task Load Index, NICU = Neonatal Intensive Care Unit, NLS = Newborn Life Support, NRP = Neonatal Resuscitation Program, OGRS = Objective Global Rating Scale, PALS = Pediatric Advanced Life Support, RCT = Randomized Controlled Trial

Reviewer Comments: Insufficient new evidence to trigger a new systematic review.

Reference list:

1. Morin CMD, Law BHY, Duff JP, Schmölzer GM. Assessing the human factors involved in chest compression with superimposed sustained inflation during neonatal and paediatric resuscitation: A randomized crossover study. Resusc Plus. 2024;19:100721. doi:10.1016/j.resplu.2024.100721.
2. Kannan Loganathan P, Garg A, McNicol R, Wall C, Pointon M, McMeekin P, Godfrey A, Wagner M, Roehr CC. Assessment of Visual Attention in Teams with or without Dedicated Team Leaders: A Neonatal Simulation-Based Pilot Randomised Cross-Over Trial Utilising Low-Cost Eye-Tracking Technology. Children. 2024;11:1023. doi:10.3390/children11081023.

2025 Evidence Update
EIT 6402 – Stepwise Approach to Skills Training in Resuscitation

Worksheet Author(s): Jan Breckwoldt, Sabine Nabecker
Task Force: Education, Implementation, and Teams
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults and children undertaking skills training related to resuscitation and First Aid in any educational setting.
Intervention: Approaches to skills teaching that are not the 'Peyton four-steps' approach. This includes: approaches without distinct stages: or modified 'Peyton four-steps' approaches with more or less than four steps; or with delivering one or more steps by alternative methods (e.g. video).
Comparator: The 'Peyton four-steps' approach (Walker 1998 171) for skills teaching.
Outcomes: Improved educational outcomes: Skill performance after end of course (CRITICAL); skill performance at end of course (IMPORTANT); participants' confidence to perform the skill on patients (IMPORTANT); participants' preference of teaching method (IMPORTANT).
Patient outcomes: Skills performed appropriately on real patient after the course (CRITICAL).
Additional outcomes: Teachers' preference of teaching method; side effects of teaching (IMPORTANT)
Study Designs: Included studies: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies, published conference abstracts, and case series where n ≥ 5) Excluded studies: unpublished results (e.g., trial protocols), commentary, editorial, reviews.

Timeframe: from 01 January 2022 to 20 November 2024, Publications all languages as long as there is an English abstract.

Year of last full review: 2022
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest that stepwise training should be the method of choice for skills training in resuscitation (weak recommendation, very low certainty of evidence).

Current Search Strategy
Cochrane Database
ID   Search   Hits
#1   (resuscitat* OR 'mouth-to-mouth' OR ventilation* OR 'intubat* OR 'chest compression*' OR defibrillat* OR cpr OR 'first aid' OR 'first response*' OR 'first responder*' OR 'rescue personnel' OR 'basic life support' OR 'advanced life support'):ti 23545
#2   peyton*:ti,ab,kw OR halsted*:ti,ab,kw   96
#3   ((4 NEXT step$):ti,ab,kw OR (4 NEXT stage$):ti,ab,kw OR (2 NEXT step$):ti,ab,kw OR (2 NEXT stage$):ti,ab,kw OR (four NEXT step$):ti,ab,kw OR (four NEXT stage$):ti,ab,kw OR (two NEXT step$):ti,ab,kw OR (two NEXT stage$):ti,ab,kw) NOT (for NEXT stage):ti,ab,kw   6474
#4   ((teaching OR training OR instruct*) AND (technique$ OR method* OR approach*)):ti,kw 23843
#5   #1 and (#2 OR #3 OR #4)   592
#6   MeSH descriptor: [Teaching] this term only   2236
#7   #1 AND #6   120
#8   #5 OR #7   608
#9   #1 and (#2 OR #3 OR #4) with Publication Year from 2022 to present, in Trials   78
#10   #1 AND #6 with Publication Year from 2022 to present, in Trials   2
#11   #9 OR #10   80

ERIC

Ovid®   Support & Training   Feedback   Close

Database(s): ERIC 1965 to October 2024
Search Strategy:

#	Searches	Results
1	(resuscitat$ or 'mouth-to-mouth' or ventilation$1 or 'chest compression$1' or defibrillat$ or intubat$ or cpr or 'first aid' or 'first response$1' or 'first responder$1' or 'rescue personnel' or 'basic life support' or 'advanced life support').ti,ab,id,hw.	2554
2	first aid/	748
3	1 or 2	2554
4	(peyton$ or halsted$ or 4-step$' or '4-stage$' or '2-step$' or '2-stage$' or 'four-step$' or 'four-stage$' or 'two-step$' or 'two-stage$').ti,ab,id,hw.	6101
5	3 and 4	10
6	((teaching or training or instruct*) adj2 (technique$ or method* or approach*)).ti,ab,id,hw.	265053
7	3 and 6	295
8	5 or 7	302
9	(resuscitat$ or 'mouth-to-mouth' or ventilation$1 or 'chest compression$1' or defibrillat$ or intubat$ or cpr or 'first aid' or 'first response$1' or 'first responder$1' or 'rescue personnel' or 'basic life support' or 'advanced life support').ti.	324
10	medical education/ or nursing education/ or health education/ or education/ or educational programs/ or teaching/ or educational audiovisual aids/ or instructional media/ or audiovisual instruction/ or videotape instruction/ or educational audiovisual aids/ or teaching/ or teaching methods/ or group instruction/ or training/ or (educat$ or train$ or teach$ or instruct$ or learn$).ti.	846776
11	(technique$ or method$ or approach* or video* or 'audio visual$' or audiovisual$).ti. or ('4-step$' or '4-stage$' or '2-step$' or '2-stage$' or 'four-step$' or 'four-stage$' or 'two-step$' or 'two-stage$').ti,ab,id,hw.	92301
12	9 and 10 and 11	18
13	8 or 12	309
14	limit 13 to yr="2022 -Current"	16

Cinahl

#	Query	Limiters/Expanders	Last Run Via	Results

S15	S9 OR S12 OR S13	Limiters - Publication Date: 20221101- Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	134
S14	S9 OR S12 OR S13	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	1,447
S13	S10 and ((MH "Teaching Methods") OR (MH "Teaching Methods, Clinical"))	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	318
S12	S11 and ((MH "Education, Emergency Medical Services") OR (MH "Education, Nursing") OR (MH "Education, Health Sciences") OR (MH "Education, Allied Health") OR (MH "Education") OR (MH "Education, Clinical") or (MH "Teaching Methods") OR (MH "Teaching Methods, Clinical"))	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	88
S11	S10 and TI (technique* or method* or approach* or video* or 'audio visual*' or audiovisual* or '4-step*' or '4-stage*' or '2-step*' or '2-stage*' or 'four-step*' or 'four-stage*' or 'two-step*' or 'two-stage*')	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	2,589
S10	S1 AND (PT Journal Article)	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	51,833
S9	S6 OR S7 OR S8	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	1,142
S8	S5 and (TI ((teaching or training or instruct*) N2 (technique* or method* or approach*)))	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	138
S7	S5 and (TI ('4-step*' or '4-stage*' or '2-step*' or '2-stage*' or 'four-step*' or 'four-stage*' or 'two-step*' or 'two-stage*') OR AB ('4-step*' or '4-stage*' or '2-step*' or '2-stage*' or 'four-step*' or 'four-stage*' or 'two-step*' or 'two-stage*') OR SU ('4-step*' or '4- stage*' or '2-step*' or '2- stage*' or 'four-step*' or 'four-stage*'	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	931

	or 'two-step*' or 'two-stage*'))			
S6	S5 and (TI (peyton* or halsted*) OR AB (peyton* or halsted*) OR SU (peyton* or halsted*)	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	79
S5	(S1 or S2 or S3 or S4) AND (PT Journal Article)	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	232,368
S4	(MH "Resuscitation") OR (MH "Heart Massage") OR (MH "Resuscitation, Cardiopulmonary+") OR (MH "First Aid") OR (MH "Respiration, Artificial") OR (MH "Ventilation, Mechanical, Differentiated") OR (MH "Intubation+") OR (MH "Intubation, Intratracheal+") OR (MH "Defibrillation") OR (MH "Emergency Treatment") OR (MH "Emergency Medical Services")	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	98,091
S3	SU (resuscitat* or 'mouth-to-mouth' or ventilation* or 'chest compression*' or defibrillat* or intubat* or cpr or 'first aid' or 'first response*' or 'first responder*' or 'rescue personnel' or 'basic life support' or 'advanced life support')	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	72,976
S2	AB (resuscitat* or 'mouth-to-mouth' or ventilation* or 'chest compression*' or defibrillat* or intubat* or cpr or 'first aid' or 'first response*' or 'first responder*' or 'rescue personnel' or 'basic life support' or 'advanced life support')	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	142,590
S1	TI (resuscitat* or 'mouth- to-mouth' or ventilation* or 'chest compression*' or defibrillat* or intubat* or cpr or 'first aid' or 'first response*' or 'first responder*' or 'rescue personnel' or 'basic life support' or 'advanced life support')	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL with Full Text	51,989

Embase

No.	Query	Results
#20	#18 OR #19	209
#19	#16 AND [20-11-2022]/sd	178
#18	#10 AND [20-11-2022]/sd	41
#17	#16 NOT #10	1017
#16	#13 AND #14 AND #15	1100
#15	technique$:ti OR method$:ti OR approach*:ti OR video*:ti OR 'audio visual$':ti OR audiovisual$:ti OR '4- step$':ti,ab,kw OR '4-stage$':ti,ab,kw OR '2-step$':ti,ab,kw OR '2-stage$':ti,ab,kw OR 'four-step$':ti,ab,kw OR 'four-stage$':ti,ab,kw OR 'two-step$':ti,ab,kw OR 'two-stage$':ti,ab,kw	1612503
#14	'education'/ de OR 'medical education'/de OR 'education program'/de OR 'educational model'/de OR 'educational technology'/de OR 'educational theory'/de OR 'clinical education'/de OR 'outcome of education'/de OR 'nursing education'/de OR 'paramedical education'/de OR 'allied health education'/de OR 'emergency medical services education'/de OR 'school'/de OR 'simulation training'/exp OR 'teacher training'/de OR 'teaching'/exp OR 'learning'/de OR 'learning theory'/de OR 'learning style'/de OR 'sequence learning'/de OR 'e-learning'/de OR 'self-directed learning'/de OR educat*:ti OR train*:ti OR teach*:ti OR instruct*:ti OR learn*:ti	1664958
	#12 NOT ([animals]/lim NOT [humans]/lim)	
#13	#11 NOT ([conference review]/lim OR [editorial]/lim OR [erratum]/lim OR [letter]/lim OR [note]/lim OR [book]/lim OR 'case report'/de)	190376
#12	(((cardiopulmonary OR 'cardio-pulmonary') NEXT/1 reanimation):ti) OR resuscitat*:ti OR 'mouth-to-mouth':ti OR ventilation$:ti OR 'intubat*':ti,ab,kw,de OR 'chest compression$':ti OR defibrillat*:ti OR cpr:ti OR 'first aid':ti OR 'first response$':ti OR 'first responder$':ti OR 'rescue personnel':ti OR 'basic life support':ti OR 'advanced life support':ti	212164
#11	#7 OR #9	298536
#10	#5 AND #8	281
#9	((teaching OR training OR instruct*) NEAR/1 (technique$ OR method* OR approach*)):ti,kw	154
#8		5132
#7	#5 AND #6	139
#6	peyton*:ti,ab,kw,de OR halsted*:ti,ab,kw,de OR '4-step$':ti,kw OR '4-stage$':ti,kw OR '2-step$':ti,kw OR '2-stage$':ti,kw OR 'four-step$':ti,kw OR 'four-stage$':ti,kw OR 'two-step$':ti,kw OR 'two-stage$':ti,kw	21754
#5	#4 NOT ([animals]/lim NOT [humans]/lim)	576347
#4	#3 NOT ([conference review]/lim OR [editorial]/lim OR [erratum]/lim OR [letter]/lim OR [note]/lim OR [book]/lim OR 'case report'/de)	634259
#3	#1 OR #2	841312
#2	'resuscitation'/ exp OR 'artificial ventilation$'/de OR 'manual ventilation'/exp OR 'noninvasive ventilation'/de OR 'maintenance of respiration and circulation'/de OR 'mouth to mouth ventilation'/de OR 'intubation'/de OR 'respiratory tract intubation'/de OR 'endotracheal intubation'/exp OR 'defibrillation'/de OR 'first aid'/de OR 'emergency treatment'/de OR 'first responder person'/exp OR 'basic life support'/de OR 'advanced life support'/exp	493029
#1	(((cardiopulmonary OR 'cardio-pulmonary') NEXT/1 reanimation):ti,ab,de,kw) OR resuscitat*:ti,ab,de,kw OR 'mouth-to-mouth':ti,ab,de,kw OR ventilation$:ti,ab,de,kw OR 'intubat*':ti,ab,kw,de OR 'chest	825757

