2021 Evidence Update Worksheet
Appendix B1 BLS 1

Worksheet author(s): Giuseppe Ristagno
Date Submitted: February 15th, 2021

PICO / Research Question: ALS-E-030A Paddle size and placement for defibrillation - In adult cardiac arrest (prehospital [OHCA], in-hospital [IHCA]) (P), does the use of any specific paddle/pad size/orientation and position (I) compared with standard resuscitation or other specific paddle/pad size/orientation and position) (C), improve outcomes (e.g. Successful defibrillation, ROSC, survival) (O).
Outcomes: Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. ROSC was ranked as an important outcome. Termination of VF and rates of recurrence of fibrillation/refibrillation were included as important outcomes.
Type (intervention, diagnosis, prognosis): The use of any specific pad size/orientation and position

Additional Evidence Reviewer(s): Theresa Olasveengen

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

Year of last full review: 2020 (Scoping review) **New question:** N.A.

Last ILCOR Consensus on Science and Treatment Recommendation: These treatment recommendations (below) are unchanged from 2010. It is reasonable to place pads on the exposed chest in an anterior-lateral position. An acceptable alternative position is anterior posterior. In large-breasted individuals, it is reasonable to place the left electrode pad lateral to or underneath the left breast, avoiding breast tissue. Consideration should be given to the rapid removal of excessive chest hair before the application of pads, but emphasis must be on minimizing delay in shock delivery.
There is insufficient evidence to recommend a specific electrode size for optimal external defibrillation in adults. However, it is reasonable to use a pad size greater than 8 cm.

2010/2015 Search Strategy: (("Heart Arrest"[Mesh] OR "Cardiopulmonary Resuscitation"[Mesh] OR "Electric Countershock"[Mesh])) AND (("pad*" OR “impedance"[All Fields] OR “transthoracic"[All Fields] OR "transthoracic impedance"[All Fields] OR "transthoracic resistance"[All Fields])).

2020 Search Strategy:

1	Electric Countershock/
2	Defibrillators/
3	(defibrillat* or AED or electroversion? or electro-version? or cardioversion? or cardio-version? or electric countershock? or electric counter-shock?).tw,kf.
4	(cardiac adj2 stimulator?).tw,kf.
5	or/1-4 [DEFIBRILLATORS]
6	Cardiography, Impedance/ or Electric Impedance/ or Electric Conductivity/
7	((transthoracic adj2 (impedance or resistance)) or TTI or TTR).tw,kf.
8	(electric* adj2 (conductiv* or impedance)).tw,kf.
9	((orientation? or position* or placement or placed or placing or situated or shape? or size? or rectangl* or square or anterior* or posterior* or anteroposterior* or antero-posterior* or lateral* or lateroposterior* or latero-posterior* or longitudinal* or transverse*) adj2 (pad? or paddle? or electrode? or defibrillat* or AED)).tw,kf.
10	or/6-9 [IMPEDANCE]
11	5 and 10
12	exp Animals/ not (exp Animals/ and Humans/)
13	11 not 12 [ANIMAL-ONLY REMOVED]
14	exp Child/ not (exp Adult/ or Adolescent/)
15	exp Infant/ not (exp Adult/ or Adolescent/)
16	13 not (14 or 15) [CHILD- AND INFANT-ONLY REMOVED]
17	(comment or editorial or news or newspaper article).pt.
18	(letter not (letter and randomized controlled trial)).pt.
19	16 not (17 or 18) [OPINION PIECES REMOVED]
20	19 and (2009* or 2010* or 2011* or 2012* or 2013* or 2014* or 2015* or 2016* or 2017* or 2018* or 2019*).dt.
21	20 use ppez
22	cardioversion/
23	defibrillator/ or exp external defibrillator/
24	(defibrillat* or AED or electroversion? or electro-version? or cardioversion? or cardio-version? or electric countershock? or electric counter-shock?).tw,kw.
25	(cardiac adj2 stimulator?).tw,kw.
26	or/22-25 [DEFIBRILLATORS]
27	impedance cardiography/ or impedance/ or electric conductivity/ or electric resistance/
28	((transthoracic adj2 (impedance or resistance)) or TTI or TTR).tw,kw.
29	(electric* adj2 (conductiv* or impedance)).tw,kw.
30	((orientation? or position* or placement or placed or placing or situated or shape? or size? or rectangl* or square or anterior* or posterior* or anteroposterior* or antero-posterior* or lateral* or lateroposterior* or latero-posterior* or longitudinal* or transverse*) adj2 (pad? or paddle? or electrode? or defibrillat* or AED)).tw,kw.
31	or/27-30 [IMPEDANCE]
32	26 and 31
33	exp animal experimentation/ or exp animal model/ or exp animal experiment/ or nonhuman/ or exp vertebrate/
34	exp human/ or exp human experimentation/ or exp human experiment/
35	32 not (33 not 34) [ANIMAL-ONLY REMOVED]
36	exp adolescent/ not (exp adult/ and exp adolescent/)
37	exp child/ not (exp adult/ and exp child/)
38	fetus/ not (exp adult/ and fetus/)
39	35 not (36 or 37 or 38) [UNDER 18 REMOVED]

40 editorial.pt.
41 letter.pt. not (randomized controlled trial/ and letter.pt.)
42 39 not (40 or 41) [OPINION PIECES REMOVED]
43 conference abstract.pt.
44 42 not 43 [CONFERENCE ABSTRACTS REMOVED]
45 44 and (2009* or 2010* or 2011* or 2012* or 2013* or 2014* or 2015* or 2016* or 2017* or 2018* or 2019*).dc.
46 45 use oemezd
47 Electric Countershock/
48 Defibrillators/
49 (defibrillat* or AED or electroversion? or electro-version? or cardioversion? or cardio-version? or electric countershock? or electric counter-shock?).tw,kw.
50 (cardiac adj2 stimulator?).tw,kw.
51 or/47-50 [DEFIBRILLATORS]
52 Cardiography, Impedance/ or Electric Impedance/ or Electric Conductivity/
53 ((transthoracic adj2 (impedance or resistance)) or TTI or TTR).tw,kw.
54 (electric* adj2 (conductiv* or impedance)).tw,kw.
55 ((orientation? or position* or placement or placed or placing or situated or shape? or size? or rectangl* or square or anterior* or posterior* or anteroposterior* or antero-posterior* or lateral* or lateroposterior* or latero-posterior* or longitudinal* or transverse*) adj2 (pad? or paddle? or electrode? or defibrillat* or AED)).tw,kw.
56 or/52-55 [IMPEDANCE]
57 51 and 56
58 exp Child/ not (exp Adult/ or Adolescent/)
59 exp Infant/ not (exp Adult/ or Adolescent/)
60 57 not (58 or 59) [CHILD- AND INFANT-ONLY REMOVED]
61 conference abstract.pt.
62 60 not 61 [CONFERENCE ABSTRACTS REMOVED]
63 62 and (2009* or 2010* or 2011* or 2012* or 2013* or 2014* or 2015* or 2016* or 2017* or 2018* or 2019*).up,pd,dp,dr.
64 63 use coch [COCHRANE DATABASE OF SYSTEMATIC REVIEWS]
65 63 use cctr [COCHRANE CENTRAL]
66 63 use acp [ACP JOURNAL CLUB]
67 63 use dare [DATABASE OF ABSTRACTS OF REVIEWS OF EFFECTS]
68 63 use clcmr [COCHRANE METHODOLOGY REGISTER DATABASE]
69 63 use clhta [HEALTH TECHNOLOGY ASSESSMENT DATABASE]
70 63 use cleed [NATIONAL HEALTH SERVICE ECONOMIC EVALUATION DATABASE]
71 21 or 46 or 64 or 65 or 66 or 67 or 68 or 69 or 70 [ALL DATABASES - NO DUPLICATES REMOVED]
72 remove duplicates from 71 [TOTAL UNIQUE RECORDS]
73 72 use ppez [MEDLINE UNIQUE RECORDS]
74 72 use oemezd [EMBASE UNIQUE RECORDS]
75 72 use coch [COCHRANE DATABASE OF SYSTEMATIC REVIEWS UNIQUE RECORDS]
76 72 use cctr [CENTRAL UNIQUE RECORDS]
77 72 use acp [ACP JOURNAL CLUB UNIQUE RECORDS]
78 72 use dare [DATABASE OF ABSTRACTS OF REVIEWS OF EFFECTS UNIQUE RECORDS]
79 72 use clcmr [COCHRANE METHODOLOGY REGISTER DATABASE]
80 72 use clhta [HEALTH TECHNOLOGY ASSESSMENT DATABASE]

81 72 use cleed [NATIONAL HEALTH SERVICE ECONOMIC EVALUATION DATABASE]

Database searched: Pubmed
Date Search Completed: February 15th, 2021
Search Results (Number of articles identified / number identified as relevant): 187 articles identified / 4 reviewed / 0 relevant
Inclusion/Exclusion Criteria: RCTs and nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion. Unpublished studies (eg, conference abstracts, trial protocols) were excluded. In addition, animal/lab studies, mathematical models, simulation and mannikin studies, algorithm studies with no outcome data, studies on double sequential defibrillation approaches, and unpublished studies (e.g., conference abstracts, trial protocols) and reviews were excluded.

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

Summary of Evidence Update: No new relevant articles were found. Update systematic review for 2021 is not needed.
Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

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
ILCOR; Olasveengen; 2020	Systematic review	Paddle Size and Placement for Defibrillation (ALS-E-030A: ScopRev)	0 relevant from 2010	There are no studies in patients with VF/pulseless VT directly comparing the effects of various positions of paddle/pad placement on defibrillation success and ROSC. Most studies evaluate cardioversion (eg, AF) or secondary end points (eg, TTI). No data on pads size related to survival outcome are available.	Unchanged from 2010

RCT: None

Nonrandomized Trials, Observational Studies: None

Reviewer Comments (including whether meet criteria for formal review):
No new evidence was identified for this question.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 2

Worksheet author(s): Christopher Smith

Date Submitted: 16th February 2021

PICO / Research Question: BLS 1527

In adults sustaining out-of-hospital cardiac arrest (P), does an immediate call for help to EMS dispatch center by a lone rescuer with a mobile phone (I), compared to a call after one minute of CPR (C), improve ROSC, survival to discharge or 30 days, survival with favourable neurological recovery (O)

Outcomes:

ROSC, survival to discharge or 30 days, survival with favourable neurological recovery

Type (intervention, diagnosis, prognosis):

Intervention

Additional Evidence Reviewer(s):

None

Conflicts of Interest (financial/intellectual, specific to this question):

None

Year of last full review:

2019 (informed 2020 CoSTR for BLS)

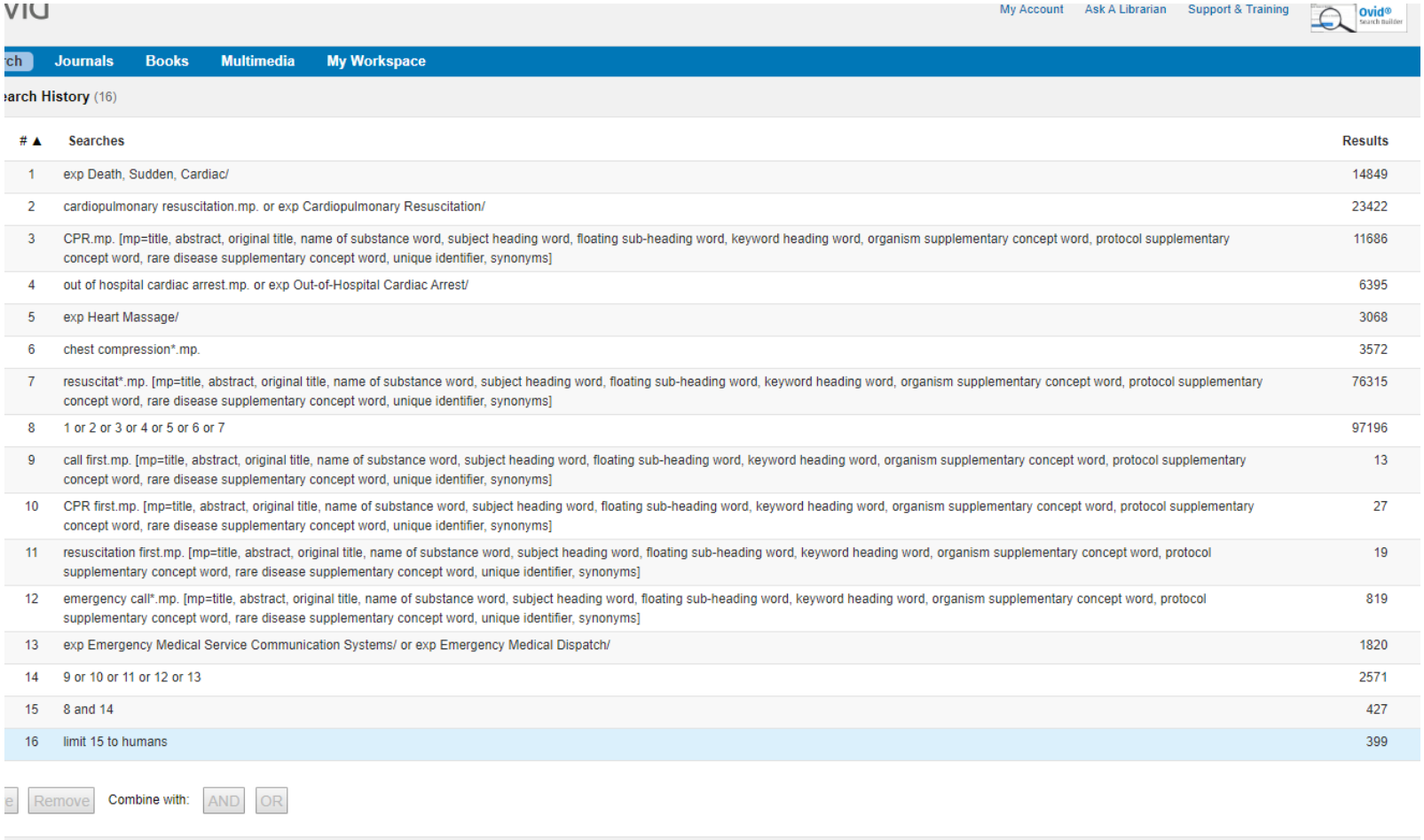
Last ILCOR Consensus on Science and Treatment Recommendation:

We recommend that a lone bystander with a mobile phone should dial EMS, activate the speaker or other hands-free option on the mobile phone, and immediately begin CPR with dispatcher assistance, if required (strong recommendation, very-low-certainty evidence).