compression$':ti,ab,de,kw OR defibrillat*:ti,ab,de,kw OR cpr:ti,ab,de,kw OR 'first aid':ti,ab,de,kw OR 'first response$':ti,ab,de,kw OR 'first responder$':ti,ab,de,kw OR 'rescue personnel':ti,ab,de,kw OR 'basic life support':ti,ab,de,kw OR 'advanced life support':ti,ab,de,kw

PsycINFO

#	Query	Limiters/Expanders	Last Run Via	Results
S16	S9 OR S14	Limiters - Publication Year: 2022- Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	17
S15	S9 OR S14	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	88
S14	S11 AND S12 AND S13	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	20
S13	TI (technique* or method* or approach* or video* or "audio visual*" or audiovisual*) or TX ("4-step*" or "4-stage*" or "2-step*" or "2-stage*" or "four-step*" or "four-stage*" or "two-step*" or "two-stage*")	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	225,681
S12	DE "Medical Education" OR DE "Nursing Education" OR DE "Health Education" OR DE "Education" OR DE "Educational Programs" OR DE "Teaching" OR DE "Educational Audiovisual Aids" OR DE "Instructional Media" OR DE "Audiovisual Instruction" OR DE "Videotape Instruction" OR DE "Teaching Methods" OR DE "Group Instruction" OR DE "Training" OR TI (educat* or train* or teach* or instruct* or learn*)	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	609,371
S11	S10 not (PZ (bibliography or chapter or clarification or "column/opinion" or "comment/reply" or editorial or encyclopedia entry or interview or letter or obituary or poetry or review-book or review-	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	2,032

	media or review-software & other) or PT (book or authored book or edited book or encyclopedia or dissertation abstract or electronic collection))			
S10	TI (resuscitat* or "mouth-to-mouth" or ventilation* or "chest compression*" or defibrillat* or intubat* or cpr or "first aid" or "first response*" or "first responder*" or "rescue personnel" or "basic life support" or "advanced life support")	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	2,543
S9	S6 OR S8	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	71
S8	S4 AND S7	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	63
S7	TX ((teaching or training or instruct*) N2 (technique* or method* or approach*))	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	170,645
S6	S4 AND S5	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	9
S5	TX (peyton* or halsted* or "4-step*" or "4-stage*" or "2-step*" or "2-stage*" or "four-step*" or "four-stage*" or "two-step*" or "two-stage*")	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	17,546
S4	S3 not (PZ (bibliography or chapter or clarification or "column/opinion" or "comment/reply" or editorial or encyclopedia entry or interview or letter or obituary or poetry or review-book or review-media or review-software & other) or PT (book or authored book or edited book or encyclopedia or dissertation abstract or electronic collection))	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	1,901
S3	S1 AND S2	Expanders - Apply equivalent subjects Search	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	2,478

		modes - Find all my search terms	Database - APA PsycInfo	
S2	DE "CPR" OR DE "Artificial Respiration" OR DE "Life Sustaining Treatment" OR DE "Medical Therapeutic Devices" OR DE "Emergency Personnel" OR DE "Emergency Services" OR DE "Emergency Management" OR DE "Emergency Medicine" OR DE "First Responders" OR DE "Rescue Workers" OR DE "Paramedics"	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - APA PsycInfo	17,835
S1	TX (resuscitat* or "mouth-to-mouth" or ventilation* or "chest compression*" or defibrillat* or intubat* or cpr or "first aid" or "first response*" or "first responder*" or "rescue	Expanders - Apply equivalent subjects Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	12,966

Database searched: Embase, CINAHL, Cochrane, PsycINFO, ERIC
Time Frame: (existing PICOST) – updated from end of last search (25 November 2022), for sufficient overlap: from 01 January 2022
Date Search Completed: 20 November 2024

Search Results (Number of articles identified and number identified as relevant): 423 articles identified, 1 identified as relevant
Summary of Evidence Update: One new RCT was identified comparing a modified Peyton's 4-step approach (all steps by video) to the classical Peyton's 4-step approach. The authors found no statistically significant differences between the two teaching approaches. The study held serious risks of bias (indirectness, inconsistency)

Relevant Guidelines or Systematic Reviews 1

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; Breckwoldt; 2023(1)	Systematic review	Stepwise approach to skills teaching in resuscitation	17	There were no differences between the effectiveness of Peyton's four-step approach and varying alternative approaches of stepwise training.	We suggest that stepwise training should be the method of choice for skills training in resuscitation (weak recommendation, very low certainty of evidence).

RCT: 1

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

Heriwardito; 2023	Study Aim: Compare the teaching of endotracheal intubation and mask ventilation by a modified 4-step approach to the classical 4-step approach. Study Type: RCT	Inclusion Criteria: 2nd year medical students	Intervention: Teaching endo-tracheal intuba-tion and mask ventilation by a modified Peyton 4-step approach: all steps performed by video) to the Comparison: classical Peyton 4-step approach.	1° endpoint: Skills performance at 2-3 months post-course ('rubric' quantitative score and pass rate based on global rating); no statistically signific. differences (rubric score p=0.936 for difference; global rating p=0.112 for difference).	Secondary endpoints: satisfaction (n.s.), self-confidence (n.s.) Study Limitations: interventions not fully equivalent (more time spent in the intervention group; spaced learning elements in the intervention group) No adverse events

Reviewer Comments:

No new evidence has been identified, that changes the conclusions drawn from the existing ILCOR SR in 2022. Therefore, a further systematic review or scoping review is not currently warranted.

Reference list:

1. Breckwoldt, 2023, 100457. https://pubmed.ncbi.nlm.nih.gov/37674547/
2. Heriwardito, 2023, 2256540. https://pubmed.ncbi.nlm.nih.gov/37679958/

2025 Evidence Update
EIT 6405 – Immersive Technologies – Virtual Reality (VR), Augmented Reality (AR)

Worksheet Author(s): Yiqun Lin (Jeffrey Lin), Adam Cheng
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: 1 November 2024
Conflicts of Interest: none

PICOST / Research Question: Immersive technologies to train/teaching neonatal/pediatric/adult basic and advanced life support (EIT 6405)
Population: All laypersons and healthcare providers in any educational setting.
Intervention: Immersive technologies (virtual reality, augmented reality, mixed reality, extended reality) as part of instructional design to train neonatal, paediatric, adult basic and advanced life support.
Comparators: Other methods of resuscitation training in basic and advanced life support (e.g., traditional manikin-based simulation training, other).
Outcomes: Knowledge acquisition and retention, skills acquisition and retention, skill performance in real CPR, willingness to help, bystander CPR rate, and patients' survival.
Study design: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies and case series where n>5, conference abstracts) and research letters are eligible for inclusion
Time frame: April 4, 2023 to October 10, 2024. All languages were included as long as there was an English abstract. The search was performed on October 10, 2024

Year of last full review: 2023
Publication title: Cheng A, Fijacko N, Lockey A, Greif R, Abelairas-Gomez C, Gosak L, Lin Y on behalf of the Education, Implementation and Teams Task Force of the International Liaison Committee on Resuscitation (ILCOR). Use of augmented and virtual reality in resuscitation training: a systematic review. Resuscitation Plus. 2024; 100643.
Publication date: April 22, 2024

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest the use of either augmented reality or traditional methods for basic life support training of lay people and healthcare providers (weak recommendation, very low quality of evidence).
We suggest against the use of virtual reality only for basic and advanced life support training of lay people and healthcare providers (weak recommendation, very low quality of evidence).

Current Search Strategy
Database: Ovid MEDLINE(R)
----
1   exp resuscitation/
2   cpr.tw,kf.
3   resuscit*.tw,kf.
4   "Cardiopulmonary resuscitation".tw,kf.
5   "Basic life support".tw,kf.
6   (basic adj4 support).tw,kf.
7   "Advanced life support".tw,kf.
8   exp Cardiopulmonary Resuscitation/
9   (Chest adj3 compress*).tw,kf.
10   "Cardiac massage".tw,kf.
11   "Cardiac life support".tw,kf.
12   "Code Blue".tw,kf.
13   exp "out of hospital cardiac arrest"/
14   exp automated external defibrillator/
15   defib*.tw,kf.
16   AED.tw,kf.
17   exp heart arrest/
18   "cardiac arrest".tw,kf.

19   exp augmented reality/
20   exp virtual reality/
21   "augmented reality".tw,kf.
22   "virtual reality".tw,kf.
23   "mixed reality".tw,kf.
24   "HTC vive".tw.
25   oculus.tw.
26   cardboard.tw.
27   hololens.tw.
28   VR.tw,kf.
29   AR.tw,kf.
30   (virtual adj4 scenario*).tw.
31   1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18
32   19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30
33   31 and 32
34   limit 33 to humans

Database: Embase
----
1   exp resuscitation/
2   cpr.tw,kf.
3   resuscit*.tw,kf.
4   "Cardiopulmonary resuscitation".tw,kf.
5   "Basic life support".tw,kf.
6   (basic adj4 support).tw,kf.
7   "Advanced life support".tw,kf.
8   exp basic life support/
9   exp advanced life support/
10   (Chest adj3 compress*).tw,kf.
11   "Cardiac massage".tw,kf.
12   "Cardiac life support".tw,kf.
13   "Code Blue".tw,kf.
14   exp cardiac resynchronization therapy defibrillator/
15   exp major adverse cardiac event/
16   exp "out of hospital cardiac arrest"/
17   exp automated external defibrillator/
18   defib*.tw,kf.
19   AED.tw,kf.
20   exp heart arrest/
21   "cardiac arrest".tw,kf.
22   1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21
23   exp augmented reality/
24   exp virtual reality/
25   "augmented reality".tw,kf.
26   "virtual reality".tw,kf.
27   "mixed reality".tw,kf.
28   "HTC vive".tw.
29   oculus.tw.
30   cardboard.tw.
31   hololens.tw.
32   VR.tw,kf.
33   AR.tw,kf.
34   (virtual adj4 scenario*).tw.
35   23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34
36   22 and 35
37   compar*.tw.

38   36 and 37
39   limit 38 to human

Database: Scopus
Search Strategy:
("CPR Training"[All Fields] OR "cardiopulmonary resuscitation"[All Fields] OR "basic life support"[All Fields] OR "Advanced Life Support"[All Fields] OR "Chest compressions"[All Fields] OR "resuscitation"[All Fields] OR "Cardiac massage"[All Fields] OR "Cardiac life support"[All Fields] OR "Code blue"[All Fields] OR "cardiac arrest"[All Fields]) AND ("augmented reality"[All Fields] OR "virtual reality"[All Fields] OR "HTC Vive"[All Fields] OR "Oculus Rift"[All Fields] OR "Oculus Quest"[All Fields] OR "Oculus Quest 2"[All Fields] OR Cardboard[All Fields] OR "mixed reality"[All Fields] OR "hololens"[All Fields] OR "VR Sim"[All Fields] OR "VR/AR"[All Fields] OR "VR App"[All Fields] OR "Virtual scenarios"[All Fields])

Database searched: Medline, Embase, Scopus
Time Frame: (existing PICOST) – From Oct 2023 to Oct 2024
Date Search Completed: Oct 10, 2024
Search Results: The updated search identified 470 studies and data from 7 relevant studies were extracted.

Summary of Evidence Update:
Seven relevant studies were identified, including five randomized controlled trials (RCTs)[1-5] and two observational studies[6, 7]. Of these, two studies focused on healthcare providers[1, 3], while five targeted lay providers[2, 4-7]. Six studies evaluated the effectiveness of virtual reality (VR) in basic life support (BLS) training[2-7], and one explored its impact on advanced life support (ALS) training[1]. None of the studies reported the patient outcomes or performance or providers in clinical settings.
For healthcare professional training, one RCT found that VR-based training resulted in better BLS knowledge acquisition and comparable knowledge retention to conventional role-playing methods, though at a higher cost (41.6 euros vs. 32.5 euros per trainee).[3] Conversely, another RCT showed that participants trained using a VR-based serious game had lower post-training knowledge scores and poorer manikin-based simulation performance compared to traditional training.[1] Both studies had significant concerns regarding bias due to inadequate reporting of the randomization process.
Among lay providers, three RCTs produced mixed results.[2, 4, 5] One study found that football coaches trained with mixed reality retained BLS knowledge better than those trained with traditional methods, although BLS skill retention was similar between the groups.[2] The other two RCTs indicated that VR-based training led to improved CPR skills compared to conventional approaches.[4, 5] All three studies, however, faced serious concerns related to the randomization process and/or failure to achieve equivalence between groups post-randomization.
Of the two observational studies, one quasi-experimental study demonstrated that adding VR training to face-to-face instruction enhanced BLS knowledge and skills.[7] The other study found that university students who completed VR-based BLS training showed significant improvements in CPR quality compared to their pre-training performance.[6]

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
Aksoy 2023[1]	Aims: to compare a VR-based ALS serous game vs. a classroom-based ALS lecture. Type: RCT N = 29	Healthcare students (medical students)	Intervention: VR-based serious game (n = 14) Control: classroom-based lecture (n = 15)	VR vs non-VR Post-training Knowledge score: 53.79 s. 64.20, p = 0.01 Manikin-based simulation technical score: 53. 80 vs 60.20, p = 0.03 Favors non-VR	Favors non-VR Limitations -Lack of details of randomization, no demographic characteristics reported, Serious concerns of risk of bias)
Alcazar Artero 2024[2]	Aims: To evaluate the effect of serious game + VR vs.	Lay providers: Football coaches	Intervention: BLS training with	VR vs non-VR	Serious games and VR improved quality of CPR

		serious game + VR (n = 31) Control: Conventional class-room-based BLS training (n = 32)	Overall quality (software) 86.1% vs 74.8%, p < 0.001 Compression rate: 102bpm vs. 74.8%, p < 0.001 Proportion of learner achieving guideline-compliant rate: 54.5% vs. 25.8% Compression depth: 41 mm vs 33mm, p = 0.001 Proportion of learners achieving guideline-compliant depth: 18% vs. 6.4% Favoring VR	compared to conventional training Limitations -Lack of details of randomization (no description of randomization process, consort diagram, demographic characteristics), serious concerns of risk of bias
conventional classroom-based BLS training Type: RCT N= 75				
Figols Pedrosa 2023 [3]	Aims: To evaluate the learning curve of students using VR environment vs role-play methodology (conventional training) Type: RCT N= 131	Healthcare professionals	Intervention: BLS training with VR programming (n=72) Control: BLS training with role-playing (n = 59)	VR vs non-VR BLS knowledge acquisition: 84.0 s 77.6, p = 0.036 BLS knowledge retention (6 months): 62.0 vs. 59.8, p = 0.371 Cost Analysis: 41.6 euros vs 32.5 euros	VR training resulted in better BLS knowledge acquisition, similar knowledge retention and more costly. No cost-effectiveness analyses conducted. Limitations -No description of randomization (serious risk of bias) -CPR quality not assessed -No cost-effectiveness analysis conducted.
Giacomini 2023 [4]	Aims: To compare the BLS knowledge and skill retention using Mixed reality vs instructor-lead training in secondary school students. Type: RCT N = 74 Only data from 2 arms used (N = 49)	Lay providers: Secondary school students	Intervention: BLS learning with mixed reality (n = 26) Control: BLS mass teaching (n = 23)	VR vs non-VR 1 month retention Knowledge: 7.0 vs 5.0, p = 0.023 Compression rate: 97 vs 108 bpm, p =0.296 Compression depth: 43 vs 41 mm, p = 0.296 Chest recoil: 100% vs 97%, p = 0.182	Short-term retention: Significant difference favoring VR for knowledge. Non-significant difference between CPR skills 3-month retention: Non-significant difference in knowledge. Significant difference favoring VR for CC depth, and favoring non-VR for rate Limitations:

| | | | | 3-month retention:

Knowledge: 7.0 vs 6.0, p =0.217

CC rate: 124 vs 105 bpm, p = 0.005 (favors non-VR)

CC depth: 44 vs 37mm, p = 0.003 (favors VR)

Chest recoil: 100% vs 100%, p > 0.99 | -No description of randomization, baseline equivalence not achieved (serious risk of bias) |
| Sungar 2024 [5] | Aims: to evaluate the effectiveness of mixed reality compared to traditional training among lay people

Type: RCT

N= 59 | Lay Providers | Intervention: CPR training with mixed reality (n not reported)

Control: CPR training with traditional method (n not reported) | VR vs non-VR

Compression rate: 113 vs 111.7 bpm, p = n.s

Compression depth: 2.31 vs 2.05 inches, p < 0.05

Knowledge exam: 72.4 vs. 80.0, pp > 0.05

Favors VR in compression depth Non-significant results for rate and knowledge. | Limitations
-very poor reporting
-No data on group allocation, process of randomization, demographic characteristics, and consort diagram, which is a serious concern of risk of bias |

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)
Pérez Rubio 2023 [6]	Aims: To analyze the effect of a serious game through the use of VR goggles Type: Pre-post study without control group Intervention: BLS training with VR programming N = 31	University students	Pre- vs post-training: CPR Quality (mean±SD): Overall Chest compression quality: 30±28% vs 47±27%, p <0.001 Compression rate (com/min): 93±36 vs 105±21, p = 0.023 Mean depth (mm): 26±10 vs 32±18%, p = 0.001	VR training was useful to learn BLS. Limitations: -No control group. -No cost-effectiveness analysis conducted -No mid- long-term evaluation.
Shatpattananunt 2023 [7]	Aims: To develop and evaluate a novel VR learning device for BLS	Undergraduate medical student in Thailand	VR vs non-VR: BLS knowledge: median 10 vs 9, p = 0.001	Favors VR Limitations:

	Type: Quasi-experimental N = 70 Intervention: MFU BliS VR (3D virtual reality BLS + Face-to-face practice) n = 35 Control: Face-to-face BLS training only; n = 35		BLS skills: median 50 vs 41, p < 0.001 NFT: median 5 vs 6 min, p < 0.001	-Potential bias due to lack of randomization -Lack of validity evidence for outcome measures No adverse events reported.

Reviewer Comments: *(including whether this PICOST should have a systematic or scoping review)*

No studies on augmented reality (AR) were found in this updated search. The virtual reality (VR) evidence identified continues to support the current recommendations. Among healthcare providers, VR training resulted in performance that was similar to or worse than conventional training, while also being more costly. In contrast, several studies demonstrated benefits of VR-based training for lay providers, although the certainty of this evidence remains low.

The current evidence update does not warrant a systematic review.

Reference list:

1. Aksoy ME, Ozkan AE, Kitapcioglu D, Usseli T. Comparing the Outcomes of Virtual Reality-Based Serious Gaming and Lecture-Based Training for Advanced Life Support Training: Randomized Controlled Trial. JMIR Serious Games. 2023;11:e46964.

2. Alcazar Artero PM, Greif R, Ceron Madrigal JJ, Escribano D, Perez Rubio MT, Alcazar Artero ME, et al. Teaching cardiopulmonary resuscitation using virtual reality: A randomized study. Australas Emerg Care. 2024;27(1):57-62.

3. Figols Pedrosa M, Barra Perez A, Vidal-Alaball J, Miro-Catalina Q, Forcada Arcarons A. Use of virtual reality compared to the role-playing methodology in basic life support training: a two-arm pilot community-based randomised trial. BMC Med Educ. 2023;23(1):50.

4. Giacomini F, Querci L, Dekel BGS. Mixed Reality Mass or Self-directed Training for Adolescents' Basic Life Support Instruction: A Prospective, Randomized Pilot Study. The Open Anesthesiology Journal. 2023;17.

5. Sungur H, van Berlo ZMC, Lüwa LM. Enhancing Cardiopulmonary Resuscitation Training with Mixed Reality: Improving Cardiopulmonary Resuscitation Performance and Enjoyment. Cyberpsychology, Behavior, and Social Networking. 2024;27(6):379-86.

6. Pérez Rubio MT, González Ortiz JJ, López Guardiola P, Alcázar Artero PM, Soto Castellón MB, Ocampo Cervantes AB, et al. Realidad virtual para enseñar reanimación cardiopulmonar en el Grado de Educación Primaria. Estudio comparativo. RIED-Revista Iberoamericana de Educación a Distancia. 2023;26(2):309-25.

7. Shatpattananunt B, Petpichetchian W, Pinsuwan S, Chaloempong T, Waraphok S, Wongwatkit C. Development and evaluation of a virtual reality basic life support for undergraduate students in Thailand: a project by Mae Fah Luang University (MFU BLiS VR). BMC Med Educ. 2023;23(1):782.

2025 Evidence Update
EIT 6409 – Blended Learning Approach for Life Support Education

Worksheet Author(s): Cristian Abelairas-Gómez, Aida Carballo-Fazanes, Andrew Lockey
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: August 2024
Conflicts of Interest: none

PICO / Research Question: EIT 6409
Population: Participants undertaking an accredited life support course (e.g. BLS, ALS, PALS)
Intervention: Blended learning approach
Comparator: Non blended learning approach
Outcomes: Clinical outcomes: Survival (Critical) and neurological outcome (Critical).
Knowledge acquisition (end of course, 6 months, 1 year) (Important).
Skills acquisition (end of course, 6 months, 1 year) (Important).
Participant satisfaction (end of course) (Important).
Implementation outcomes (cost, time needed) (Important).
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: The literature was searched from Jan 1, 2021 to Jun 19, 2024

PROSPERO Registration: CRD42022274392 (Last SyR; Elgohary et al. 2022)
Year of last full review: SyR 2021

Last ILCOR Consensus on Science and Treatment Recommendation:
Blended-learning is recommended as opposed to non-blended approach for life support training when resources and accessibility permit its implementation (strong recommendation, very low–certainty evidence).