2020 Search Strategy:

Searches conducted on 23rd October 2019

MEDLINE



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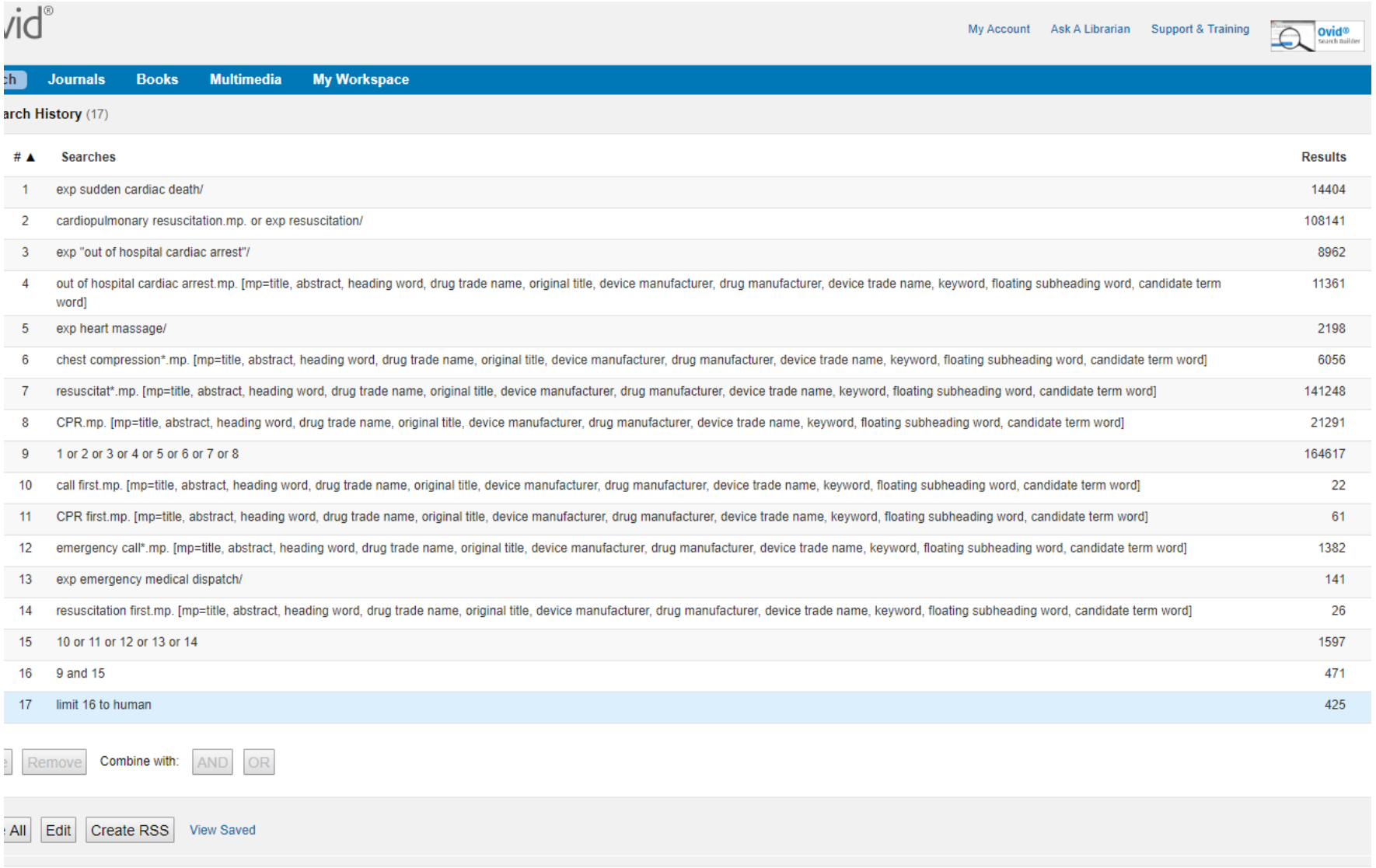
arch History (16)

# ▲	Searches	Results
1	exp Death, Sudden, Cardiac/	14849
2	cardiopulmonary resuscitation.mp. or exp Cardiopulmonary Resuscitation/	23422
3	CPR.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	11686
4	out of hospital cardiac arrest.mp. or exp Out-of-Hospital Cardiac Arrest/	6395
5	exp Heart Massage/	3068
6	chest compression*.mp.	3572
7	resuscitat*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	76315
8	1 or 2 or 3 or 4 or 5 or 6 or 7	97196
9	call first.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	13
10	CPR first.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	27
11	resuscitation first.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	19
12	emergency call*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	819
13	exp Emergency Medical Service Communication Systems/ or exp Emergency Medical Dispatch/	1820
14	9 or 10 or 11 or 12 or 13	2571
15	8 and 14	427
16	limit 15 to humans	399

e Remove Combine with: AND OR

EMBASE



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arch History (17)

# ▲	Searches	Results
1	exp sudden cardiac death/	14404
2	cardiopulmonary resuscitation.mp. or exp resuscitation/	108141
3	exp "out of hospital cardiac arrest"/	8962
4	out of hospital cardiac arrest.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	11361
5	exp heart massage/	2198
6	chest compression*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	6056
7	resuscitat*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	141248
8	CPR.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	21291
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8	164617
10	call first.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	22
11	CPR first.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	61
12	emergency call*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	1382
13	exp emergency medical dispatch/	141
14	resuscitation first.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]	26
15	10 or 11 or 12 or 13 or 14	1597
16	9 and 15	471
17	limit 16 to human	425

e Remove Combine with: AND OR

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Cochrane Library

#1	MeSH descriptor: [Death, Sudden, Cardiac] explode all trees	MeSH	592
#2	MeSH descriptor: [Cardiopulmonary Resuscitation] explode all trees	MeSH	990
#3	cardiopulmonary resuscitation	Limits	2169
#4	CPR	Limits	2093
#5	MeSH descriptor: [Out-of-Hospital Cardiac Arrest] explode all trees	MeSH	314
#6	out of hospital cardiac arrest	Limits	1414
#7	MeSH descriptor: [Heart Massage] explode all trees	MeSH	144
#8	chest compression*	Limits	1394
#9	resuscitat*	Limits	8553
#10	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9	Limits	10665
#11	"call first"	Limits	4
#12	"CPR first"	Limits	15
#13	"resuscitation first"	Limits	9
#14	emergency call*	Limits	2359
#15	MeSH descriptor: [Emergency Medical Service Communication Systems] explode all trees	MeSH	50
#16	MeSH descriptor: [Emergency Medical Dispatch] in all MeSH products	MeSH	2
#17	#11 or #12 or #13 or #14 or #15 or #16	Limits	2403
#18	#10 and #17	Limits	367

Search Results (Number of articles identified / number identified as relevant):

One paper

Inclusion/Exclusion Criteria:

We included RCTs, non-randomised studies, case series with at least five cases. We considered papers in all languages provided there was an English language abstract available for review.

We excluded unpublished studies, conference abstracts, manikin or simulation studies, narrative reviews, editorials or opinions with no primary data, animal studies and experimental / lab models

We set no time limits on our searches

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

Kamikura T, Iwasaki H, Myojo Y, Sakagami S, Takei Y, Inaba H. Advantage of CPR-first over call-first actions for out-of-hospital cardiac arrests in nonelderly patients and of noncardiac aetiology. *Resuscitation* 2015;96:37-45.

https://pubmed.ncbi.nlm.nih.gov/26193378/

Summary of Evidence Update:

MEDLINE, EMBASE and Cochrane library searches re-run on 16-February 2021. MEDLINE and EMBASE searches covered the period 2019-2021 (so there will have been some overlap with the 2019 search and the Cochrane search covered the period October 2019 – present.

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

The searches returned:

MEDLINE: 34 articles
EMBASE: 107 articles
Cochrane: 68 articles

There were no new articles for consideration after title and abstract review

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

This does NOT meet criteria for formal review at this point.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

No new papers identified

2021 Evidence Update Worksheet
Appendix B1 BLS 3

Worksheet author(s): Federico Semeraro
Date Submitted: Feb 16th 2021

PICO / Research Question:
In rescuers performing CPR on adult or paediatric patients (out-of-hospital and in-hospital) (P), does the use of barrier devices (I) as opposed to no such use (C), improve outcome (O) (eg. lower infection risk)?

Outcomes: Lower infection rates, quality of ventilation
Type (intervention, diagnosis, prognosis): Intervention

Additional Evidence Reviewer(s): Theresa M. Olasveengen
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2005

Last ILCOR Consensus on Science and Treatment Recommendation:
Treatment Recommendation
Providers should take appropriate safety precautions when feasible and when resources are available to do so, especially if a victim is known to have a serious infection (eg, HIV, tuberculosis, HBV, or SARS).

2010/2015 Search Strategy:
Database(s): Ovid MEDLINE(R) ALL 1946 to February 15, 2021
Search Strategy:

#	Searches	Results
1	Cardiopulmonary Resuscitation/	18097
2	Infectious Disease Transmission, Patient-to-Professional/	4905
3	1 and 241	
4	Respiration, Artificial/	50511
5	2 and 440	

6	5 not 3	39
7	3 or 6	80
8	Respiratory Protective Devices/	2207
9	1 and 8	5
10	9 not 7	3
11	8 and 4	20
12	masks/	5126
13	11 not 7	17
14	7 or 13	97
15	12 and 2	174
16	15 not 14	167
17	16 or 14	264
18	1 and 12	79
19	18 not 17	74
20	17 or 19	338

2019 Search Strategy: Same as above
Database searched: Pubmed/Medline
Date Search Completed: Feb 16th 2021
Search Results (Number of articles identified / number identified as relevant): 338 / 4
Inclusion/Exclusion Criteria: No exclusion criteria were applied to the search strategy. For the article review only studies whose title or abstract stated the article directly related to disease transmission during CPR or that compared effectiveness in ventilation using barrier devices were further evaluated.

Link to Article Titles and Abstracts (if available on PubMed):
https://pubmed.ncbi.nlm.nih.gov/32325096/
https://pubmed.ncbi.nlm.nih.gov/33039225/
https://pubmed.ncbi.nlm.nih.gov/24773395/
https://pubmed.ncbi.nlm.nih.gov/21330044/

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

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
Couper 2020	Systematic review	Three questions: (1) aerosol generation associated with key interventions; (2) risk of airborne infection transmission associated with key interventions; and (3) the effect of different personal protective equipment strategies.	Eleven studies included: two cohort studies, one case control study, five case reports, and three manikin randomised controlled trials.	We did not find any direct evidence that chest compressions or defibrillation either are or are not associated with aerosol generation or transmission of infection. Data from manikin studies indicates that donning of personal protective equipment delays treatment delivery. Studies provided only indirect evidence, with no study describing patients with COVID-19. Evidence certainty was low or very low for all outcomes.	It is uncertain whether chest compressions or defibrillation cause aerosol generation or transmission of COVID-19 to rescuers. There is very limited evidence and a rapid need for further studies.

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
Barcala-Furelos 2020	Simulation / manikin pilot study was carried out to determine the feasibility of the pre-assembled kit of face-mask and HEPA filter adapted on a pre-set plastic-blanket	Ten rescuers took part in the pilot study.	Intervention: Use of plastic blanket with HEPA filter	The average time to wear PPE and place the pre-assembly kit on the victim was 82 s [IC 58-105]. After 10 min the quality of the resuscitation (QCPR) was 91% [87-94]. Quality chest compressions (CC) were 22% better than ventilations (V). Most of the rescuers (60%) thought that placing the plastic blanket on the victim on the beach was somewhat simple or very simple.	Author conclusion: Plastic blanket plus basic ventilations equipment resource could be a new alternative to be considered for lifeguards to keep ventilation on use while reducing risk transmission

Adelborg 2014	A randomised crossover comparison of mouth-to-face-shield ventilation and mouth-to-pocket-mask ventilation by surf lifeguards in a manikin	Surf lifeguards	Intervention: Mouth-to-face-shield Control: Mouth-to-pocket-mask	Thirty surf lifeguards (mean (SD) age: 25.1 (4.8) years; 21 male, 9 female) were randomly assigned to perform 2 x 3 min of cardiopulmonary resuscitation on a manikin using mouth-to-face-shield ventilation (AMBU LifeKey) and mouth-to-pocket-mask ventilation (Laerdal Pocket Mask). Interruptions in chest compressions per cycle were increased with mouth-to-face-shield ventilation (mean (SD) 8.6 (1.7) s) compared with mouth-to-pocket-mask ventilation (6.9 (1.2) s, $p < 0.0001$). The proportion of effective ventilations was less using mouth-to-face-shield ventilation (199/242 (82%)) compared with mouth-to-pocket-mask ventilation (239/240 (100%), $p = 0.0002$). Tidal volume was lower using mouth-to-face-shield ventilation (mean (SD) 0.36 (0.20) l) compared with mouth-to-pocket-mask ventilation (0.45 (0.20) l, $p = 0.006$). No differences in inspiratory times were observed between mouth-to-face-shield ventilation and mouth-to-pocket-mask ventilation	Author conclusion: Mouth-to-face-shield ventilation increases interruptions in chest compressions, reduces the proportion of effective ventilations and decreases delivered tidal volumes compared with mouth-to-pocket-mask ventilation.
Adelborg 2011	A randomised crossover comparison of mouth-to-pocket and bag-mask ventilation to mouth-to-mouth ventilation by surf lifeguards in a manikin	Surf lifeguards	Intervention: 1. Mouth-to-pocket-mask ventilation 2. Bag-mask-ventilation Control: Mouth-to-mouth	A total of 60 surf lifeguards were included (67% male, 33% female, mean age 25 years). Interruptions in chest compressions were significantly reduced by MMV (8.9 +/- 1.6 s) when compared to MPV (10.7 +/- 3.0 s, $P < 0.001$) and BMV (12.5 +/- 3.5s, $P < 0.001$). Significantly more effective ventilations (visible chest rise) were delivered using MMV (91%) when compared to MPV (79%, $P < 0.001$) and BMV (59%, $P < 0.001$). The inspiratory time was longer during MMV (0.7 +/- 0.2 s) and MPV (0.7 +/- 0.2s, $P < 0.001$ for both) compared to BMV (0.5 +/- 0.2s). Tidal volumes were significantly lower using BMV (0.4 +/- 0.2L) compared to MMV (0.6 +/- 0.2L, $P < 0.001$) and MPV (0.6 +/- 0.3 L, $P < 0.001$), whereas no differences were observed when comparing MMV and MPV.	Author conclusion: MMV reduces interruptions in chest compressions and produces a higher proportion of effective ventilations during lifeguard CPR. This suggests that CPR quality is improved using MMV compared to MPV and BMV.

Nonrandomized Trials, Observational Studies: None

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

No clinical evidence evaluating disease transmission using barrier devices were identified, although a related review on disease transmission during CPR was identified. Simulation studies comparing quality of CPR between mouth-to-mouth ventilation and ventilation using various barrier devices might suggest barrier devices could have an impact of CPR quality. The Basic Life Support Task Force did not find the results of the three simulation manikin studies sufficient to challenge current guidelines and warrant a full review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

Couper K, Taylor-Phillips S, Grove A, Freeman K, Osokogu O, Court R, Mehrabian A, Morley PT, Nolan JP, Soar J, Perkins GD. COVID-19 in cardiac arrest and infection risk to rescuers: A systematic review. Resuscitation. 2020 Jun;151:59-66. doi: 10.1016/j.resuscitation.2020.04.022. Epub 2020 Apr 20.

Barcala-Furelos R, Szpilman D, Abelairas-Gómez C, Alonso-Calvete A, Domínguez-Graña M, Martínez-Isasi S, Palacios-Aguilar J, Rodríguez-Núñez A. Plastic blanket drowning kit: A protection barrier to immediate resuscitation at the beach in the Covid-19 era. A pilot study. Am J Emerg Med. 2020 Nov;38(11):2395-2399. doi: 10.1016/j.ajem.2020.08.101. Epub 2020 Sep 16.

Adelborg K, Bjørnshave K, Mortensen MB, Espeseth E, Wolff A, Løfgren B. A randomised crossover comparison of mouth-to-face-shield ventilation and mouth-to-pocket-mask ventilation by surf lifeguards in a manikin. Anaesthesia. 2014 Jul;69(7):712-6. doi: 10.1111/anae.12669. Epub 2014 Apr 28.

Adelborg K, Dalgas C, Grove EL, Jørgensen C, Al-Mashhadi RH, Løfgren B. Mouth-to-mouth ventilation is superior to mouth-to-pocket mask and bag-valve-mask ventilation during lifeguard CPR: a randomized study.
Resuscitation. 2011 May;82(5):618-22. doi: 10.1016/j.resuscitation.2011.01.009. Epub 2011 Feb 16.

2021 Evidence Update Worksheet
Appendix B1 BLS 4

Worksheet author(s): Julie Considine
Date Submitted: 15 February 2021

PICO / Research Question:
Population: Adults in any setting (in-hospital or out-of-hospital) with (cardiac arrest)

Intervention: Different chest compression rate, depth and incomplete chest wall recoil during CPR,

Comparators: Standard chest compression rate, depth and incomplete chest wall recoil during CPR

Outcomes: Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. Return of spontaneous circulation (ROSC) and physiological measures (e.g., blood pressure and end-tidal PCO2) were ranked as a important outcomes.

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.

Timeframe: All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded. Literature search updated to February 2021.

Additional Evidence Reviewer(s): N/A
Conflicts of Interest (financial/intellectual, specific to this question): Nil

Year of last full review: 2015

Last ILCOR Consensus on Science and Treatment Recommendation: Taskforce Insights (2019)
This scoping review demonstrated that the majority of studies focused on a single chest compression component, whereas a number of studies suggest the presence of confounding interactions that prompt caution when evaluating any chest compression component in isolation.

The majority of the studies identified in this review were focused on out-of-hospital cardiac arrest highlighting a major gap in research in the in-hospital context.

This scoping review has not identified sufficient new evidence to prompt new systematic review.

The information from the studies identified was considered insufficient to alter existing recommendations

2019 Search Strategy:

PubMed

((((“Resuscitation" [Mesh] OR resuscitation[TIAB] OR “Cardiopulmonary Resuscitation”[MeSH] OR CPR[TI] OR “Heart Massage”[MeSH] OR compression*[TIAB] OR “heart massage”[TIAB] OR “cardiac massage”[TIAB] OR "Advanced Cardiac Life Support"[TIAB] OR “high-quality CPR”[TIAB] OR “high quality CPR”[TIAB] OR “CPR metrics”[TIAB] OR “CPR quality”[TIAB] OR “compression quality”[TIAB]) AND (lean*[TIAB] OR “chest recoil”[TIAB] OR recoil*[TIAB] OR (("Thoracic Wall"[Mesh] OR “thoracic wall”[TIAB] OR “chest wall”[TIAB] OR mm/s[TIAB]) AND (Recoil*[TIAB] OR decompress*[TIAB] OR release*[TIAB]))) NOT (animals[Mesh] NOT humans[Mesh]) NOT ("letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])) OR ((((((((((((((((((((Heart Arrest[MeSH Terms]) OR Ventricular Fibrillation[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR "advanced cardiac life support"[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract] OR Basic Life Support[Title/Abstract] OR BLS[Title/Abstract])) AND ((((((((((((((((((((compression rate*[Title/Abstract]) OR cc rate*[Title/Abstract]) OR fast compression[Title/Abstract]) OR slow compression[Title/Abstract]) OR compression ratio[Title/Abstract]) OR compression ratios[Title/Abstract]) OR "compression-decompression ratio"[Title/Abstract]) OR "compression-to-ventilation ratio"[Title/Abstract]) OR "compression-to ventilation ratios"[Title/Abstract]) OR compression-ventilation ratio[Title/Abstract]) OR compression ventilation ratios[Title/Abstract]) OR compression fraction[Title/Abstract]) OR rate directed[Title/Abstract]) OR high impulse[Title/Abstract]) OR CPR rate*[Title/Abstract]) OR fast rate*[Title/Abstract]) OR time dependent[Title/Abstract]) OR interruption*[Title/Abstract]) OR pause*[Title/Abstract]) OR hands off[Title/Abstract]) OR per minute[Title/Abstract]) OR rest[Title/Abstract]))) NOT ((animals[mh] NOT humans[mh])))) NOT (("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp])))) OR ((((((((((((((((((((Heart Arrest[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole*[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Ventricular Fibrillation[MeSH Terms]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR pulseless electrical activity[Title/Abstract]) OR advanced cardiac life support[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract]) OR chest compression*[Title/Abstract]) OR cardiac compression*[Title/Abstract])) AND ((((((((((depth[Title/Abstract]) OR recoil[Title/Abstract]) OR decompression[Title/Abstract]) OR elasticity[Title/Abstract]) OR inches[Title/Abstract]) OR centimetres[Title/Abstract]) OR centimeters[Title/Abstract]) OR depress[Title/Abstract]) OR relaxation[Title/Abstract]) OR chest wall compression[Title/Abstract]) OR chest compression quality[Title/Abstract]) OR compression force[Title/Abstract]))

Embase

('resuscitation'/exp OR resuscitation:ti,ab OR CPR:ti OR 'heart massage'/exp OR compression*:ti,ab OR “heart massage”:ti,ab OR “cardiac massage”:ti,ab OR "Advanced Cardiac Life Support":ti,ab OR “high-quality CPR”:ti,ab OR “high quality CPR”:ti,ab OR “CPR metrics”:ti,ab OR “CPR quality”:ti,ab OR “compression quality”:ti,ab) AND (lean*:ti,ab OR “chest recoil”:ti,ab OR recoil*:ti,ab OR (('thorax wall'/exp OR “thoracic wall”:ti,ab OR “chest wall”:ti,ab OR “mm/s”:ti,ab) AND (Recoil*:ti,ab OR decompress*:ti,ab OR release*:ti,ab))) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim OR 'heart arrest'/exp OR 'heart ventricular

fibrillation'/de OR 'heart arrest':ab,ti OR 'cardiac arrest':ab,ti OR asystole:ab,ti OR 'cardiopulmonary arrest':ab,ti OR 'cardiovascular arrest':ab,ti OR 'cardiopulmonary resuscitation':ab,ti OR cpr:ab,ti OR 'advanced cardiac life support':ab,ti OR acls:ab,ti OR 'basic life support':ab,ti OR bls:ab,ti OR 'heart massage'/de OR 'heart massage':ab,ti OR 'cardiac massage':ab,ti AND ((compression NEAR/3 rate*):ab,ti OR 'cc rate':ab,ti OR 'cc rates':ab,ti OR 'fast compression':ab,ti OR 'slow compression':ab,ti OR (compression NEAR/3 ratio):ab,ti OR (compression NEAR/3 ratios):ab,ti OR 'compression fraction':ab,ti OR 'rate directed':ab,ti OR 'high impulse':ab,ti OR 'per minute':ab,ti OR 'per min':ab,ti OR 'cpr rate':ab,ti OR 'cpr rates':ab,ti OR 'fast rate':ab,ti OR 'fast rates':ab,ti OR 'time+dependent':ab,ti OR interruption*:ab,ti OR pause*:ab,ti OR 'hands+off':ab,ti OR rest:ab,ti) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim OR (‘Heart Arrest’/exp OR ‘heart arrest’:ab,ti OR ‘cardiac arrest’:ab,ti OR asystole*:ab,ti OR ‘cardiopulmonary arrest’:ab,ti OR ‘cardiovascular arrest’:ab,ti OR ‘Heart Ventricular Fibrillation’/de OR ‘cardiopulmonary resuscitation’:ab,ti OR CPR:ab,ti OR ‘pulseless electrical activity’:ab,ti OR ‘advanced cardiac life support’:ab,ti OR ACLS:ab,ti OR ‘Heart Massage’/de OR ‘heart massage’:ab,ti OR ‘cardiac massage’:ab,ti OR ‘chest compression’:ab,ti OR ‘cardiac compression’:ab,ti) AND (depth:ab,ti OR recoil:ab,ti OR decompression:ab,ti OR elasticity:ab,ti OR inches:ab,ti OR centimetres:ab,ti OR centimeters:ab,ti OR depress:ab,ti OR relaxation:ab,ti OR ‘chest wall compression’:ab,ti OR ‘chest compression quality’:ab,ti OR ‘compression force’:ab,ti) AND [Embase]/lim