2024 Search Strategy: Database searched: EMBASE and Medline: Jan 2021 to Jun 2024; CINAHL Plus with Full Text: from inception; Cochrane Library: from inception.

Ovid Multi-Database
Embase and Medline
1. ("advanced life support" or "advanced cardiac life support" or "basic life support" or cpr or resuscitation or "life saving" or ((neonatal or newborn or pediatric or paediatric) adj3 "life support")).ti,ab.
2. (acls or als or arni or atls or bls or epals or epls or nls or nrp or pals).ti. and ("life saving" or "life support").ti,ab,kw,hw.
3. "Advanced Cardiac Life Support"/ or "advanced life support"/ or "basic life support"/ or "pediatric advanced life support"/ or "newborn resuscitation"/
4. "resuscitation"/ and (train* or learn* or course? or teach* or program* or educat* or student).hw.
5. 1 or 2 or 3 or 4
6. (train* or pretrain* or "pre train*" or learn* or prelearn* or "pre learn*" or course? or precourse? or "pre course?" or teach* or program* or educat*).ti.
7. "Education, Continuing"/ or "continuing education"/ or "education program"/ or "Education"/ or "Learning"/ or "outcome of education"/ or "Teaching"/ or "Vocational Education"/
8. "allied health education"/ or "Clinical Competence"/ or "clinical education"/ or "emergency medical services education"/ or "Education, Medical"/ or "medical education"/ or "Education, Nursing"/ or "nursing education"/ or "paramedical education"/
9. 6 or 7 or 8
10. 6 and (computer or "educational technology" or "e learning" or electronic or game? or gamified or online or simulation or video or virtual or "web course" or "web based").ti,ab.
11. "Educational Technology"/ or "e-learning"/ or exp "Patient Simulation"/ or exp "Simulation Training"/ or "computer assisted learning"/ or "Computer Simulation"/ or "virtual learning environment"/
12. 10 or 11

13.   (classroom or "face to face" or "in person" or "self directed" or "self learning" or ((distance or remote) adj2 (learn* or class or classes))).ti,ab.
14.   "classroom"/ or exp "Education, Distance"/ or exp "distance learning"/ or "Self-Directed Learning as Topic"/ or "self-directed learning"/ or "face to face training"/
15.   13 or 14
16.   (blend* or flip* or invert* or hybrid).ti,ab.
17.   "blended learning"/ or "flipped classroom"/
18.   16 or 17
19.   ("educational model" or "educational theory" or "learning style" or "learning theory" or "teaching model").ti,ab.
20.   "Models, Educational"/ or "educational model"/ or "educational theory"/ or "learning style"/ or "learning theory"/ or "teaching model"/
21.   19 or 20
22.   5 and 9 and (12 or 15 or 18 or 21)
23.   22 not ("conference abstract" or "conference review" or congress or editorial or erratum or "published erratum" or letter or note or book or "case report" or "case reports").pt.
24.   limit 23 to yr="2021 -Current"
Embase <1974 to 2024 June 18>
Ovid MEDLINE(R) ALL <1946 to June 18, 2024>
25.   from 24 keep 1-612 [EMBASE]
26.   from 24 keep 613-1192 [MEDLINE]

CINAHL Plus with Full Text
1.   TI ("advanced life support" OR "advanced cardiac life support" OR "basic life support" OR cpr OR resuscitation OR "life saving" OR ((neonatal OR newborn OR pediatric OR paediatric) N2 "life support")) OR AB ("advanced life support" OR "advanced cardiac life support" OR "basic life support" OR cpr OR resuscitation OR "life saving" OR ((neonatal OR newborn OR pediatric OR paediatric) N2 "life support"))
2.   (TI (acls OR als OR arni OR atls OR bls OR epals OR epls OR nls OR nrp OR pals)) AND (TI ("life saving" OR "life support") OR AB ("life saving" OR "life support") OR MW ("life saving" OR "life support"))
3.   MH "Advanced Cardiac Life Support" OR MH "Pediatric Advanced Life Support"
4.   MH "Resuscitation" AND MW (train* OR learn* OR course? OR teach* OR program* OR educat* OR student)
5.   S1 OR S2 OR S3 OR S4
6.   TI (train* OR pretrain* OR "pre train*" OR learn* OR prelearn* OR "pre learn*" OR course? OR precourse? OR "pre course?" OR teach* OR program* OR educat*)
7.   MH "Education, Continuing" OR MH "Education" OR MH "Learning" OR MH "Outcomes of Education" OR MH "Teaching" OR MH "Vocational Education"
8.   MH "Education, Allied Health" OR MH " Clinical Competence" OR MH "Education, Clinical" OR MH "Education, Emergency Medical Services" OR MH "Education, Medical" OR MH "Education, Nursing"
9.   S6 OR S7 OR S8
10.   S6 AND (TI (computer OR "educational technology" OR "e learning" OR electronic OR game? OR gamified OR online OR simulation OR video OR virtual OR "web course" OR "web based") OR AB (computer OR "educational technology" OR "e learning" OR electronic OR game? OR gamified OR online OR simulation OR video OR virtual OR "web course" OR "web based"))
11.   MH "Educational Technology" OR MH "Patient Simulation" OR MH "Computer-Assisted Instruction" OR MH "Computer Simulation"
12.   S10 OR S11
13.   TI (classroom OR "face to face" OR "in person" OR "self directed" OR "self learning" OR ((distance OR remote) N1 (learn* OR class OR classes))) OR AB (classroom OR "face to face" OR "in person" OR "self directed" OR "self learning" OR ((distance OR remote) N1 (learn* OR class OR classes)))
14.   MH "Learning Environment" OR MH "Self-Directed Learning"
15.   S13 OR S14
16.   TI (blend* OR flip* OR invert* OR hybrid) OR AB (blend* OR flip* OR invert* OR hybrid)
17.   TI ("educational model" OR "educational theory" OR "learning style" OR "learning theory" OR "teaching model") OR AB ("educational model" OR "educational theory" OR "learning style" OR "learning theory" OR "teaching model")
18.   MH "Models, Educational" OR MH "Educational Theory" OR MH "Learning Styles" OR MH "Learning Theory"
19.   S17 OR S18
20.   S5 AND S9 AND (S12 OR S15 OR S16 OR S19)
21.   PT ("Commentary" OR "Editorial " OR "Letter" OR "Pamphlet" OR "Pamphlet Chapter" OR "Case Study")

22.   S20 NOT S21
23.   S22 AND (DT 2021-2024)

Cochrane Library: *Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials*

1.   ("advanced life support" OR "advanced cardiac life support" OR "basic life support" OR cpr OR resuscitation OR "life saving" OR ((neonatal OR newborn OR pediatric OR paediatric) NEAR3 "life support")):ti,ab
2.   (acls OR als OR arni OR atls OR bls OR epals OR epls OR nls OR nrp OR pals):ti AND ("life saving" OR "life support"):ti,ab,kw
3.   [mh "Advanced Cardiac Life Support"]
4.   [mh ^"Resuscitation"] AND (train* OR learn* OR course* OR teach* OR program* OR educat* OR student):ti
5.   {OR #1-#4}
6.   (train* OR pretrain* OR (pre NEXT train*) OR learn* OR prelearn* OR (pre NEXT learn*) OR course? OR precourse? OR (pre NEXT course?) OR teach* OR program* OR educat*):ti
7.   [mh "Education, Continuing"] OR [mh ^"Education"] OR [mh ^"Learning"] OR [mh ^"Teaching"] OR [mh "Vocational Education"]
8.   [mh "Clinical Competence"] OR [mh ^"Education, Medical"] OR [mh "Education, Nursing"]
9.   {OR #6-#8}
10.   #6 AND (computer OR "educational technology" OR "e learning" OR electronic OR game? OR gamified OR online OR simulation OR video OR virtual OR "web course" OR "web based"):ti,ab
11.   [mh ^"Educational Technology"] OR [mh "Patient Simulation"] OR [mh "Simulation Training"] OR [mh ^"Computer Simulation"]
12.   #10 OR #11
13.   (classroom OR "face to face" OR "in person" OR "self directed" OR "self learning" OR ((distance OR remote) NEAR2 (learn* OR class OR classes))):ti,ab
14.   [mh "Education, Distance"] OR [mh "Self-Directed Learning as Topic"]
15.   #13 OR #14
16.   (blend* OR flip* OR invert* OR hybrid):ti,ab
17.   ("educational model" OR "educational theory" OR "learning style" OR "learning theory" OR "teaching model"):ti,ab
18.   [mh "Models, Educational"]
19.   #17 OR #18
20.   #5 AND #9 AND (#12 OR #15 OR #16 OR #19)
21.   #5 AND #9 AND (#12 OR #15 OR #16 OR #19) with Cochrane Library publication date Between Jan 2021 and Jun 2024, in Cochrane Reviews, Trials
22.   (Reviews: 0, Trials: 229)

Summary of 2024 search results (EvUp)		
Database	Date Searched	Results
EMBASE	Jun 2024	612
Medline	Jun 2024	580
CINAHL	Jun 2024	262
CCRCT	Jun 2024	229
CDSR	Jun 2024	0
TOTAL after duplicates removed		382
Articles meeting inclusion criteria		0

Link to Article Titles and Abstracts (if available on PubMed): none
Summary of Evidence Update:
Relevant Guidelines or Systematic Reviews: 2

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

ILCOR; Wyckoff; 2022	2022 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the BLS; ALS; PLS; NLS; EIT; and FA Task Forces	Blended learning for life support education (SysRev)	23	A blended-learning approach enables ongoing training in life support skills for those in remote locations and lower-resource settings and in times of pandemic. It may not be feasible in areas where access to online learning is limited or unavailable. Blended learning enables consistent messaging about content, which can be particularly beneficial for precourse preparation, and it reduces participant and stakeholder costs.	Blended-learning is recommended as opposed to non-blended approach for life support training when resources and accessibility permit its implementation (strong recommendation, very low–certainty evidence).
Elgohary; 2022	Blended learning for accredited life support courses – A systematic review	In participants undertaking an accredited life support course (P), does a blended learning approach (I), as opposed to a non-blended learning approach (C), affect the following outcomes: knowledge acquisition and retention, skills acquisition, and retention, participant satisfaction, and resource outcomes (O).	22	A blended learning approach to life support education is at least as effective as traditional face-to-face training regarding educational outcomes.	Combined with the lower ongoing costs for learners and stakeholders, the evidence suggests that a blended learning approach is a more efficient means of delivery for life support education

RCT: 0

Nonrandomized Trials, Observational Studies: 0

Reviewer Comments (including whether meet criteria for formal review):

There were 382 new articles identified of which none were relevant to the PICO. A new SysRev is not warranted.

Reference List

Elgohary M, et al. Blended learning for accredited life support courses – A systematic review. Resusc Plus. 2022;10:100240. Doi: https://doi.org/10.1016/j.resplu.2022.100240

Wyckoff MH, et al. 2022 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. Circulation. 2022;146:e483-e557. Doi: https://doi.org/10.1161/CIR.000000000000109

2025 Evidence Update
EIT 6412 – Gamified Learning vs. Other Forms of Non-Gamified Learning

Worksheet Author(s): Aaron Donoghue, Taylor Sawyer, Alexander Olausson, Lorrel Toft
Task Force: Education, Implementation, and Teams
Conflicts of Interest: none

PICOST / Research Question:

PICOST	Description *(with recommended text)*
Population	Learners training in basic or advanced life support
Intervention	Instruction using gamified learning (use of game-like elements in the context of training (e.g. point systems, intergroup competition, leaderboards, scaffolded learning with increasing challenge, 'medals' or 'badges')
Comparison	Compared to traditional instruction or other forms of non-gamified learning
Outcomes	Educational outcomes: *Skill* (e.g. CPR performance, other procedural performance, scores in scenarios, time to task performance) immediately following training (e.g. end of course), at 3 months, 6 months, 1 year *Knowledge* e.g. test scores immediately following training (e.g. end of course), at 3 months, 6 months, 1 year *Attitudes*: Participant satisfaction, learner preference, learner confidence Clinical outcomes: change in healthcare practitioner behavior at resuscitation in case of real cardiac arrest (CPR quality, time to task completion, teamwork/crisis resource management) Patient outcomes: ROSC, survival to hospital d/c; neurologic intact survival Process: costs and resources utilization
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. Unpublished studies (e.g., conference abstracts, trial protocols) are excluded.
Timeframe	All years until May 30, 2023 and all languages are included if there is an English abstract

Year of last full review: 2023
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:

It may be reasonable to consider the use of Gamified Learning (GL) elements as a component of resuscitation training (weak recommendation, very low quality of evidence).

Current Search Strategy
Embase

1	exp "Resuscitation"/ or (resuscitat* or ((cardiac or heart) adj2 (massag* or compression*)) or (chest adj2 compression*) or CPR or "life support" or ACLS or BCLS or BLS).ti,ab,kf,kw.	362243
2	Computer-Assisted Instruction/ or Video Games/ or "Games, Recreational"/ or "Games, Experimental"/ or "Simulation Training"/ or "High Fidelity Simulation Training"/ or video game/ or recreational game/ or game/	134956
3	(gamification or gamify* or gamified or game* or leaderboard* or ("competition based" adj4 training) or ("non evaluation" adj4 training) or (Relive adj4 game) or (DIANA adj4 game) or "point system" or "point systems" or (scaffold* adj4 (learning or education or teaching)) or medal* or badge*).ti,ab,kf,kw.	180344
4	("Leiden Infant Simulator Sensitivity Assessment" or LISSA or Laerdal or ResusciAnne or ResusciBaby).ti,ab,kf,kw.	1665
5	or/2-4	297749
6	1 and 5	4373
7	(Animals/ or "Animal Experimentation"/ or "Models, Animal"/ or "Disease Models, Animal"/) not (Humans/ or "Human Experimentation"/)	8971215
8	(exp "animal model"/ or exp "animal experiment"/ or "nonhuman"/ or exp "vertebrate"/) not (exp "human"/ or exp "human experiment"/)	11206926

9	6 not (7 or 8)	4333
10	(comment or editorial or "newspaper article" or news or note or lecture).pt.	3398478
11	(letter not (letter and randomized controlled trial)).pt.	2515578
12	9 not (10 or 11)	4121
13	(conference or conference abstract or "conference review" or congresses).pt.	5548357
14	12 not 13	2809
15	"case reports".pt.	2336813
16	14 not 15	2781
17	limit 16 to english language	2664
18	limit 16 to abstracts	2566
19	17 or 18 [ENGLISH LANGUAGE OR ENGLISH ABSTRACT] Embase <1974 to 2023 May 24> Ovid MEDLINE(R) ALL <1946 to May 24, 2023>	2756 1660 1096
20	remove duplicates from 19 Embase <1974 to 2023 May 24> Ovid MEDLINE(R) ALL <1946 to May 24, 2023>	1955 859 1096

Cochrane Central Register of Controlled Trials

#1	(resuscitat* OR ((cardiac OR heart) NEAR/2 (massag* OR compression*)) OR (chest NEAR/2 compression*) OR CPR OR "life support" OR ACLS OR BCLS OR BLS):ti,ab,kw	11330
#2	(gamification OR gamify* OR gamified OR game* OR leaderboard* OR ("competition based" NEAR/4 training) OR ("non evaluation" NEAR/4 training) OR (Relive adj4 game) OR (DIANA NEAR/4 game) OR "point system" OR "point systems" OR (scaffold* NEAR/4 (learning OR education OR teaching)) OR medal* OR badge*):ti,ab,kw	8942
#3	("Leiden Infant Simulator Sensitivity Assessment" OR LISSA OR Laerdal OR ResusciAnne OR ResusciBaby):ti,ab,kw	351
#4	#2 OR #3	9289
#5	#1 AND #4	299
#6	#1 AND #4 in Trials	298

Database searched: Medline, Embase, Cochrane
Time Frame: (existing PICOST) – updated from end of last search (February 2024 to present)
Date Search Completed: October 16, 2024
Search Results:

Summary of 2024 search results (EvUp)		
Database	**Date Searched**	**Results**
Embase	Oct 16 2024	11
Medline	Oct 16 2024	106
Cochrane library	Oct 16 2024	39
TOTAL after duplicates removed		145
Articles meeting inclusion criteria		6

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

Cheng, 2024 (China)[1]	Systematic review	Effect of serious games on CPR training and education	6	RCTs only; CPR skill as outcome measures only; No significant difference between serious games and traditional learning on CPR skill performance	Serious games are equally effective as traditional training methods in CPR training
Donoghue, 2024 (ILCOR)[2]	Systematic review	Gamified learning in resuscitation training	13	7 RCTs, 6 observational studies; 12 of 13 demonstrated improvement in one domain (skill, knowledge, attitude) with GL; no studies showed a negative effect	It may be reasonable to consider the use of Gamified Learning (GL) elements as a component of resuscitation training (weak recommendation, very low quality of evidence).

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
Bilodeau, 2024 (Canada)[3]	Study Aim: whether the digital game simulation instructional method was at least as good as a more traditional alternative (video lecture) at updating and maintaining participants' neonatal resuscitation knowledge Study Type: RCT Sample size: IG 21, CG 21	Inclusion Criteria: Labor and delivery healthcare personnel	Intervention: digital game simulator for NRP (RETAIN) Comparison: 20-30 minute NRP instructional video	1° endpoint: Clinical checklist immediately post-training No difference between groups (ANOVA, p=0.6) 2° endpoints: Clinical checklist 2 months post-training No difference btw groups (p=0.5) Attitudes towards RETAIN simulator; range of 3.29 to 3.86 on 5-point Likert scale items regarding realism and usefulness	Study Limitations: Sample size Limited untested clinical assessment (checklist)
Cutumisu, 2024 (Canada)[4]	Study Aim: whether the digital game simulation instructional method was at least as good as a more traditional alternative (video lecture) at updating and maintaining participants' neonatal	Inclusion Criteria: Paramedics	Intervention: digital game simulator for NRP (RETAIN) Comparison: 20-30 minute NRP instructional video	1° endpoint: Clinical checklist immediately post-training No difference between groups IG: pre 10 + 2.2 to post 10.7 + 2 vs. CG pre 9.6 + 2.3 to post 11.5 + 1.8) 2° endpoint:	Study Limitations: Sample size Limited untested clinical assessment (checklist)

	resuscitation knowledge Study Type: RCT Sample size: IG 21, CG 21			Attitudes towards RETAIN simulator; range of 3.53 to 4.00 on 5-point Likert scale items regarding realism and usefulness	
Kim, 2024 (South Korea)[5]	Study Aim: whether GL in KALS (Korean Advanced Life Support) leads to better outcomes than traditional KALS Study Type: RCT Sample size: IG 139, CG 148	Inclusion Criteria: Healthcare personnel (physician, nurse, paramedic, medical/nursing student)	Intervention: digital game (Kahoot! Software) used during "reminder" session (roundtable discussion with images of CA scenario pre assessment) Comparison: standard "reminder" session (without gamification)	1° endpoint: Immediate post-training MCQ assessments (algorithm, rhythm analysis, teamwork) Algorithm (5 points): CG better than IG (4.88 vs 4.70, p=0.002) Rhythm (3 pts): NSD Teamwork (2 points) NSD	Study Limitations: Limited untested clinical assessment (checklist) Comparisons of point scores on outcomes analyzed as means; difference btw algorithm score 4.7 and 4.88 unlikely to be practically significant

Abbreviations: CG= control group; IG=intervention group; NSD=no significant difference

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Subject Population	Gamification element(s)	Comparator	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Khaledi, 2024 (Iran)[6]	Quasi-experimental (3 groups) N= 154	Nursing students	Kahoot! Software during CPR training	Standard training (3rd group: role-playing during training)	Basic Resuscitation Skills Self-efficacy Scale (self-reported) Greater reported self efficacy in GL group than control (p<0.01)	
Rodriguez-Garcia, 2024 (Spain)[7]	Observational N=68	Laypeople (secondary school students)	'Survivor" game (digital interface, teams compete for badges, certificates) *both groups with identical 10 mins hands-on training	Traditional training	CPR skills Mean depth: NSD Correct compression %: GL: 67.8 + 41.3 versus Ctrl: 90.7 + 14.7, p=0.004) Correct release %: NSD Total CC in 2 min: NSD Overall CPR quality (Laerdal manikin algorithm): GL 61.4% + 31.9% versus Ctrl 89.2% + 13.5%, p<0.001) Correct AED application: NSD Time to AED application: GL 82 + 27 sec versus Ctrl 40 + 11 sec, p<0.001	

Reviewer Comments: *(including whether this PICOST should have a systematic or scoping review)*
A total of 6 new studies were included in this update. In addition to the publication of the ILCOR systematic review on this PICOST, another systematic review was included. This latter review focused on RCTs only, and only included studies where the outcome(s)

were metrics of CPR psychomotor skill performance. The authors identified 9 RCTs with the exposure and comparator of interest which reported results allowing meta-analysis to be performed on at least one outcome measure. Four outcomes (theory assessment (knowledge), CPR skill assessment, chest compression depth, and chest compression rate) were identified and meta-analysis of 6 studies for each of the four outcomes was performed. None of the meta-analyses demonstrated a significant association with their outcomes, and a high degree of heterogeneity was noted in all four (I2 ranging from 56% to 95%). GRADE analysis performed on the four groups of studies yielded low to very low quality evidence, with all four groups of studies being downgraded for inconsistency, three for indirectness, and one for accuracy.

The authors concluded that gamified learning (discussed in their review as "Serious games") is equally effective as traditional training methods in CPR training. Importantly, the inclusion criteria for their review did not give an explicit definition of what was considered a serious game. All of the included studies were based on a digital platform; however, additional criteria such as the use of point systems, leaderboards, team competition, or scoring/scaffolding of cases were not mentioned (these were inclusion criteria in the ILCOR systematic review published in 2024).

We included three new RCTs in this update. Two RCTs examined the impact of a digital-based game for neonatal resuscitation training on educational outcomes, one in labor and delivery room staff and one in paramedics. Bilodeau et al enrolled 42 labor and delivery staff (21 per group) and compared a digital game (RETAIN) to a standard instructional video. Subjects were tested immediately post training and at 2 months post training with a 12-item task checklist. No significant difference in score was found between the groups at either timepoint.