Cochrane
([mh ^Resuscitation] OR resuscitation:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR CPR:ab,ti OR [mh “Heart Massage”] OR compression*:ab,ti OR “heart massage”:ab,ti OR “cardiac massage”:ab,ti OR "Advanced Cardiac Life Support":ab,ti OR “high-quality CPR”:ab,ti OR “high quality CPR”:ab,ti OR “CPR metrics”:ab,ti OR “CPR quality”:ab,ti OR “compression quality”:ab,ti) AND ((lean*:ab,ti OR “chest recoil”:ab,ti OR recoil*:ab,ti) OR ([mh "Thoracic Wall"] OR “thoracic wall”:ab,ti OR “chest wall”:ab,ti) AND (Recoil*:ab,ti OR decompress*:ab,ti OR release*:ab,ti)) NOT ([mh animals] NOT [mh humans]) OR ([mh “Heart Arrest”] OR [mh “Ventricular Fibrillation”] OR “heart arrest”:ab,ti OR “cardiac arrest”:ab,ti OR asystole:ab,ti OR “cardiopulmonary arrest”:ab,ti OR “cardiovascular arrest”:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR resuscitation:ab,ti OR CPR:ab,ti OR “advanced cardiac life support”:ab,ti OR ACLS:ab,ti OR “basic life support”:ab,ti OR BLS:ab,ti OR [mh “Heart Massage”] OR “heart massage*”:ab,ti OR “cardiac massage*”:ab,ti) AND ((compression near/3 rate*):ab,ti or "cc rate*":ab,ti or "fast compression":ab,ti or "slow compression":ab,ti or (compression near/3 ratio):ab,ti or (compression near/3 ratios):ab,ti or "compression fraction":ab,ti or "rate directed":ab,ti or "high impulse":ab,ti or "per min*":ab,ti or "CPR rate*":ab,ti or "fast rate*":ab,ti or "time dependent":ab,ti or interruption*:ab,ti or pause*:ab,ti or "hands-off":ab,ti or rest:ab,ti, OR ([mh “Heart Arrest”] or “heart arrest”:ab,ti or “cardiac arrest”:ab,ti or Asystole*:ab,ti or “cardiopulmonary arrest”:ab,ti or “cardiovascular arrest”:ab,ti or [mh “Ventricular Fibrillation”] or [mh “Cardiopulmonary Resuscitation”] or resuscitation:ab,ti or CPR:ab,ti or “pulseless electrical activity”:ab,ti or “advanced cardiac life support”:ab,ti or ACLS:ab,ti or [mh “Heart Massage”] or “heart massage”:ab,ti or “cardiac massage”:ab,ti or “chest compression”:ab,ti or “cardiac compression”:ab,ti) AND (depth:ab,ti or recoil:ab,ti or decompression:ab,ti or elasticity:ab,ti or inches:ab,ti or centimetres:ab,ti or centimeters:ab,ti or depress:ab,ti or relaxation:ab,ti

2020 Search Strategy: as above
Database searched: Medline, Embase, Cochrane
Date Search Completed: 15 February 2021
Search Results (Number of articles identified / number identified as relevant): Nil

Inclusion/Exclusion Criteria: Unpublished studies or studies published in abstract form only, manikin studies, animal studies, and studies that did not specifically address the PICO questions related to CC rate, CC depth, chest wall recoil, and leaning were excluded.
Link to Article Titles and Abstracts (if available on PubMed): N/A

Summary of Evidence Update:
No new papers related to this PICOST have been identified since the 2019 scoping review.

Evidence Update Process for topics not covered by ILCOR Task Forces

2. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies: None

Reviewer Comments (including whether meet criteria for formal review):
No new evidence identified for this question.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list
SEARCH STRATEGY

1. MEDLINE

Chest compression depth
((((“Resuscitation" [Mesh] OR resuscitation[TIAB] OR “Cardiopulmonary Resuscitation”[MeSH] OR CPR[TI] OR “Heart Massage”[MeSH] OR compression*[TIAB] OR “heart massage”[TIAB] OR “cardiac massage”[TIAB] OR "Advanced Cardiac Life Support"[TIAB] OR “high-quality CPR”[TIAB] OR “high quality CPR”[TIAB] OR “CPR metrics”[TIAB] OR “CPR quality”[TIAB] OR “compression quality”[TIAB]) AND (lean*[TIAB] OR “chest recoil”[TIAB] OR recoil*[TIAB] OR (("Thoracic Wall"[Mesh] OR “thoracic wall”[TIAB] OR “chest wall”[TIAB] OR mm/s[TIAB]) AND (Recoil*[TIAB] OR decompress*[TIAB] OR release*[TIAB]))) NOT (animals[Mesh] NOT humans[Mesh]) NOT ("letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])))
OR
Chest compression rate
((((((((((((((((((((Heart Arrest[MeSH Terms]) OR Ventricular Fibrillation[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR "advanced cardiac life support"[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract] OR Basic Life Support[Title/Abstract] OR BLS[Title/Abstract])) AND ((((((((((((((((((((compression rate*[Title/Abstract]) OR cc rate*[Title/Abstract]) OR fast compression[Title/Abstract]) OR slow compression[Title/Abstract]) OR compression ratio[Title/Abstract]) OR compression ratios[Title/Abstract]) OR "compression-decompression ratio"[Title/Abstract]) OR "compression-to-ventilation ratio"[Title/Abstract]) OR "compression-to ventilation ratios"[Title/Abstract]) OR compression-ventilation ratio[Title/Abstract]) OR compression ventilation ratios[Title/Abstract]) OR compression fraction[Title/Abstract]) OR rate directed[Title/Abstract]) OR high impulse[Title/Abstract]) OR CPR rate*[Title/Abstract]) OR fast rate*[Title/Abstract]) OR time dependent[Title/Abstract]) OR interruption*[Title/Abstract]) OR pause*[Title/Abstract]) OR hands off[Title/Abstract]) OR per minute[Title/Abstract]) OR rest[Title/Abstract]))) NOT ((animals[mh] NOT humans[mh]))))) NOT (("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp]))))
OR
Leaning and recoil
((((((((((((((((((Heart Arrest[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole*[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Ventricular Fibrillation[MeSH Terms]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR pulseless electrical activity[Title/Abstract]) OR advanced cardiac life support[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract]) OR chest compression*[Title/Abstract]) OR cardiac compression*[Title/Abstract])) AND ((((((((((depth[Title/Abstract]) OR recoil[Title/Abstract]) OR decompression[Title/Abstract]) OR elasticity[Title/Abstract]) OR inches[Title/Abstract]) OR centimetres[Title/Abstract]) OR centimeters[Title/Abstract]) OR depress[Title/Abstract]) OR relaxation[Title/Abstract]) OR chest wall compression[Title/Abstract]) OR chest compression

quality[Title/Abstract]) OR compression force[Title/Abstract]))

2. EMBASE

Chest compression depth

('resuscitation'/exp OR resuscitation:ti,ab OR CPR:ti OR 'heart massage'/exp OR compression*:ti,ab OR “heart massage”:ti,ab OR “cardiac massage”:ti,ab OR "Advanced Cardiac Life Support":ti,ab OR “high-quality CPR”:ti,ab OR “high quality CPR”:ti,ab OR “CPR metrics”:ti,ab OR “CPR quality”:ti,ab OR “compression quality”:ti,ab) AND (lean*:ti,ab OR “chest recoil”:ti,ab OR recoil*:ti,ab OR (('thorax wall'/exp OR “thoracic wall”:ti,ab OR “chest wall”:ti,ab OR “mm/s”:ti,ab) AND (Recoil*:ti,ab OR decompress*:ti,ab OR release*:ti,ab))) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim

OR

Chest compression rate

'heart arrest'/exp OR 'heart ventricular fibrillation'/de OR 'heart arrest':ab,ti OR 'cardiac arrest':ab,ti OR asystole:ab,ti OR 'cardiopulmonary arrest':ab,ti OR 'cardiovascular arrest':ab,ti OR 'cardiopulmonary resuscitation':ab,ti OR cpr:ab,ti OR 'advanced cardiac life support':ab,ti OR acls:ab,ti OR 'basic life support':ab,ti OR bls:ab,ti OR 'heart massage'/de OR 'heart massage':ab,ti OR 'cardiac massage':ab,ti AND ((compression NEAR/3 rate*):ab,ti OR 'cc rate':ab,ti OR 'cc rates':ab,ti OR 'fast compression':ab,ti OR 'slow compression':ab,ti OR (compression NEAR/3 ratio):ab,ti OR (compression NEAR/3 ratios):ab,ti OR 'compression fraction':ab,ti OR 'rate directed':ab,ti OR 'high impulse':ab,ti OR 'per minute':ab,ti OR 'per min':ab,ti OR 'cpr rate':ab,ti OR 'cpr rates':ab,ti OR 'fast rate':ab,ti OR 'fast rates':ab,ti OR 'time+dependent':ab,ti OR interruption*:ab,ti OR pause*:ab,ti OR 'hands+off':ab,ti OR rest:ab,ti) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim

OR

Leaning and recoil

(‘Heart Arrest’/exp OR ‘heart arrest’:ab,ti OR ‘cardiac arrest’:ab,ti OR asystole*:ab,ti OR ‘cardiopulmonary arrest’:ab,ti OR ‘cardiovascular arrest’:ab,ti OR ‘Heart Ventricular Fibrillation’/de OR ‘cardiopulmonary resuscitation’:ab,ti OR CPR:ab,ti OR ‘pulseless electrical activity’:ab,ti OR ‘advanced cardiac life support’:ab,ti OR ACLS:ab,ti OR ‘Heart Massage’/de OR ‘heart massage’:ab,ti OR ‘cardiac massage’:ab,ti OR ‘chest compression’:ab,ti OR ‘cardiac compression’:ab,ti) AND (depth:ab,ti OR recoil:ab,ti OR decompression:ab,ti OR elasticity:ab,ti OR inches:ab,ti OR centimetres:ab,ti OR centimeters:ab,ti OR depress:ab,ti OR relaxation:ab,ti OR ‘chest wall compression’:ab,ti OR ‘chest compression quality’:ab,ti OR ‘compression force’:ab,ti) AND [Embase]/lim

3. COCHRANE

Chest compression depth

([mh ^Resuscitation] OR resuscitation:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR CPR:ab,ti OR [mh “Heart Massage”] OR compression*:ab,ti OR “heart massage”:ab,ti OR “cardiac massage”:ab,ti OR "Advanced Cardiac Life Support":ab,ti OR “high-quality CPR”:ab,ti OR “high quality CPR”:ab,ti OR “CPR metrics”:ab,ti OR “CPR quality”:ab,ti OR “compression quality”:ab,ti) AND ((lean*:ab,ti OR “chest recoil”:ab,ti OR recoil*:ab,ti) OR ([mh "Thoracic Wall"] OR “thoracic wall”:ab,ti OR “chest wall”:ab,ti) AND (Recoil*:ab,ti OR decompress*:ab,ti OR release*:ab,ti)) NOT ([mh animals] NOT [mh humans])

OR

Chest compression rate

([mh “Heart Arrest”] OR [mh “Ventricular Fibrillation”] OR “heart arrest”:ab,ti OR “cardiac arrest”:ab,ti OR asystole:ab,ti OR “cardiopulmonary arrest”:ab,ti OR “cardiovascular arrest”:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR resuscitation:ab,ti OR CPR:ab,ti OR “advanced cardiac life support”:ab,ti OR ACLS:ab,ti OR “basic life support”:ab,ti OR BLS:ab,ti OR [mh “Heart Massage”] OR “heart massage*”:ab,ti OR “cardiac massage*”:ab,ti) AND ((compression near/3 rate*):ab,ti or "cc rate*":ab,ti or "fast compression":ab,ti or "slow compression":ab,ti or (compression near/3 ratio):ab,ti or (compression near/3 ratios):ab,ti or "compression fraction":ab,ti or "rate directed":ab,ti or "high impulse":ab,ti or "per min*":ab,ti or "CPR rate*":ab,ti or "fast rate*":ab,ti or "time dependent":ab,ti or interruption*:ab,ti or pause*:ab,ti or "hands-off":ab,ti or rest:ab,ti,

OR

Leaning and recoil

([mh “Heart Arrest”] or “heart arrest”:ab,ti or “cardiac arrest”:ab,ti or Asystole*:ab,ti or “cardiopulmonary arrest”:ab,ti or “cardiovascular arrest”:ab,ti or [mh “Ventricular Fibrillation”] or [mh “Cardiopulmonary Resuscitation”] or resuscitation:ab,ti or CPR:ab,ti or “pulseless electrical activity”:ab,ti or “advanced cardiac life support”:ab,ti or ACLS:ab,ti or [mh “Heart Massage”] or “heart massage”:ab,ti or “cardiac massage”:ab,ti or “chest compression”:ab,ti or “cardiac compression”:ab,ti) AND (depth:ab,ti or recoil:ab,ti or decompression:ab,ti or elasticity:ab,ti or inches:ab,ti or centimetres:ab,ti or centimeters:ab,ti or depress:ab,ti or relaxation:ab,ti

2021 Evidence Update Worksheet
Appendix B1 BLS 5

Worksheet author(s): Giuseppe Ristagno
Date Submitted: February 14th 2021

PICO / Research Question: Should checking the cardiac rhythm immediately after defibrillation vs. immediate resumption of chest compressions with delayed check of the cardiac rhythm be used in cardiac arrest?

Outcomes: Critical: Survival with good neurological function (i.e. at hospital discharge, 1 month, 6 months, 1 year), survival (i.e. hospital discharge, 1 month, 6 months, 1 year survival). Important: short term survival (return of spontaneous circulation – ROSC, hospital admission), rates of recurrence of fibrillation/re-fibrillation), CPR quality parameters (i.e. compression fraction).

Type (intervention, diagnosis, prognosis): Checking the cardiac rhythm immediately after defibrillation

Additional Evidence Reviewer(s): Raffo Escalante, Theresa Olasveengen
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2019 **New question:** N.A.