Cutumisu et al enrolled 42 paramedics (21 per group) and compared the same digital game (RETAIN) to a standard instructional video. Subjects were tested immediately post training with a 12-item task checklist. No significant difference in score was found between the groups.

In a third RCT, Kim et al enrolled 287 healthcare personnel (physicians, nurses, students, paramedics) in a trial comparing a locally created advanced life support course (KALS (Korean Advanced Life Support)) taught in standard fashion to the same course with gamified learning elements included. 148 subjects in the control group went through the standard course, which ends with a "reminder" session where learners participate in a round table discussion while reviewing a video-based case of cardiac arrest. 139 subjects in the intervention group went through the same course, but completed the "reminder" session using a digital gaming platform (Kahoot!). Three outcomes were examined by question-based checklist: knowledge of ALS algorithm, rhythm analysis, and teamwork. There were no significant differences between the groups in the rhythm and teamwork assessment; the CG had higher mean score than the IG in the algorithm assessment (4.88 out of 5 versus 4.70 out of 5, p=0.002).

We included two new observational studies in this update. Rodriguez-Garcia et al reported a study where groups of secondary school students underwent a CPR training session and were assessed performing CPR on a manikin. The control group (n=34) received a traditional slide-based didactic session with 10 minutes of hands-on training; the gamified group received a training session using a digital game (using competition between teams and 'badges') with 10 minutes of hands-on training. There was no difference between groups in compression depth, release, total compressions in 2 minutes, or frequency of AED application; the gamification group performed worse than the traditional group in fraction of correct compressions (68% + 41% vs 91% + 15%, p=0.004); overall CPR quality (61% + 31.9% vs 89% + 14%, p<0.001); and time to AED application (82 + 27 sec vs 40 + 11 sec, p<0.001).

In a second observational study. Khaledi et al reported on nursing students' reported self-efficacy (Basic Resuscitation Skills Self-efficacy Scale) at CPR following training in either standard fashion or with gamification (Kahoot! Software); self-efficacy was greater in the gamification group (p<0.01).

Summary

In a summary assessment of these new studies, we do not believe that a new systematic review is warranted, nor that the existing ILCOR CoSTR be changed. In making this recommendation, we consider that, between the previous SysRev and this EvUp, a total of 10 RCTs have been identified, with 8 finding a benefit from gamified learning and one finding no benefit. Importantly, one RCT found that subjects taught with GL elements scored worse than non-GL counterparts on a post-training assessment of ALS algorithm knowledge; however, given that the assessment consisted of a score out of 5 total possible points, we do not believe the difference between a mean score of 4.88 and 4.70 is likely to be a meaningful difference.

Among 8 observational studies between the previous SysRev and the current EvUp, 7 studies found a benefit to GL. One newly included observational study found that GL was associated with worse outcomes in secondary school students performing simulated CPR. Given that this one study is the only one to find a negative effect of GL, we do not believe it warrants changing the current recommendation.

Finally, the newly included studies exhibit the same high degree of heterogeneity in terms of intervention, outcome, and subject inclusion that we do not believe including these studies would alter the strength of the existing recommendation.

Reference list:

1.   Cheng P, Huang Y, Yang P, et al. The Effects of Serious Games on Cardiopulmonary Resuscitation Training and Education: Systematic Review With Meta-Analysis of Randomized Controlled Trials. *JMIR serious games* 2024; 12: e52990. DOI: https://dx.doi.org/10.2196/52990.
2.   Donoghue A, Sawyer T, Olaussen A, et al. Gamified learning for resuscitation education: A systematic review. *Resusc Plus* 2024; 18: 100640. 20240417. DOI: 10.1016/j.resplu.2024.100640.
3.   Bilodeau C, Schmolzer GM and Cutumisu M. A Randomized Controlled Simulation Trial of a Neonatal Resuscitation Digital Game Simulator for Labour and Delivery Room Staff. *Children (Basel, Switzerland)* 2024; 11. DOI: https://dx.doi.org/10.3390/children11070793.
4.   Cutumisu M and Schmolzer GM. The Effects of a Digital Game Simulator versus a Traditional Intervention on Paramedics' Neonatal Resuscitation Performance. *Children (Basel, Switzerland)* 2024; 11. DOI: https://dx.doi.org/10.3390/children11020174.
5.   Kim K, Choi D, Shim H, et al. Effects of gamification in advanced life support training for clinical nurses: A cluster randomized controlled trial. *Nurse education today* 2024; 140: 106263. DOI: https://dx.doi.org/10.1016/j.nedt.2024.106263.
6.   Khaledi A, Ghafouri R, Anboohi SZ, et al. Comparison of gamification and role-playing education on nursing students' cardiopulmonary resuscitation self-efficacy. *BMC medical education* 2024; 24: 231. DOI: https://dx.doi.org/10.1186/s12909-024-05230-7.
7.   Rodriguez-Garcia A, Ruiz-Garcia G, Navarro-Paton R, et al. Attitudes and Skills in Basic Life Support after Two Types of Training: Traditional vs. Gamification, of Compulsory Secondary Education Students: A Simulation Study. *Pediatric reports* 2024; 16: 631-643. DOI: https://dx.doi.org/10.3390/pediatric16030053.

2025 Evidence Update
EIT 6413 – Scripted Debriefing vs. Non-scripted Debriefing

Worksheet Author(s): Adam Cheng, Yiqun (Jeffrey) Lin
Task Force: Education, Implementation, and Teams
Date Approved by SAC Representative: 17 October 2024
Conflicts of Interest: none

PICO / Research Question:
Population: Healthcare providers or laypeople receiving resuscitation training (primary), and instructors teaching resuscitation courses (secondary)
Intervention: Debriefing with a cognitive aid, checklist, script or tool
Comparators: Debriefing without the use of a cognitive aid, checklist, script or tool
Outcomes: Primary population: (1) Patient outcomes [CRITICAL]; (2) Improved resuscitation performance in clinical environments [CRITICAL]; (3) Improved learning outcomes (knowledge and skill acquisition and retention [IMPORTANT]; (4) Satisfaction of learning [IMPORTANT].
Secondary population: (5) Quality of teaching / debriefing [IMPORTANT]; (6) Workload / Cognitive load of instructor/debriefer [IMPORTANT]
Study design: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion. Unpublished studies (e.g., conference abstracts, trial protocols) and grey literature were excluded. All relevant publications in any language were included as long as there was an English abstract available.
Time frame: January 1 to October 10, 2024. All languages were included as long as there was an English abstract. The search was performed on October 10, 2024
PROSPERO Registration: Was never registered.

Publication title: Lin Y, Lockey A, Greif R, Cheng A for the Education, Implementation and Teams Task Force of the International Liaison Committee on Resuscitation (ILCOR). The effect of scripted debriefing in resuscitation training: a scoping review. Resuscitation Plus. 2024; 20:18:100581.
Publication date: February 20, 2024

Type (intervention, diagnosis, prognosis): Intervention
Additional Evidence Reviewer(s): none
Conflicts of Interest (financial/intellectual, specific to this question): Intellectual. Adam Cheng and Yiqun Lin were contributing authors on several papers included in the initial review.
Year of last full review: 2023

Last ILCOR Consensus on Science and Treatment Recommendation:
No CoSTR as this was initially conducted as a scoping review.
Last Evidence Update Summary: An extensive search of the databases *(see search strategy)* yielded 1151 citations. Of these, 11 articles were included for full-text review, which resulted in 6 eligible studies being included with publication years ranging from 2013 to 2023[1-6]. We found 5 randomized controlled studies[1-5] and one quasi-experimental (non-RCT) study[6]; three were conducted in Canada and/or the USA[1, 3, 4], and one each was conducted in Norway[6], Australia[5], and Germany[2]. In each of the included studies, clinical resuscitation scenarios were provided as the trigger for the debriefing. Three studies utilized pediatric scenarios[1, 4, 5] and three others had adult scenarios[2, 3, 6]. Five of the studies had real participants (healthcare providers or trainees) in the simulated scenarios and debriefings[1, 2, 4-6], while one study used pre-recorded scenarios and actors as participants in the debriefing (i.e. study population were the debriefers)[3]. The nature of the scripted debriefing intervention varied amongst the included studies. Five studies[1, 3-6] used debriefing scripts that included a debriefing framework, topics for discussion and suggested phrasing, with the other paper describing a script comprised of a framework and teamwork principles (i.e. topics) but no suggested phrases[2].   Four additional studies assessed a wide range of learning outcomes, with mixed results[1, 2, 4, 6]. Two studies assessing debriefing quality in scripted vs. non-scripted groups demonstrated mixed results, and ene randomized trial evaluated the impact of a PEARLS scripted debriefing tool when used by novice debriefers (i.e. simulation fellows) showed reduced cognitive load with scripted debriefing[3].

2023 and 2024 Search Strategy:
Medline
1."cognitive aid".kf,tw.

2. script*.kf,tw.
3."cognitive tool".kf,tw.
4.(debriefing adj4 tool*).kf,tw.
5.(debriefing adj4 algorithm).kf,tw.
6.(debriefing adj4 checklist).kf,tw.
7.(debriefing adj4 form).kf,tw.
8.(debriefing adj4 aid).kf,tw.
9.(debriefing adj4 guide).kf,tw.
10.(debriefing adj4 template).kf,tw.
11.(debriefing adj4 model).kf,tw.
12.1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
13.debrief*.kf,tw.
14.exp Computer Simulation/
15.(12 and 13) not 14

EMBASE
1.debrief*.kf,tw.
2.script*.kf,tw.
3."cognitive aid".kf,tw.
4.(cognitive adj4 tool).kf,tw.
5.(debriefing adj4 tool).kf,tw.
6.(debriefing adj4 template).kf,tw.
7.(debriefing adj4 model).kf,tw.
8.(debriefing adj4 checklist).kf,tw.
9.(debriefing adj4 algorithm).kf,tw.
10.(debriefing adj4 script).kf,tw.
11.(debriefing adj4 form).kf,tw.
12.(debriefing adj4 guide).kf,tw.
13.(debriefing adj4 aid).kf,tw.
14. 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13
15.1 and 14
16.exp computer simulation/
17.15 not 16

Scopus
(TITLE-ABS-KEY (debriefing) AND TITLE-ABS-KEY ("scripted" OR "script" OR "cognitive guidance" OR "debriefing guidance" OR "cognitive aid" OR "debriefing algorithm" OR "debriefing checklist" OR "debriefing template" OR "debriefing tool" OR "debriefing model"))

Database searched: PubMed, Scopus, Embase
Date Search Completed: January 05 (end of last search) to October 10, 2024
Search Results (Number of articles identified / number identified as relevant): 100 identified, 0 were relevant
Inclusion/Exclusion Criteria: *Inclusion:* Studies comparing the use of debriefing scripts, tools, cognitive aids or checklists to debriefing without any adjuncts; and the context of studies was resuscitation training, including adult and/or pediatric BLS and ALS courses, neonatal resuscitation courses, or local/ institutional resuscitation training sessions, courses or programs. *Exclusion:* No English abstract available; unpublished studies (e.g., conference abstracts, trial protocols), letters, editorials, comments, case reports and grey literature; and studies describing the use of debriefing scripts, tools, cognitive aids or checklists outside of the resuscitation training environment.
Link to Article Titles and Abstracts : No new studies identified.
Summary of Evidence Update: No new studies identified.
Reviewer Comments (including whether meet criteria for formal review): As there were no new studies identified, this evidence update does not trigger a systematic review.

2025 Evidence Update
EIT 6414 – Rapid Cycle Deliberate Practice in Resuscitation Training

Worksheet Author(s): Cristian Abelairas-Gómez, Aaron Donoghue
Task Force: Education, Implementation, and Teams
Conflicts of Interest: none

PICOST / Research Question:
Population: Learners in training for BLS or ALS
Intervention: Instruction that uses Rapid cycle deliberate practice (RCDP)
Comparators: Traditional instruction or other forms of learning without RCDP
Outcomes: Knowledge acquisition and retention, skills acquisition and retention, skill performance in real CPR, attitudes, willingness to help, and patients' survival
Study Designs: RCTs and non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion. Unpublished studies (e.g. conference abstracts, trial protocols) were excluded. All languages were included as long as there was an English abstract available.
Timeframe   From September 1, 2022 to October 30, 2024**.**

Year of last full review: 2023 (CoSTR 2024)
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest that it may be reasonable to include Rapid Cycle Deliberate Practice as an instructional design feature of BLS and ALS training (weak recommendation, very low–certainty evidence).

Current Search Strategy:
Embase 1974 to 2023 September 18, Ovid MEDLINE(R) ALL 1946 to September 18, 2023

1	Resuscitation/ or Cardiopulmonary Resuscitation/ or Heart Massage/ or Heart Arrest/ or "Out-of-Hospital Cardiac Arrest"/ or cardiopulmonary arrest/
2	(resuscitat* or ((cardiac or heart) adj2 (massag* or compression*)) or (chest adj2 compression*) or CPR or "life support" or ACLS or BCLS or BLS or "cardiac arrest" or "heart arrest").ti,ab,kf,kw.
3	1 or 2 [RESUSCITATION]
4	("deliberate practice" or RCDP* or "rapid cycl*" or "stop and go" or "time out" or "time outs" or (single adj2 session) or debriefing or master* or feedback).ti,ab,kf,kw.
5	Feedback/ or "feedback system"/
6	4 or 5 [RCDP]
7	3 and 6 [RESUSCITATION + RCDP]
8	(Animals/ or "Animal Experimentation"/ or "Models, Animal"/ or "Disease Models, Animal"/) not (Humans/ or "Human Experimentation"/)
9	(exp "animal model"/ or exp "animal experiment"/ or "nonhuman"/ or exp "vertebrate"/) not (exp "human"/ or exp "human experiment"/)
10	7 not (8 or 9) [ANIMAL STUDIES REMOVED]
11	(comment or editorial or "newspaper article" or news or note or lecture).pt.
12	(letter not (letter and randomized controlled trial)).pt.
13	10 not (11 or 12) [OPINION PIECES REMOVED]
14	(conference abstract or "conference review").pt.
15	13 not 14 [CONFERENCES REMOVED]
16	Case Reports.pt. or case report/ or exp case study/
17	15 not 16 [CASE REPORTS REMOVED]
18	limit 17 to english language
19	limit 17 to abstracts
20	18 or 19 [ENGLISH LANGUAGE OR ENGLISH ABSTRACT]
21	remove duplicates from 20

Cochrane Library via Wiley

#1   (resuscitat* OR ((cardiac OR heart) NEAR/2 (massag* OR compression*)) OR (chest NEAR/2 compression*) OR CPR OR "life support" OR ACLS OR BCLS OR BLS):ti,ab,kw

#2   ("deliberate practice" OR RCDP* OR (rapid NEXT cycl*) OR "stop and go" OR "time out" OR "time outs" OR (single NEAR/2 session) OR debriefing OR master* OR feedback):ti,ab,kw

#3   #1 AND #2

#4   ([mh ^"Animals"] OR [mh ^"Animal Experimentation"] OR [mh ^"Models, Animal"] OR [mh ^"Disease Models, Animal"]) NOT ([mh ^Humans] OR [mh ^"Human Experimentation"])

#5   #3 NOT #4

#6   (comment OR editorial OR "newspaper article" OR news OR note OR lecture):pt

#7   (letter NOT (letter AND randomized controlled trial)):pt

#8   "case reports":pt

#9   (conference OR "conference abstract" OR "conference review" OR congresses):pt

#10   #3 NOT #9

#11   English:la

#12   #10 AND #11

#13   #10 in Cochrane Reviews, Trials

Database searched: Medline, Embase, Cochrane
Time Frame: (existing PICOST): September 2023 from inception
Time Frame: (EvUp): From September 1, 2022 to October 30, 2024
Date Search Completed: October 30, 2024
Search Results (Number of articles identified and number identified as relevant): 255 identified. 3 relevant articles (1 SyR and 2 RCT).

Summary of 2024 search results (EvUp)		
Database	**Date Searched**	**Results**
Embase	Oct 2024	26
Medline	Oct 2024	209
Cochrane library	Oct 2024	61
TOTAL after duplicates removed		**255**
Articles meeting inclusion criteria		**2**

Summary of Evidence Update:
Relevant Guidelines or Systematic Reviews: 1

Organization (if relevant); Author; Year Published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
Abelairas-Gómez; 2024	SyR	Rapid Cycle Deliberate Practice in Resuscitation Training	8	-It may be reasonable to include Rapid Cycle Deliberate Practice as an instructional design feature of BLS and ALS training. -Substantial variations of delivering Rapid Cycle Deliberate Practice exist and there is no uniform use of this instructional design.	We suggest that it may be reasonable to include Rapid Cycle Deliberate Practice as an instructional design feature of BLS and ALS training (weak recommendation, very low–certainty evidence).

RCT: 2

Study Acronym; Author; Year Published	Aim of Study; Study Type; Study Size (N)	Patient Population	Study Intervention (# patients) / Study Comparator	Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)	Relevant 2° Endpoint (if any); Study Limitations; Adverse Events

				(# patients)	
Coelho; 2024	**Study Aim:** To compare PSD and RCDP for pediatric CPR training **Study Type:** RCT	**Inclusion Criteria:** 40 pediatric PGY-1 and 40 pediatric PGY-2 Clinic Hospital of the Faculty of Medicine at University of São Paulo [N=62 RCDP group=33 (split into 8 groups) IS group=29 (split into 7 groups)]	**Intervention:** 45-min of RCDP in a CPA scenario **Comparison:** 15-min of CPA scenario with 30-min of PSD	**1° endpoint:** Time to chest compressions (shown as mean±SD): RCDP group: pre- (36.38±20.6 s) vs post-intervention (23.1±7.99 s), p=0.002 PSD group: pre- (31.38±13.9 s) vs post-intervention (19.1±3.98 s), p=0.027 RCDP group: post-intervention (23.1±7.99 s) vs after 5-6-week wash-out (34.4±4.93 s), p=0.003 PSD group: post-intervention (19.1±3.98 s) vs after 5-6-week wash-out (28.1±11.45 s), no sig No differences on inter-group and interaction analysis	**2° Endpoint:** Time to recognition of CPA, time to checking the rhythm on the monitor, and time to initiation of chest compressions after defibrillation also significantly decreased between pre- and post-intervention in both groups. These times increased after the washout period (no data provided) No differences on inter-group or interaction analysis **Study Limitations:** Small sample size; randomization 1:1 but no information about the process; many of variables are not described with statistics
Raper; 2024	**Study Aim:** To compare the time to performance of ACLS actions between trainees who completed RCDP vs IS **Study Type:** RCT	**Inclusion Criteria:** PGY-1; 43 internal medicine and 12 emergency medicine University of Alabama at Birmingham (N=55 RCDP group=28 IS group=27)	**Intervention:** 45-min of RCDP in an adult scenario **Comparison:** 45-min of IS in an adult scenario with PSD. IS finalized after the fourth pulse check or until 30 minutes	**1° endpoint:** Shown as mean±SD Nine times to critical ACLS tasks were assessed with only significant differences in resuscitation mean pause duration: RCDP: 6.20±2.07; IS; 14.20±6.53, p=0.01.	**2° Endpoint:** Shown as median (min-max) Measured throughout 1-5 Likert-type scale. Post-simulation differences in: self-reported ability to participate: RCDP: 4.5 (4-5); IS; 4 (3-5), p=0.01; stress experienced as participant: RCDP: 2 (1-3); IS; 3 (2-4), p=0.01. No differences in overall effectiveness **Study Limitations:** Small sample size; no blinding; participants had experience as part of resuscitation teams and completed an ACLS course two weeks before the study.
ACLS: Advanced Cardiac Life Support; CPA: Pediatric cardiopulmonary arrest; CPR: Cardiopulmonary resuscitation; IS: Immersive simulation; PSD: Post-simulation debriefing; RCDP: Rapid Cycle Deliberate Practice; RCT: Randomized controlled trial; SD: Standard deviation.					

Reviewer Comments:

There were 255 new articles identified of which 2 were relevant to the PICO.

Coelho et al aimed to compare PSD and RCDP for pediatric CPR training. Sixty-two pediatric PGY-1 and PGY-2 were included, after randomization, into two groups: RCDP group and PSD group. They were, at the same time, distributed into small groups (RCPD: 8 groups; PSD: 7 groups). All participants were involved in a pediatric cardiac arrest simulated scenario (pre-intervention). Then, they received training according with their instructional design: 45-min of RCDP and 15 min of simulation with 30-min of PSD. Finally, both groups participated again in two rounds of simulated pediatric cardiopulmonary arrest to assess the simulated pediatric cardiopulmonary resuscitation performance gain (post-intervention) and retention after a 5-6-week washout period (retention). Time to chest compressions decreased from pre-intervention scenario to the post-intervention test scenario and increased from post-intervention to retention test. There were no differences on inter-group and interaction analysis.

Raper et al aimed to compare the time to performance of ACLS actions between trainees who completed RCDP vs IS. Fifty-five PGY-1 of internal medicine and emergency medicine were distributed into two groups: RCDP group (n=28) and IS group (n=27). Both

groups received 45-min-training of RCDP and IS with PSD respectively. Nine times to critical ACLS tasks were assessed after training with only significant differences in resuscitation mean pause duration (RCDP: 6.20±2.07; IS; 14.20±6.53, p=0.01). In addition, participants scored their ability to lead and their levels of anticipated stress similarly. However, RCDP group rated their ability to participate in resuscitation more highly (4.50 vs 3.96, p=0.01). The RCDP groups also reported their realized stress of participating in the event as lower than that of the IS groups (2.36 vs 2.85, P = 0.01).

On the basis of this one additional non-randomized study, we do not believe there is any justification for a fresh systematic review at this time.

Reference list:

Coelho LP, et al. Rapid cycle deliberate practice versus postsimulation debriefing in pediatric cardiopulmonary resuscitation training: a randomized controlled study. Einstein (São Paulo). 2024;22:eAO0825. Doi: https://doi.org/10.31744/einstein_journal/2024AO0825.