Last ILCOR Consensus on Science and Treatment Recommendation: For the critical outcome of «survival with favorable neurologic outcome at discharge», we identified low-certainty evidence (downgraded for serious risk of bias and indirectness) from 1 RCT enrolling 415 OHCAs showing no benefit for interrupting chest compressions to check rhythm immediately after shock delivery (RR, 0.89; 95% CI, 0.70–1.15) (Beesems 2016, 1) and a very-low-certainty evidence (downgraded for serious risk of bias, indirectness, and imprecision) from 3 observational studies enrolling 763 OHCAs showing a harmful effect for interrupting chest compressions to check rhythm immediately after shock delivery (RR, 0.62; 95% CI, 0.51–0.75) (Kellum 2006, 335; Rea 2006, 2760; Bobrow 2008, 1158).
For the critical outcome of «survival to hospital discharge», we identified low-certainty evidence (downgraded for serious risk of bias and indirectness) from 2 RCTs enrolling 1260 OHCAs showing no benefit for interrupting chest compressions to check rhythm immediately after shock delivery (RR, 0.89; 95% CI, 0.72–1.10) (Jost 2010, 1614; Beesems 2016, 1) and very-low-certainty evidence (downgraded for serious risk of bias and indirectness) from 3 observational studies enrolling 3094 OHCAs showing a harm effect for checking rhythm immediately after defibrillation (RR, 0.55; 95% CI, 0.45–0.67) (Kellum 2006, 335; Rea 2006, 2760; Bobrow 2008, 1158).
For the important outcome of «survival to hospital admission», we identified low-certainty evidence (downgraded for serious risk of bias and indirectness) from 2 RCTs enrolling 1260 victims of OHCA showing no benefit for interrupting chest compressions to check rhythm immediately after shock delivery (RR, 1.02; 95% CI, 0.91–1.14) (Jost 2010, 1614; Beesems 2016, 1).

For the important outcome of «ROSC», we identified very-low-certainty evidence (downgraded for serious risk of bias and indirectness) from 2 observational studies enrolling 2969 victims of OHCA showing a harm effect for interrupting chest compressions to check rhythm immediately after shock delivery (RR, 0.69; 95% CI, 0.61–0.78) (Rea 2006, 2760; Bobrow 2008, 1158).
For the important outcome of «recurrence of VF», we identified a very-low-certainty (downgraded for serious risk of bias, indirectness, and imprecision) evidence from 2 RCTs, enrolling 551 OHCAs showing no benefit for interrupting chest compressions to check rhythm immediately after shock delivery (RR, 1.08; 95% CI, 0.95–1.22) (Berdowski 2010, 72; Beesems 2016, 1).
In addition, for the important outcome «chest compression fraction», data from 3 RCTs enrolling 1412 OHCAs showed a harm effect for interrupting chest compressions to check rhythm immediately after shock delivery (Jost 2010, 1614; Berdowski 2010, 72; Beesems 2016, 1).

We suggest against the checking of cardiac rhythm immediately after defibrillation. Weak recommendation / very-low certainty evidence

2010/2015 Search Strategy: ("Pulse"[Mesh] OR “heart rate”[Mesh] OR “rhythm check”[TIAB] OR “heart rhythm”[TIAB] OR “cardiac rhythm”[TIAB] OR “pulse check”[TIAB] OR “pulse checks”[TIAB] OR “pulse checking”[TIAB] OR “pulse assessment”[TIAB] OR “rhythm analysis”[TIAB] OR "Monitoring, Physiologic"[Mesh] OR “pulse palpation”[TIAB]) AND (early[TIAB] OR earlie*[TIAB] OR late[TIAB] OR later[TIAB] OR resum*[TIAB] OR length[TIAB] OR minute*[TIAB] OR second*[TIAB] OR time[TIAB] OR timing[TIAB] OR "Time Factors"[Mesh] OR paus*[TIAB] OR delay*[TIAB]) AND ("Out-of-Hospital Cardiac Arrest"[Mesh] OR “Out of Hospital Cardiac Arrest”[TIAB] OR “Out-of-Hospital Cardiac Arrest”[TIAB] OR "Heart Arrest"[Mesh] OR "cardiac arrest"[TIAB] OR "cardiac arrests"[TIAB] OR "cardiovascular arrest"[TIAB] OR "cardiovascular arrests"[TIAB] OR "heart arrest"[TIAB] OR "heart arrests"[TIAB] OR "asystole"[TIAB] OR "pulseless electrical activity"[TIAB] OR "cardiopulmonary arrest"[TIAB] OR "cardiopulmonary arrests"[TIAB] OR "Heart Failure"[Mesh] OR “heart failure”[TIAB] OR "Myocardial Infarction"[Mesh] OR “myocardial infarction”[TIAB] OR “myocardial infarctions”[TIAB] OR “AMI”[TIAB] OR "Ventricular Fibrillation"[Mesh]) AND (("Resuscitation"[Mesh] OR resuscitat*[TIAB] OR "Advanced Cardiac Life Support"[Mesh] OR "Advanced Cardiac Life Support"[TIAB] OR "ACLS"[TIAB] OR "return of spontaneous circulation"[TIAB] OR ROSC[TIAB] OR "cardiopulmonary resuscitation"[Mesh] OR "cardiopulmonary resuscitation"[TIAB] OR CPR[TIAB] OR “Electric Countershock”[Mesh] OR Countershock*[TIAB] OR Cardioversion*[TIAB] OR Electroversion*[TIAB] OR “Defibrillators”[Mesh] OR defibrillator*[TIAB] defibrillation*[TIAB] OR “automatic external defibrillator”[TIAB] OR “automatic external defibrillators”[TIAB] OR “automated external defibrillator”[TIAB] OR “automated external defibrillators”[TIAB] OR AED*[TIAB] OR “automatic external defibrillation”[TIAB] OR “chest compression”[TIAB] OR “chest compressions”[TIAB] OR “heart massage”[TIAB] OR “cardiac massage”[TIAB] OR “cardiac compression”[TIAB] OR “cardiac compressions”[TIAB] OR “thoracic
compression”[TIAB] OR “thoracic compressions”[TIAB]) AND ("methods" [Subheading] OR method*[TIAB] OR technique*[TIAB])) NOT ((animals[mesh] NOT humans[mesh])) NOT ("letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])

2020 Search Strategy: Same as above.

Database searched: Pubmed
Date Search Completed: Feb 14th 2021

Search Results (Number of articles identified / number identified as relevant): 20 article identified/0 relevant

Inclusion/Exclusion Criteria: 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. Animal/lab studies, mathematical models, simulation and mannikin studies, algorithm studies for rhythm analysis recognition with no outcome data, unpublished studies (e.g., conference abstracts, trial protocols) and reviews were excluded.
Link to Article Titles and Abstracts (if available on PubMed): N.A.

Summary of Evidence Update: No new relevant articles were found. Update review for 2021 not needed.

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

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
ILCOR; Olasveengen T; 2020	Systematic review	Timing of Rhythm Check (BLS 345: SysRev)	6	The meta-analysis of the RCTs did not demonstrate any differences between immediate rhythm analysis and immediate compressions, but unadjusted analysis of observational data suggested that immediate compressions were associated with better outcomes	We suggest immediate resumption of chest compressions after shock delivery for adults in cardiac arrest in any setting (weak recommendation, very-low-certainty evidence)

RCT: None
Nonrandomized Trials, Observational Studies: None

Reviewer Comments (including whether meet criteria for formal review):
No new evidence identified.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

N.A.

2021 Evidence Update Worksheet
Appendix B1 BLS 6

Worksheet author(s): Kevin KC Hung
Date Submitted: February 2021

PICO / Research Question: BLS 346 Timing of CPR cycles (2 min vs other)

Population: Adults and children with cardiac arrest
Intervention: Pausing chest compressions at another interval
Comparator: Pausing chest compressions every 2 minutes to assess the cardiac rhythm
Outcome: Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. ROSC was ranked as an important outcome.

Outcomes:

Survival with Favorable neurological/functional outcome at discharge, 30 days, 60 days, 180 days AND/OR 1 year;
Survival only at discharge, 30 days, 60 days, 180 days AND/OR 1 year;
ROSC;
Coronary perfusion pressure;
Cardiac output (O)

Type (intervention, diagnosis, prognosis): Intervention

Additional Evidence Reviewer(s): Maaret Castrén
Conflicts of Interest (financial/intellectual, specific to this question): no conflicts to declare

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:
We suggest pausing chest compressions every 2 minutes to assess the cardiac rhythm (weak recommendation, low-certainty evidence).

2010/2015 Search Strategy:

(“CPR cycle”[TIAB] OR “CPR cycles”[TIAB] OR “CPR sequences”[TIAB] OR “CPR sequence”[TIAB] OR “cycle duration”[TIAB] OR “loop duration”[TIAB] OR “loop durations”[TIAB] OR "Pulse"[Mesh] OR “pulse check”[TIAB] OR “pulse checks”[TIAB] OR “pulse checking”[TIAB] OR “pulse assessment”[TIAB] OR “heart rate”[Mesh] OR “heart rhythm”[TIAB] OR “cardiac rhythm”[TIAB] OR “rhythm check”[TIAB] OR “rhythm analysis”[TIAB] OR “analysis of rhythm”[TIAB] OR “rhythm assessment”[TIAB] OR “rhythm assessments”[TIAB] OR “compression interruption”[TIAB] OR “compression interruptions”[TIAB] OR “compression delay”[TIAB] OR “compression pause”[TIAB] OR “compression pauses”[TIAB] OR “No flow time”[TIAB] OR “Hands off time”[TIAB]) AND (minute*[TIAB] OR min[TIAB] OR “1 min”[TIAB] OR “1-min”[TIAB] OR “1min”[TIAB] OR “2 minute”[TIAB] OR “2 minutes”[TIAB] OR “two minute”[TIAB] OR “two minutes”[TIAB] OR “2-minute”[TIAB] OR “2-minutes”[TIAB] OR “two-minute”[TIAB] OR “2 min”[TIAB] OR “2-min”[TIAB] OR “2min”[TIAB] OR “3 min”[TIAB] OR “3-min”[TIAB] OR “3min”[TIAB] OR “4 min”[TIAB] OR “4-min”[TIAB] OR “4min”[TIAB] OR “5 min”[TIAB] OR “5-min”[TIAB] OR “5min”[TIAB] OR timing[TI] OR "Time Factors"[Mesh] OR resum*[TIAB] OR length[TIAB] OR last*[TIAB] OR seconds[TIAB] OR paus*[TIAB] OR delay*[TIAB] OR interval*[TIAB]) AND ("Resuscitation"[Mesh] OR resuscitat*[TIAB] OR "cardiopulmonary resuscitation"[Mesh] OR "cardiopulmonary resuscitation"[TIAB] OR CPR[TIAB] OR “heart massage”[Mesh] OR “heart massage”[TIAB] OR “chest compression”[TIAB] OR “chest compressions”[TIAB] OR “cardiac massage”[TIAB] OR “cardiac compression”[TIAB] OR “cardiac compressions”[TIAB] OR “thoracic compression”[TIAB] OR “thoracic compressions”[TIAB]) AND ("Out-of-Hospital Cardiac Arrest"[Mesh] OR “Out of Hospital Cardiac Arrest”[TIAB] OR “Out-of-Hospital Cardiac Arrest”[TIAB] OR
“Out of Hospital Cardiac Arrests”[TIAB] OR “Out-of-Hospital Cardiac Arrests”[TIAB] OR "Heart Arrest"[Mesh] OR “heart arrest”[TIAB] OR "heart arrests"[TIAB] OR "asystole"[TIAB] OR "pulseless electrical activity"[TIAB] OR "cardiac arrest"[TIAB] OR "cardiac arrests"[TIAB] OR "cardiovascular arrest"[TIAB] OR "cardiovascular arrests"[TIAB] OR "cardiopulmonary arrest"[TIAB] OR "cardiopulmonary arrests"[TIAB] OR "cardio-pulmonary arrest"[TIAB] OR "cardio-pulmonary arrests"[TIAB] OR "Ventricular Fibrillation"[Mesh] OR “Ventricular Fibrillation”[TIAB] OR "Tachycardia, Ventricular"[Mesh]) NOT (animal[mesh] NOT humans[mesh]) NOT ("letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])

2020 Search Strategy:
Same as above

Database searched: PubMed
Date Search Completed: 16 February 2021
Search Results (Number of articles identified / number identified as relevant): (From 1 January 2019 to 16 February 2021 - 100 identified/ 0 relevant)
Inclusion/Exclusion Criteria:
Link to Article Titles and Abstracts (if available on PubMed):

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies: None

Reviewer Comments (including whether meet criteria for formal review):
No study identified for full text review in the specified period.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 7

Worksheet author(s): Sung Phil Chung
Date Submitted: 2021 Jan

Public access AED programs

PICO / Research Question: Among adults and children who are in cardiac arrest outside of a hospital (P), does implementation of a public access AED program (I), compared with traditional EMS response (C), improve any clinical outcome?
Outcomes: Survival with favorable neurologic outcome, Survival only at discharge, 30 days, 60 days, 180 days AND/OR 1 year, ROSC, bystander CPR rates, time to first compressions, time to first shock, CPR quality
Type (intervention, diagnosis, prognosis): Intervention

Additional Evidence Reviewer(s): Swee Han Lim
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2015 / 2020

Last ILCOR Consensus on Science and Treatment Recommendation: We recommend the implementation of public-access defibrillation programs for patients with OHCAs. (Strong recommendation, low-certainty evidence)