Raper JD, et al. Rapid Cycle Deliberate Practice Training for Simulated Cardiopulmonary Resuscitation in Resident Education. West J Emerg Med. 2024;25:197–204. Doi: https://doi.org/10.5811/westjem.17923

2025 Evidence Update
EIT 6415 – Team Competences in Resuscitation Training

Worksheet Author(s): Barbara Farquharson, Sabine Nabecker
Task Force: Education, Implementation, and Teams
Conflicts of Interest: none

PICOST / Research Question:
Population: Learners undertaking life support training in any setting;
Intervention: Life support training with a specific emphasis on team competencies training;
Comparators: Life support training without specific emphasis on team competencies training;
Outcomes: Patient survival (actual resuscitation), cardiopulmonary resuscitation (CPR) skill performance at course completion (simulation), CPR skill performance (in actual resuscitation and simulation) <1yr and ≥ 1yr of course completion; CPR quality (simulation) (at course completion, <1yr and ≥ 1yr of course completion); confidence (at course completion and <1yr and ≥ 1yr of course completion), teamwork competencies (in actual resuscitation and simulation) (at course completion, <1yr and ≥ 1yr of course completion); resources (time, equipment, cost);
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-RCT, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion. Studies evaluating scoring systems (no relevant outcome), and studies with self-assessment as the only outcome were excluded, as well as reviews and unpublished studies (e.g., conference abstracts, trial protocols).
Timeframe: Literature was searched from inception to 30 Aug 2023, and updated January 18, 2024 and updated again 06 November 2024 . All languages were included if there was an English abstract available.

Year of last full review: 2023
Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
Based on the evidence found in this systematic review the Task Force suggests that teaching teamwork competencies be included in BLS and all kinds of advanced life support training (weak recommendation, very low quality of evidence).

Current Search Strategy
Ovid MEDLINE(R)

1	exp "Resuscitation"/ or (resuscitat* or ((cardiac or heart) adj2 (massag* or compression*)) or (chest adj2 compression*) or CPR or "life support" or ACLS or BCLS or BLS).ti,ab,kf,kw. [RESUSCITATION]	169125
2	"Education"/ or exp "Education, Medical"/ or "Education, Graduate"/ or "Education, Professional"/ or "Education, Nonprofessional"/ or exp "Education, Nursing"/ or exp "Inservice Training"/ or "Teaching"/ or "Models, Educational"/ or "Problem-Based Learning"/ or exp "Simulation Training"/ or "Health Education"/ or "Learning"/ or exp "Curriculum"/ or education.fs.	649985
3	(educat* or train* or teach* or inservice or "in service" or student*).ti,ab,kf,kw.	1778305
4	exp "Professional Competence"/ or competenc*.ti,ab,kf,kw.	220910
5	or/2-4 [EDUCATION]	2138137
6	1 and 5 [RESUSCITATION + EDUCATION]	19246
7	"Leadership"/ or "Crew Resource Management, Healthcare"/ or "Patient Care Team"/ or " Hospital Rapid Response Team"/ or "Nursing, Team"/	119433
8	("crisis resource management" or "crew resource management" or "healthcare CRM*" or "health care CRM*" or leader* or team or teams or teamwork).ti,ab,kf,kw.	325865
9	7 or 8 [LEADERS/TEAMWORK]	389864
10	1 and 5 and 9 [RESUSCITATION + EDUCATION + LEADERS/TEAMWORK]	3117
11	(Animals/ or "Animal Experimentation"/ or "Models, Animal"/ or "Disease Models, Animal"/) not (Humans/ or "Human Experimentation"/)	5153719
12	10 not 11 [ANIMAL STUDIES REMOVED]	3113
13	(comment or editorial or "newspaper article" or news or note or lecture).pt.	1728867
14	(letter not (letter and randomized controlled trial)).pt.	1234230
15	12 not (13 or 14) [OPINION PIECES REMOVED]	3054

16	Case Reports.pt. or case report/ or exp case study/	2379747
17	15 not 16 [CASE REPORTS REMOVED]	2984
18	limit 17 to english language	2754
19	limit 17 to abstracts	2889
20	18 or 19	2968
21	limit 20 to yr="1999 -Current" [English language, 1999-Current]	2674

Embase

1	exp "resuscitation"/ or (resuscitat* or ((cardiac or heart) adj2 (massag* or compression*)) or (chest adj2 compression*) or CPR or "life support" or ACLS or BCLS or BLS).ti,ab,kf,kw. [RESUSCITATION]	203038
2	"education"/ or exp "medical education"/ or exp "graduate education"/ or "nursing education"/ or "nurse training"/ or "emergency medical services education"/ or exp "in service training"/ or "teaching"/ or "educational model"/ or "problem based learning"/ or exp "simulation training"/ or "health education"/ or "learning"/ or "curriculum"/ or education.fs.	1237432
3	(educat* or train* or teach* or inservice or "in service" or student*).ti,ab,kf,kw.	2325915
4	exp "professional competence"/ or competenc*.ti,ab,kf,kw.	171788
5	or/2-4 [EDUCATION]	2897290
6	1 and 5 [RESUSCITATION + EDUCATION]	29275
7	"leadership"/ or "patient care team"/ or "collaborative care team"/ or "rapid response team"/ or "team nursing"/	99509
8	("crisis resource management" or "crew resource management" or "healthcare CRM*" or "health care CRM*" or leader* or team or teams or teamwork).ti,ab,kf,kw.	484897
9	7 or 8 [LEADERS/TEAMWORK]	519306
10	1 and 5 and 9 [RESUSCITATION + EDUCATION + LEADERS/TEAMWORK]	5401
11	(exp "animal model"/ or exp "animal experiment"/ or "nonhuman"/ or exp "vertebrate"/) not (exp "human"/ or exp "human experiment"/)	6846345
12	10 not 11 [ANIMAL STUDIES REMOVED]	5386
13	(comment or editorial or "newspaper article" or news or note or lecture).pt.	1766723
14	(letter not (letter and randomized controlled trial)).pt.	1304966
15	12 not (13 or 14) [OPINION PIECES REMOVED]	5284
16	Case Reports.pt. or case report/ or exp case study/	3038906
17	15 not 16 [CASE REPORTS REMOVED]	4995
18	("conference abstract" or "conference review").pt.	5042376
19	17 not 18 [CONFERENCE ABSTRACTS REMOVED]	2790
20	limit 19 to english language	2545
21	limit 19 to abstracts	2724
22	20 or 21	2786
23	limit 22 to yr="1999 -Current"	2552

Cochrane Library via Wiley
Cochrane Database of Systematic Reviews
Cochrane Central Register of Controlled Trials

#1	(((cardiac or heart) NEAR/2 (massag* or compression*)) or (chest NEAR/2 compression*) or CPR or "life support" or ACLS or BCLS or BLS):ti,ab,kw	4576
#2	(educat* or train* or teach* or inservice or "in service" or student* or competenc*):ti,ab,kw	268791
#3	("crisis resource management" or "crew resource management" or "healthcare CRM" or "health care CRM" or "healthcare CRMs" or "health care CRMs" or leader* or team or teams or teamwork):ti,ab,kw	35613

#4	#1 AND #2 AND #3	300
#5	#1 AND #2 AND #3 with Cochrane Library publication date Between Jan 1999 and Jan 2024, in Trials	297
#6	#1 AND #2 AND #3 with Cochrane Library publication date Between Jan 1999 and Jan 2024, in Cochrane Reviews	2
#7	#5 OR #6	299

Database searched: Medline, Embase and Cochrane
Time Frame: (existing PICOST): updated from 01 January 2024 (overlap with end of last search)
Date Search Completed: 06 November 2024 (Medline and Cochrane), 18 November (Embase)
Search Results (Number of articles identified and number identified as relevant):

> 404 articles identified
> 286 duplicates
> 257 articles screened
> 11 full-texts assessed
> 2 identified as relevant

Summary of Evidence Update:

Two studies (both randomized controlled trials) were identified for inclusion in this Evidence Update. One evaluated a flipped classroom approach (providing e-learning on team roles prior to ALS)[1] and one the TeamSTEPPs interprofessional team training as part of ALS.[2]

Ohlenburg[1] reported no significant difference between the intervention and control group in any CPR parameter, and similarly, Yun [2] found no difference in technical skills but did find a significantly greater improvement in clinical competencies in the intervention group vs. control group.

Ohlenburgh[1] found global team performance and most team-related competencies were higher in the intervention group compared to the control group. Yun[2] found a significantly greater change in non-technical skills in the intervention group compared to the control group, but no difference in communication clarity.

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; Farquharson; 2024[3]	Systematic review	Teaching team competencies within resuscitation training	17	Benefit of team competencies training for all levels of learners	Based on the evidence found in this systematic review the Task Force suggests that teaching teamwork competencies be included in BLS and all kinds of advanced life support training (weak recommendation, very low quality of evidence).

RCT:

Study Acronym; Author; Year Published	Aim of Study; Study Type; Study Size (N)	Participant 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
Ohlenburg, 2024[1]	**Study Aim:** To assess if a flipped classroom approach with an online workshop prior to an instructor-led course can improve	**Inclusion Criteria:** Final year medical students	**Intervention:** 45-min e-learning session utilizing an interactive online course on team roles (iMuVi) followed by 2 ALS	**1° endpoint:** Except for teamwork , all TEAM scores were higher in the intervention group compared to the control group.	**Study Limitations:** Both groups received the intervention, but at different time points.

	team performance and CPR quality. **Study Type:** Cluster-randomized controlled rater-blinded simulation trial n=111 (22 teams)		simulation scenarios (n=55/11 teams) **Comparison:** ALS simulation scenario, then iMuVi, then 2nd ALS simulation scenario (n=56/11 teams)	Global TEAM rating mark was 7.4 (95% CI 6.9 to 7.8) vs 6.4 (95% CI 5.8 to 6.3 (P < 0.01), leadership 4.5 (95% CI 4.3 to 4.6) vs 3.9 (95% CI 3.6 to 4.1) (P < 0.001), Task 4.4 (95% CI 4.2 to 4.5) vs 3.8 (95% CI 3.5 to 4.0) (P < 0.001), and summative score 4.4 (95% CI 4.3 to 4.5) vs 4.1 (95% CI 3.9 to 4.3) (P < 0.01). There was no significant difference in any CPR parameter between control and intervention in this comparison.	
TeamSTEPPS Yun, 2024(2)	**Study Type:** Randomized controlled trial (no blinding) n=115	**Inclusion Criteria:** Residents (n=73) and nurses (n=42)	**Intervention:** 45-min interprofessional communication team training program incorporated into an established ALS course (n=56/10 teams) **Comparison:** ALS course alone (n=59/10 teams)	**1° endpoint:** Communication clarity (self-report): no significant difference between intervention and control group.	**Clinical competence:** There was a significant difference in pre- and post clinical competence in simulation between the two groups, Int: 17.00 ± 9.68 vs ctrl: 4.60 ± 11.64 (p = 0.006). Technical skills: no sig difference in post-pre technical skills between intervention and control groups Significant difference in pre- and post- non-technical skills between the two groups, Int: 14.6 ± 8.75 vs ctrl: 3.8 ± 9.89 (p = 0.012), situational awareness sig. Limitations: raw stats not reported

Reviewer Comments: *(including whether this PICOST should have a systematic or scoping review)*
The two new studies identified are consistent in supporting previous findings, however, they do not substantially change the weight of evidence. A further systematic review or scoping review is not currently warranted.

Reference list:

1.	Ohlenburg H, Arnemann PH, Hessler M, Gorlich D, Zarbock A, Friederichs H. Flipped Classroom: Improved team performance during resuscitation training through interactive pre-course content - a cluster-randomised controlled study. BMC Med Educ. 2024;24(1):459.
2.	Yun S, Park HA, Na SH, Yun HJ. Effects of communication team training on clinical competence in Korean Advanced Life Support: A randomized controlled trial. Nurs Health Sci. 2024;26(1):e13106.
3.	Farquharson B, Cortegiani A, Lauridsen KG, Yeung J, Greif R, Nabecker S, et al. Teaching team competencies within resuscitation training: A systematic review. Resusc Plus. 2024;19:100687.