2010/2015 Search Strategy:
PubMed ("Out-of-Hospital Cardiac Arrest"[Mesh] OR “Out of Hospital Cardiac Arrest” [TIAB] OR “Out-of-Hospital Cardiac Arrest” [TIAB] OR “Out of Hospital Cardiac Arrests” [TIAB] OR “Out-of-Hospital Cardiac Arrests” [TIAB] OR (("out-of-hospital"[TIAB] OR “out of hospital”[TIAB] OR “outside of hospital”[TIAB]) AND cardiac[TIAB] AND arrest*[TIAB]) OR "Heart Arrest"[Mesh:NoExp] OR “heart arrest”[TIAB] OR "heart arrests"[TIAB] OR "cardiac arrest"[TIAB] OR "cardiac arrests"[TIAB] OR "cardiovascular arrest"[TIAB] OR "cardiovascular arrests"[TIAB] OR "asystole"[TIAB] OR "Heart Failure"[Mesh] OR “heart failure”[TIAB] OR "cardiopulmonary arrest"[TIAB] OR "cardiopulmonary arrests"[TIAB] OR "cardio-pulmonary arrest"[TIAB] OR "cardio-pulmonary arrests"[TIAB] OR "Ventricular Fibrillation"[Mesh] OR “Ventricular Fibrillation”[TIAB] OR "Tachycardia, Ventricular"[Mesh] OR “pulseless ventricular tachycardia”[TIAB] OR (Pulseless[TIAB] AND (V-tach[TIAB] OR VT[TIAB])) OR "Cardiopulmonary Resuscitation"[Mesh] OR "cardiopulmonary resuscitation"[TIAB] OR CPR[TIAB] OR “Resuscitation"[Mesh] OR resuscitat*[TIAB]) AND (“early defibrillation”[TIAB] OR “automatic external defibrillator”[TIAB] OR “automatic external defibrillators”[TIAB] OR “automated external defibrillator”[TIAB] OR “automated external defibrillators”[TIAB] OR AED[TIAB] OR AEDs[TIAB] OR “automatic external defibrillation”[TIAB] OR “public access defibrillation program”[TIAB] OR “public access defibrillation programs”[TIAB] OR ((“Electric Countershock”[Mesh] OR “electric countershock”[TIAB] OR countershock*[TIAB] OR electroversion*[TIAB] OR cardioversion*[TIAB] OR

“Defibrillators”[Mesh] OR defibrillator*[TIAB] OR defibrillation*[TIAB]) AND (public[TIAB] OR bystander*[TIAB] OR "first responder"[TIAB] OR "first responders"[TIAB] OR "firstresponder"[TIAB] OR "first-responders"[TIAB] OR Layperson*[TIAB] OR “lay people”[TIAB] OR “lay rescuer”[TIAB] OR “lay rescuers”[TIAB] OR witness*[TIAB] OR Firefighter*[TIAB] OR “fire fighter” OR “fire fighters” OR "Firefighters"[Mesh] OR "Police"[Mesh] OR Police[TIAB] OR “non-healthcare professionals”[TIAB] OR “non-healthcare professional”[TIAB] OR "Emergency Medical Technicians"[Mesh] OR “emergency medic”[TIAB] OR “emergency medical”[TIAB] OR “EMS”[TIAB] OR “EMT”[TIAB] OR paramedic*[TIAB]))) NOT (animals[Mesh] NOT humans[Mesh]) NOT ("letter"[Publication Type] OR "comment"[Publication Type]OR "editorial"[Publication Type] or Case Reports[Publication Type] OR “case series”[TIAB])

Embase: (“Out of Hospital Cardiac Arrest”:ab,ti OR “Out+of+Hospital Cardiac Arrest”:ab,ti OR “Out of Hospital Cardiac Arrests”:ab,ti OR “Out+of+Hospital Cardiac Arrests”:ab,ti OR (("out+of+hospital":ab,ti OR “out of hospital”:ab,ti OR “outside of hospital”:ab,ti) AND cardiac:ab,ti AND arrest*:ab,ti) OR 'heart arrest'/exp OR “heart arrest”:ab,ti OR "heart arrests":ab,ti OR "cardiac arrest":ab,ti OR "cardiac arrests":ab,ti OR "cardiovascular arrest":ab,ti OR "cardiovascular arrests":ab,ti OR "asystole":ab,ti OR 'heart failure'/exp OR “heart failure”:ab,ti OR "cardiopulmonary arrest":ab,ti OR "cardiopulmonary arrests":ab,ti OR "cardio+pulmonary arrest":ab,ti OR "cardio+pulmonary arrests":ab,ti OR 'heart ventricle fibrillation'/exp OR “Ventricular Fibrillation”:ab,ti OR 'heart ventricle tachycardia'/exp OR “pulseless ventricular tachycardia”:ab,ti OR (Pulseless:ab,ti AND (V+tach:ab,ti OR VT:ab,ti)) OR "cardiopulmonary resuscitation":ab,ti OR CPR:ab,ti OR 'resuscitation'/exp OR resuscitat*:ab,ti) AND (“early defibrillation”:ab,ti OR 'automated external defibrillator'/exp OR “automatic external defibrillator”:ab,ti OR “automatic external defibrillators”:ab,ti OR “automated external defibrillator”:ab,ti OR “automated external defibrillators”:ab,ti OR AED*:ab,ti OR “automatic external defibrillation”:ab,ti OR “public access defibrillation program”:ab,ti OR “public access defibrillation programs”:ab,ti OR ((“electric countershock”:ab,ti OR countershock*:ab,ti OR electroversion*:ab,ti OR 'cardioversion'/exp OR cardioversion*:ab,ti OR defibrillator*:ab,ti OR defibrillation*:ab,ti OR 'defibrillation'/exp) AND (public:ab,ti OR bystander*:ab,ti OR "first responder":ab,ti OR "first responders":ab,ti OR "first+responder":ab,ti OR "first+responders":ab,ti OR Layperson*:ab,ti OR “lay people”:ab,ti OR “lay rescuer”:ab,ti OR “lay rescuers”:ab,ti OR witness*:ab,ti OR 'rescue personnel'/exp OR Firefighter*:ab,ti OR “fire fighter” OR “fire fighters” OR 'fire fighter'/exp OR 'police'/exp OR Police:ab,ti OR “non+healthcare professionals”:ab,ti OR “non+healthcare professional”:ab,ti OR "Emergency Medical Technician":ab,ti OR "Emergency Medical Technicians":ab,ti OR “emergency medic”:ab,ti OR “emergency medical”:ab,ti OR “EMS”:ab,ti OR “EMT”:ab,ti OR paramedic*:ab,ti))) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim

Cochrane Library: ([mh "Out-of-Hospital Cardiac Arrest"] OR “Out of Hospital Cardiac Arrest”:ab,ti OR “Out-of-Hospital Cardiac Arrest”:ab,ti OR “Out of Hospital Cardiac Arrests”:ab,ti OR “Out-of-Hospital Cardiac Arrests”:ab,ti OR (("out-of-hospital":ab,ti OR “out of hospital”:ab,ti OR “outside of hospital”:ab,ti) AND cardiac:ab,ti AND arrest*:ab,ti) OR [mh "Heart Arrest"] OR “heart arrest”:ab,ti OR "heart arrests":ab,ti OR "cardiac arrest":ab,ti OR "cardiac arrests":ab,ti OR "cardiovascular arrest":ab,ti OR "cardiovascular arrests":ab,ti OR "asystole":ab,ti OR [mh "Heart Failure"] OR “heart failure”:ab,ti OR "cardiopulmonary arrest":ab,ti OR "cardiopulmonary arrests":ab,ti OR "cardio-pulmonary arrest":ab,ti OR "cardio-pulmonary arrests":ab,ti OR [mh "Ventricular Fibrillation"] OR “Ventricular Fibrillation”:ab,ti OR [mh "Tachycardia, Ventricular"] OR “pulseless ventricular tachycardia”:ab,ti OR (Pulseless:ab,ti AND (V-tach:ab,ti OR VT:ab,ti)) OR [mh "Cardiopulmonary Resuscitation"] OR "cardiopulmonary resuscitation":ab,ti OR CPR:ab,ti OR [mh “Resuscitation"] OR resuscitat*:ab,ti) AND (“early defibrillation”:ab,ti OR “automatic external defibrillator”:ab,ti OR “automatic external defibrillators”:ab,ti OR “automated

external defibrillator":ab,ti OR "automated external defibrillators":ab,ti OR AED*:ab,ti OR "automatic external defibrillation":ab,ti OR "public access defibrillation program":ab,ti OR "public access defibrillation programs":ab,ti OR (([mh "Electric Countershock"] OR "electric countershock":ab,ti OR countershock*:ab,ti OR electroversion*:ab,ti OR cardioversion*:ab,ti OR [mh "Defibrillators"] OR defibrillator*:ab,ti OR defibrillation*:ab,ti) AND (public:ab,ti OR bystander*:ab,ti OR "first responder":ab,ti OR "first responders":ab,ti OR "first-responder":ab,ti OR "first-responders":ab,ti OR Layperson*:ab,ti OR "lay people":ab,ti OR "lay rescuer":ab,ti OR "lay rescuers":ab,ti OR witness*:ab,ti OR Firefighter*:ab,ti OR "fire fighter" OR "fire fighters" OR [mh "Firefighters"] OR [mh "Police"] OR Police:ab,ti OR "non-healthcare professionals":ab,ti OR "non-healthcare professional":ab,ti OR [mh "Emergency Medical Technicians"] OR "emergency medic":ab,ti OR "emergency medical":ab,ti OR "EMS":ab,ti OR "EMT":ab,ti OR paramedic*:ab,ti)))

2019 Search Strategy: same as above
Database searched: PubMed, Embase, Cochrane Library
Date Search Completed: 2019 Oct 1 to 2021 Jan 12
Search Results (Number of articles identified / number identified as relevant):
PubMed: 228 articles identified / Embase: 280 articles identified / 8 selected for full-text review
2 articles identified as relevant

Inclusion/Exclusion Criteria:
The public access AED is defined as defibrillation with onsite AED attempted by bystander layperson in the OHCA setting. Both patients with no AED use (CPR only group) and those who received defibrillation by first responders (ex, policeman) or paramedics were all included to control group because we considered them as one of several forms of traditional EMS response. This meta-analysis also includes "before vs after comparison study" or "early vs late comparison study" which compare before or early period of PAD implementation with after or late period in the community.
The studies with overlapping population were excluded in the analysis. Studies with wrong population, wrong intervention, wrong outcome, wrong design, and lack of information were excluded.

Link to Article Titles and Abstracts (if available on PubMed):
Nakashima T, Noguchi T, Tahara Y, Nishimura K, Yasuda S, Onozuka D, Iwami T, Yonemoto N, Nagao K, Nonogi H, Ikeda T, Sato N, Tsutsui H; Japanese Circulation Society with Resuscitation Science Study Group. Public-access defibrillation and neurological outcomes in patients with out-of-hospital cardiac arrest in Japan: a population-based cohort study. Lancet. 2019 Dec 21;394(10216):2255-2262. doi: 10.1016/S0140-6736(19)32488-2. Epub 2019 Dec 17. PMID: 31862250.

Background: More than 80% of public-access defibrillation attempts do not result in sustained return of spontaneous circulation in patients who have had an out-of-hospital cardiac arrest (OHCA) and a shockable heart rhythm before arrival of emergency medical service (EMS) personnel. Neurological and survival outcomes in such patients have not been evaluated. We aimed to assess the neurological status and survival outcomes in such patients.

Methods: This is a retropective analysis of a cohort study from a prospective, nationwide, population-based registry of 1 299 784 patients who had an OHCA event between Jan 1, 2005, and Dec 31, 2015 in Japan. The primary outcome was favourable neurological outcome (Cerebral Performance Category of 1 or 2) at 30 days after the OHCA and the secondary outcome was survival at 30 days following the OHCA. This study is registered with the University Hospital Medical Information Network Clinical Trials Registry, UMIN000009918.

Findings: We identified 28 019 patients with bystander-witnessed OHCA and shockable heart rhythm who had received CPR from a bystander. Of these, 2242 (8·0%) patients did not achieve return of spontaneous circulation with CPR plus public-access defibrillation, and 25 087 (89·5%) patients did not achieve return of spontaneous circulation with CPR alone before EMS arrival. The proportion of patients with a favourable neurological outcome was significantly higher in those who received public-access defibrillation than those who did not (845 [37·7%] vs 5676 [22·6%]; adjusted odds ratio [OR] after propensity score-matching, 1·45 [95% CI 1·24-1·69], p<0·0001). The proportion of patients who survived at 30 days after the OHCA was also significantly higher in those who received public-access defibrillation than those who did not (987 [44·0%] vs 7976 [31·8%]; adjusted OR after propensity score-matching, 1·31 [95% CI 1·13-1·52], p<0·0001).

Interpretation: Our findings support the benefits of public-access defibrillation and greater accessibility and availability of automated external defibrillators in the community.

Merdler I, Sadeh B, Hochstadt A, Kofman N, Szekely Y, Steinvil A, Shacham Y. Automated external defibrillator use and outcomes after out-of-hospital cardiac arrest: an Israeli cohort study. Coron Artery Dis. 2020 May;31(3):289-292. doi: 10.1097/MCA.0000000000000807. PMID: 31658139.

Background: Out-of-hospital cardiac arrests (OHCA) are a serious healthcare situation with low survival rates. Application of an automated external defibrillator (AED) by bystanders shortens time to defibrillation and increases survival. In Israel, a regulation ensuring the presence of AED in public places was issued and implemented since 2014. We investigated whether this regulation had an impact on the outcomes of OHCA patients.

Methods: We performed a retrospective, single-center observational study. Included in the cohort were patients who were admitted to the department of intensive care cardiac unit with OHCA. Patients were stratified into two groups according to the year the regulation was introduced: group 1 (2009-2013) and group 2 (2014-2018).

Results: A total of 77 patients were included in group 1 and 61 in group 2. The utilization of AED was significantly higher in group 2 compared to group 1 (42% vs. 27%; P = 0.04). Compared to group 1 patients, group 2 had lower 48 h (0% vs. 8%; P = 0.02) and 30-day mortality (28% vs. 42%; P = 0.02). Cognitive damage following recovery was less frequent in group 2 (55% vs. 81%; P = 0.01).

Conclusion: Deployment of AEDs in public places by mandatory regulations increased utilization for OHCA and may improve outcomes.

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: not reported

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

RCT: not reported

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
	Study Aim: **Study Type:**	**Inclusion Criteria:**	**Intervention:** **Comparison:**	**1° endpoint:**	**Study Limitations:**

Nonrandomized Trials, Observational Studies

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)
Nakashima 2019	Retrospective cohort study N=27,329 (2005-2015)	OHCA of cardiac origin and a shockable rhythm, witnessed and resuscitated by a bystander, not have achieved ROSC before arrival of an EMS	**1° endpoint:** CPC 1,2 at 30 days after OHCA **Results:** significantly higher in those who received public-access defibrillation than those who did not (845 [37.7%] vs 5676 [22.6%]; adjusted odds ratio [OR] after propensity score-matching, 1.45 [95% CI 1.24–1.69], p<0.0001)	This study support the benefits of public-access defibrillation and greater accessibility and availability of AEDs in the community.

Merdler 2020	Retrospective, single-center before vs after observational study N=138	ICU admitted patients after OHCA; group 1 (2009–2013) and group 2 (2014–2018) according to the year the AED regulation was introduced in Israel	**Outcomes:** mortality at 48 h and 30 days and cognitive impairment following the event; **Results:** Group 2 (after AED regulation) had lower 48 h (0% vs. 8%; P = 0.02) and 30-day mortality (28% vs. 42%; P = 0.02). Cognitive damage following recovery was less frequent in group 2 (55% vs. 81%; P =0.01).	Deployment of AEDs in public places by mandatory regulations increased utilization for OHCA and may improve outcomes.

Reviewer Comments (including whether meet criteria for formal review):
The 2020 CoSTR review included 1 RCT and 30 observational studies for this PICO. Two observational studies were added after the 2020 review. Both studies favored public access defibrillation. Therefore, the 2020 treatment recommendation should be maintained. We recommend the implementation of public-access defibrillation programs for patients with OHCAs. (Strong recommendation, low-certainty evidence)

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list
1. Nakashima T, et al. PAD and neurological outcomes in patients with OHCA in Japan: a population-based cohort study. Lancet. 2019 Dec;394(10216):2255-62.
2. Merdler I, et al. Automated external defibrillator use and outcomes after out-of-hospital cardiac arrest: an Israeli cohort study. Coron Artery Dis. 2020 May;31(3):289-292.

2021 Evidence Update Worksheet
Appendix B1 BLS 8

Worksheet author(s): Chika Nishiyama
Date Submitted: Feb/2/2021

PICO / Research Question:
Among adults and children who are in cardiac arrest in any setting (P), interruption of CPR to check circulation (I), no interruption of CPR (C), change outcomes (O)
T: Search completed on January 31, 2021
Outcomes:
Survival with Favorable neurological/functional outcome at discharge, 30 days, 60 days, 180 days AND/OR 1 year, Survival only at discharge, 30 days, 60 days, 180 days AND/OR 1 year, ROSC, chest compression fraction
Type (intervention, diagnosis, prognosis): intervention

Additional Evidence Reviewer(s): None
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2015
Note: BLS TF performed the Evidence update in 2019

Last ILCOR Consensus on Science and Treatment Recommendation:
Consensus on Science (2015):
Of the 654 articles found during the search, and a follow-up search performed in early 2015 identifying a potential additional 112 studies, none were found to relate to the specific question.

Treatment Recommendation (2015):
Outside of the ALS environment where invasive monitoring is available, there is insufficient data around the value of a pulse check while performing CPR. We therefore do not make a treatment recommendation regarding the value of a pulse check.

2015 Search Strategy:
((((((((((((((((((((((Heart Arrest[MeSH Terms]) OR Ventricular Fibrillation[MeSH Terms]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR Heart Massage[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole[Title/Abstract]) OR ventricular fibrillation[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR heart massage[Title/Abstract]) OR cardiac massage[Title/Abstract]) OR chest

compression*[Title/Abstract]) OR cardiac compression*[Title/Abstract]) OR Basic Life Support[Title/Abstract]) OR BLS[Title/Abstract])) AND (((((((Coronary Circulation[MeSH Terms]) OR Pulse[MeSH Terms]) OR Heart Rate[MeSH Terms]) OR circulation[Title/Abstract]) OR pulse[Title/Abstract]) OR heart rate[Title/Abstract]) OR rhythm[Title/Abstract])) AND (((interrupt*[Title/Abstract]) OR check*[Title/Abstract]) OR pause*[Title/Abstract]))) NOT (((animals[mh] NOT humans[mh])))) NOT (("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp]))

2020 Search Strategy:

Based on the 2015 search strategies, BLS TF rerun literature review between 1 Jan 2020 to 31 Jan 2021.

Database searched:

Pubmed

Date Search Completed:

31 Jan 2021

Search Results (Number of articles identified / number identified as relevant):

59

Inclusion/Exclusion Criteria:

Inclusion Criteria

Studies according to PICO components, human data only

Exclusion Criteria

No control group.

Rhythm analysis only (recording or during CPR)

Only other techniques used to assess presence of circulation (plethysmography, arterial pressure monitoring, ETCO2, NIRS, ultrasound etc).

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

No

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

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

RCT: None

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
	Study Aim: **Study Type:**	**Inclusion Criteria:**	**Intervention:** **Comparison:**	**1° endpoint:**	**Study Limitations:**

Nonrandomized Trials, Observational Studies: None

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)
	Study Type:	**Inclusion Criteria:**	**1° endpoint:**	

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

There is no new study to justify a scoping review or a systematic review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 9

Worksheet author(s): Anthony Lagina

Date Submitted: 02.09.2021

PICO / Research Question:

The PICOST (Population, Intervention, Comparator, Outcome, Study Designs and Timeframe)

Population: In rescuers performing CPR on adult or paediatric patients

Intervention: compression only CPR

Comparators: traditional CPR

Outcomes: increase in rescuer fatigue with resulting decrease in CPR quality

Study Designs: 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.

Timeframe: All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded. Literature search updated to February 5,2021.

Additional Evidence Reviewer(s):
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question:
ERC/TF scoping Review 24.11.2020

Last ILCOR Consensus on Science and Treatment Recommendation:

2010/2015 Search Strategy:
Cardiopulmonary resuscitation OR CPR AND fatigue
Cardiopulmonary resuscitation OR CPR AND quality
Chest compression AND fatigue
Chest compression AND quality
Chest compression AND continuous

2020 Search Strategy:

Cardiopulmonary resuscitation OR CPR AND fatigue
Cardiopulmonary resuscitation OR CPR AND quality
Chest compression AND fatigue
Chest compression AND quality
Chest compression AND continuous

Database searched: Pubmed, Embase

Date Search Completed:05.02.2021

Search Results (Number of articles identified / number identified as relevant):

Pubmed (109 records)

Cardiopulmonary resuscitation OR CPR AND fatigue
Cardiopulmonary resuscitation OR CPR AND quality
Chest compression AND fatigue
Chest compression AND quality
Chest compression AND continuous

Embase (8 records)

Cardiopulmonary resuscitation OR CPR AND fatigue
Cardiopulmonary resuscitation OR CPR AND quality
Chest compression AND fatigue
Chest compression AND quality
Chest compression AND continuous

Inclusion/Exclusion Criteria:

Inclusion Criteria: human and manikin studies.

Exclusion Criteria: animal studies or those that did not have a comparator group of 30:2 or 15:2 CPR.

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

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7017996/ -Rossler
https://pubmed.ncbi.nlm.nih.gov/33313571/ -Supatankij
https://pubmed.ncbi.nlm.nih.gov/32976224/ - Baldi
https://pubmed.ncbi.nlm.nih.gov/32044210/ - Suto

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Reference	Methods	Participants	Intervention	Comparisons	Outcomes
Rössler B 2020	RCT simulation manikin	84 Laypersons	flowchart-assisted standard resuscitation or CC-only resuscitation for 5min	CPR according to either standard BLS or with a CC-only algorithm Primary: # of CC that are of correct depth Secondary: (i) hand-off time (HOT), (ii) time to the administration of CCs; (iii) total number of CCs; (iv) relative number of correct CCs (%), (v) CCs >5cm; (vi) relative number of CCs >5cm; and (vii) average compression rate. Fatigue also measured	The total number of correct CCs (5-6cm) was 79 (±86) in the standard BLS group and 63 (±81) in the CC-only group (p = 0.394; 95% CI of difference: -21-53). The total HOT was 72 (±56)s in the CC-only group vs. 130 (±38)s in the standard BLS group (p<0.001; 95% CI of difference: 37–79). The time to commencement of the CCs was 53 (±26)s in the standard BLS group and 51 (±25)s in the CC-only group (p = 0.762; 95% CI of difference: -10-13). The total number of CCs was 395 (±152) in the CC-only group and 278 (±84) in the standard BLS group (p<0.001; 95% CI of difference: -171 to 63) Time and level of exhaustion had no difference
Supatanakij 2020	RCT, manikin	124 emergency physicians, general nurses, ambulance staff, and medical and paramedic students of Faculty of Medicine Ramathibodi Hospital. Airline staff, flight attendants, and cabin practitioners, crew members of the Airports of Thailand Public Company	4 min of continuous chest compression delivered side saddle position	Compression rate and depth Participant SBP, PR,RR	No difference in quality of cpr, compression rate, provider vital signs or comfort
Baldi 2020	Multicenter RCT Manikin 8 min OHCA	2154 consecutive layperson following bls/aed course	Variable compression to pause time(s)	Percentage of correct depth CC	Correct depth 30c2s, 96%; 50c5s, 96%

		participants	30c2s 50c5s 100c10s CCC	CC fraction (% of time where CC were given)	100c10s, 92% compression only, 79%; P=0.006). significant difference for 30c2s (P= 0.023) and for 50c5s(P= 0.003) versus compression only. There was a higher chest compression fraction in the compression-only group and a higher rate of pauses longer than 10 seconds in the 100c10s
Suto 2020	Observational case study 8 min mannequin	3 male volunteers having completed BLS/CPR courses Summit of Mt Fuji	3700 m altitude 30:2 vs CCC	Chest compression rate and depth Participant heart rate and SpO2	The rescuers could meet the 30:2 compression ratio and ensured the chest rose and fell adequately with breaths. Rescuer 3's CPR quality did not decrease during profound desaturations into the mid-70s. compression-only CPR at high altitude may deteriorate rescuer oxygenation, whereas CPR with breaths might ameliorate

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

No clinical studies were identified that actually addressed the criteria set out in the PICOST (fatigue in rescuers providing standard CPR vs compression only CPR). Simulation studies on manikins were identified, but the Basic Life Support Task Force did not find the results of these studies sufficient to challenge current guidelines and warrant a full review.

A study suggesting additional factors such as wearing a face mask might influence fatigue during CPR. (Tian 2020) While not specifically searched for, future reviews will consider broadening the scope of this PICOST.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement**

Reference list

Rössler B, Goschin J, Maleczek M, Piringer F, Thell R, Mittlböck M, Schebesta K. Providing the best chest compression quality: Standard CPR versus chest compressions only in a bystander resuscitation model. PLoS One. 2020 Feb 13;15(2):e0228702. doi: 10.1371/journal.pone.0228702. PMID: 32053634; PMCID: PMC7017996.

Supatanakij P, Yuksen C, Chantawong T, Sawangwong P, Jenpanitpong C, Patchkrua J, Kanchayawong P. Straddle versus Conventional Chest Compressions in a Confined Space; a Comparative Study. Arch Acad Emerg Med. 2020 Nov 14;9(1):e4. PMID: 33313571; PMCID: PMC7720852.

Baldi E, Contri E, Burkart R, Borrelli P, Ferraro OE, Paglino M, Pugliesi M, Barbati C, Bertaia D, Tami C, Lopez D, Boldarin S, Dénéréaz S, Terrapon M, Cortegiani A; MANI-CPR investigators. A Multicenter International Randomized Controlled Manikin Study on Different Protocols of Cardiopulmonary Resuscitation for Laypeople: The MANI-CPR Trial. Simul Healthc. 2020 Sep 23. doi: 10.1097/SIH.0000000000000505. Epub ahead of print. PMID: 32976224.

Suto T, Saito S, Tobe M, Kanamoto M, Matsui Y. Reduction of Arterial Oxygen Saturation Among Rescuers During Cardiopulmonary Resuscitation in a Hypobaric Hypoxic Environment. Wilderness Environ Med. 2020 Mar;31(1):97-100. doi: 10.1016/j.wem.2019.10.008. Epub 2020 Feb 7. PMID: 32044210.

Tian Y, Tu X, Zhou X, Yu J, Luo S, Ma L, Liu C, Zhao Y, Jin X. Wearing a N95 mask increases rescuer's fatigue and decreases chest compression quality in simulated cardiopulmonary resuscitation. Am J Emerg Med. 2020 May 27:S0735-6757(20)30424-1. doi: 10.1016/j.ajem.2020.05.065. Epub ahead of print. PMID: 33046304; PMCID: PMC7255202.

2021 Evidence Update Worksheet
Appendix B1 BLS 10

Worksheet author(s): Olasveengen
Date Submitted: 02.14.2021

PICO / Research Question:

The PICOST (Population, Intervention, Comparator, Outcome, Study Designs and Timeframe)

Population: Among adults and children who are not in cardiac arrest (CA) out-side of a hospital (OHCA)

Intervention: Does provision of chest compressions from lay rescuers

Comparators: Compared with no use of chest compressions.

Outcomes: Change survival with favorable neurological / functional outcome at discharge, 30 days, 60 days, 180 days, and/or 1 year; harm (e.g. rib fracture); complications; major bleeding; risk of complications (e.g. aspiration); survival only at discharge, 30 days, 60 days, 180 days and/or 1 year; survival to admission

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. It is anticipated that there will be insufficient studies from which to draw a conclusion; case series and case reports will also be included in the initial search.

Type (intervention, diagnosis, prognosis): intervention

Additional Evidence Reviewer(s): None
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:
We recommend that lay persons initiate CPR for presumed cardiac arrest without concerns of harm to patients not in cardiac arrest (strong recommendation, very low certainty evidence).

2010/2015 Search Strategy:
((((("Cardiopulmonary Resuscitation/adverse effects"[Mesh:NoExp]) OR ((((("Cardiopulmonary Resuscitation"[Mesh:NoExp] OR "cardiopulmonary resuscitation"[TIAB] OR "cardio-pulmonary resuscitation"[TIAB] OR CPR[TIAB] OR "thorax compressions"[TIAB] or "chest compressions"[TIAB] OR "chest compression"[TIAB] OR "basic life support"[TIAB] OR "Basic Cardiac Life Support"[TIAB]))) AND (("Thoracic Injuries"[Mesh] OR "Wounds and Injuries"[Mesh:NoExp] OR "Abdominal Injuries"[Mesh] OR "Rupture"[Mesh] OR "Pneumothorax"[Mesh] OR "Respiratory Aspiration"[Mesh] OR "Pain"[Mesh] OR Complications[TIAB])))))) AND (bystander[TIAB] OR

bystanders[TIAB] OR "lay rescuer"[TIAB] OR "lay rescuers"[TIAB] OR "first responder"[TIAB] OR "first responders"[TIAB] OR "layperson"[TIAB] OR "lay people"[TIAB] OR "lay person"[TIAB]))

2020 Search Strategy: Pubmed search as above.
Additional search in Embase:

1 heart arrest/ or resuscitation/ or heart ventricle fibrillation/
2 Cardiopulmonary Resuscitation.mp. or exp resuscitation/
3 thorax compressions.mp.
4 chest compressions.mp.
5 basic life support.mp.
6 Basic Cardiac Life Support.mp.
7 1 or 2 or 3 or 4 or 5 or 6
8 Thoracic Injuries.mp. or thorax injury/
9 (Wounds and Injuries).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
10 Abdominal Injuries.mp. or abdominal injury/
11 rupture/ or Rupture.mp.
12 tension pneumothorax/ or pneumothorax/ or Pneumothorax.mp.
13 Respiratory Aspiration.mp. or acid aspiration/
14 pain/co, dm [Complication, Disease Management]
15 Complications.mp. or complication/
16 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
17 bystander.mp.
18 lay rescuer.mp.
19 first responder.mp.
20 layperson.mp. or layperson/
21 lay person.mp.
22 17 or 18 or 19 or 20 or 21
23 22 and 16 and 7

Database searched: Pubmed and Embase
Date Search Completed: 14.02.2021
Search Results (Number of articles identified / number identified as relevant): 2
Inclusion/Exclusion Criteria: Animal studies, conference abstracts, trial protocols
Link to Article Titles and Abstracts (if available on PubMed):
https://pubmed.ncbi.nlm.nih.gov/30819095/
https://pubmed.ncbi.nlm.nih.gov/32208039/

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies:

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**
	Study Type:	**Inclusion Criteria:**	**1° endpoint:**	
Deliliga 2019	Observational study/ Case series	88 cardiac arrest cases autopsied	Injuries resulting from the application of CPR	26.7% had rib fractures 17.4% had sternal fractures Number of fractures was 7.86 (4.11 on the right side and 4.75 on the left side). 16% of the cases were found to be mild, 48% were moderate, and 35% of the cases were severe.
Rowland D 2020	Case report		Injury during mechanical chest compression	Description of case: Seven minutes after AM-CPR application, the patient had absent right-sided breath sounds and ventilations were more difficult. Needle decompression was performed with an audible release of air. A chest tube was placed by an EMS physician and roughly 400 mL of blood were immediately returned. At the next 2-minute pulse check, ROSC was noted, and the patient was transported to the hospital.

Reviewer Comments (including whether meet criteria for formal review):
The Basic Life Support Task Force did not find the results of the two case series/case reports sufficient to challenge current guidelines and warrant a full review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

Deliliga A, Chatzinikolaou F, Koutsoukis D, Chrysovergis I, Voultsos P. Cardiopulmonary resuscitation (CPR) complications encountered in forensic autopsy cases. BMC Emerg Med. 2019 Feb 28;19(1):23. doi: 10.1186/s12873-019-0234-5.

Rowland D, Vryhof N, Overton D, Mastenbrook J. Tension Hemopneumothorax in the Setting of Mechanical CPR during Prehospital Cardiac Arrest. Prehosp Emerg Care. 2020 Apr 14:1-7. doi: 10.1080/10903127.2020.1743800. Online ahead of print.

2021 Evidence Update Worksheet
Appendix B1 BLS 11

Worksheet author(s): Federico Semeraro
Date Submitted: Feb 16th 2021

PICO / Research Question:

The PICOST (Population, Intervention, Comparator, Outcome, Study Designs and Timeframe)

Population: Rescuers providing CPR to unconscious persons not breathing normally in any setting

Intervention: Performing resuscitation (ventilations, compressions, defibrillation, etc)

Comparators: Not performing resuscitation

Outcomes: Harm to rescuer (eg. Infection, exhaustion, stress, physical harm etc.)?

Study Designs: 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.

Timeframe: All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded. Literature search updated to November 1st, 2019.

Outcomes: Any harm to rescuer
Type (intervention, diagnosis, prognosis): Intervention

Additional Evidence Reviewer(s): Theresa M. Olasveengen
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2010

Last ILCOR Consensus on Science and Treatment Recommendation:
Treatment Recommendation
Evidence supporting rescuer safety during CPR is limited. The few isolated reports of adverse effects resulting from the widespread and frequent use of CPR suggest that performing CPR is relatively safe. Delivery of
defibrillator shock with an AED during BLS is also safe. The incidence and morbidity of defibrillator-related injuries in the rescuers are low.

2010/2015/2020 Search Strategy:
Pubmed (153 records; Period 01/01/2007- 01/11/2019)

((Rescuer OR “Single rescuer” OR “single-rescuer” OR saviour* OR savior* OR deliverer) AND ("Heart Arrest"[Mesh] OR "heart arrest*"[TIAB] OR "cardiac arrest*"[TIAB] OR "cardiovascular arrest*"[TIAB] OR "cardiopulmonary arrest*"[TIAB] OR "cardio-pulmonary arrest*"[TIAB] OR "Out-of-Hospital Cardiac Arrest*"[Mesh] OR OHCA OR "Out of Hospital Cardiac Arrest*"[TIAB] OR "Out-of-Hospital Cardiac Arrest*"[TIAB] OR "Outside-of-Hospital Cardiac Arrest"[TIAB] OR resuscitation [Mesh] OR resuscitation* [TIAB] OR "cardiopulmonary resuscitation"[Mesh] OR "cardiopulmonary resuscitation"[TIAB] OR "Cardio-Pulmonary Resuscitation" OR "Cardio Pulmonary Resuscitation" OR CPR [TIAB] OR "Life Support Care"[Mesh] OR "Basic Cardiac Life Support" OR "basic life support" OR "Cardiac Life Support" [TIAB] OR "cardiorespiratory resuscitation"[TIAB] OR "Heart Massage*"[Mesh] OR “heart massage*”[TIAB] OR “cardiac massage*” [TIAB] OR “chest compression*”[TIAB] OR “cardiac compression*”[TIAB] OR ventilation OR defibrillation OR “Electric countershock” [MeSH Terms] OR “Electric Defibrillation” OR “Automated External Defibrillator*” OR AED)) AND (harm OR harms OR danger* OR injur* OR trauma OR damage OR hurt OR “adverse effects” OR safety OR hazard OR “disease transmission” OR infection [MeSH Terms] OR infection* OR “patient-to-professional” OR stress OR psychological OR exhaustion OR fatigue OR collapse OR burnout))

Embase (249 records; Period 2007- 2019)

(Rescuer OR “Single rescuer” OR “single-rescuer” OR saviour* OR savior* OR deliverer) AND ('heart arrest'/exp OR ('cardiac arrest*' OR 'cardiovascular arrest*' OR 'cardiopulmonary arrest*' OR 'cardio-pulmonary arrest'):ta,ab,kw OR 'out of hospital cardiac arrest'/exp OR (ohca OR 'out-of-hospital cardiac arrest*' OR 'outside-of-hospital cardiac arrest'):ta,ab,kw OR 'heart massage'/exp OR ('cardiopulmonary resuscitation' OR 'cardio-pulmonary resuscitation' OR 'cardio pulmonary resuscitation' OR cpr OR 'basic life support' OR 'cardiorespiratory resuscitation' OR 'heart massage*' OR 'cardiac massage*' OR 'chest compression*' OR 'cardiac compression*' OR ventilation OR defibrillation OR “Electric countershock” OR “Electric Defibrillation” OR “Automated External Defibrillator*” OR AED) :ta,ab,kw) AND (harm OR harms OR danger* OR injur* OR trauma OR damage OR hurt OR “adverse effects” OR safety OR hazard OR “disease transmission” OR infection OR infection* OR “patient-to-professional” OR stress OR psychological OR exhaustion OR fatigue OR collapse OR burnout))

Cochrane (267 records; Period 01/01/2007- 01/11/2019)

((Rescuer OR “Single rescuer” OR “single-rescuer” OR saviour* OR savior* OR deliverer) AND (MeSH descriptor: [Heart Arrest] OR ("cardiac arrest" OR "cardiovascular arrest*" OR "cardiopulmonary arrest*" OR "cardio-pulmonary arrest*"):ti,ab,kw OR MeSH descriptor: [Out-of-Hospital Cardiac Arrest] OR ("cardiopulmonary resuscitation" OR "Cardio Pulmonary Resuscitation" OR CPR OR "Life Support Care" OR "Basic Cardiac Life Support" OR "basic life support" OR "Cardiac Life Support" OR "cardiorespiratory resuscitation"):ti,ab,kw OR MeSH descriptor: [Heart Massage] OR ("cardiac massage*" OR "chest compression*" OR "cardiac compression" OR ventilation OR defibrillation OR “Electric countershock” OR “Electric Defibrillation” OR “Automated External Defibrillator*” OR AED):ti,ab,kw) AND (harm OR harms OR danger* OR injur* OR trauma OR damage OR hurt OR “adverse effects” OR safety OR hazard OR “disease transmission” OR infection [MeSH Terms] OR infection* OR “patient-to-professional” OR stress OR psychological OR exhaustion OR fatigue OR collapse OR burnout))

2020 Search Strategy: Same as above
Database searched: Pubmed, Embase and Cochrane
Date Search Completed: Feb 16th 2021

Search Results (Number of articles identified / number identified as relevant): 65 / 1
Inclusion/Exclusion Criteria: Inclusion Criteria: human studies. Exclusion Criteria: animal studies or those that did not describe risk or adverse effects in CPR performers. Abstract only studies and studies not peer reviewed or not answer question.

Link to Article Titles and Abstracts (if available on PubMed):
https://pubmed.ncbi.nlm.nih.gov/33489737/

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Chen 2020	Qualitative study to explore the experiences of rescuers (n=9)	Lay rescuers who had performed CPR and AED in public locations in Taiwan	Event-to-interview duration was within 1 year (n = 4) and 1-2 years (n = 5). (1) the lay rescuers possessed helping traits and high motivation; (2) the lay rescuers reported certain aspects of rescue reality that differed much from prior training and expectations, including difficulty in the depth of chest compression, and uncertainties in real emergency situations; (3) the lay rescuers gained positive personal fulfillment in sharing their experience and receiving positive feedback from others, and were willing to help next time, although they experienced a short-term negative psychological impact from the event.	Author conclusion: This study provides valuable information on strategies to increase layperson CPR rates and effectiveness in CPR training. Measures should be taken to increase layperson's confidence and situation awareness, reduce training-reality discrepancy, build up a support system to avoid negative psychological effects, and prepare lay rescuers for the next resuscitation.

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

The Basic Life Support Task Force did not find the results of the single qualitative study sufficient to challenge current guidelines and warrant a full review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

Chen HH, Chiang WC, Hsieh MJ, Lee CH, Yuan ZF, Lin HY, Chew LF, Huang EP, Yang CW, Liao SC, Lin CW, Lee MN, Ma MH. Experiences and Psychological Influences in Lay Rescuers Performing Bystander Cardiopulmonary Resuscitation: A Qualitative Study. J Acute Med. 2020 Dec 1;10(4):138-148. doi: 10.6705/j.jacme.202012_10(4).0002.

2021 Evidence Update Worksheet
Appendix B1 BLS 12

Worksheet author(s): Giuseppe Ristagno
Date Submitted: 14th February 2021

PICO / Research Question: BLS 357 Hand position during compressions
Outcomes: Any clinical outcome. Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. ROSC was ranked as an important outcome. Physiological outcomes, such as blood pressure, coronary perfusion pressure, or ETCO2, also were considered important.
Type (intervention, diagnosis, prognosis): Delivery of chest compressions on the lower half of the sternum.

Additional Evidence Reviewer(s):
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2019 **New question:** N.A.

Last ILCOR Consensus on Science and Treatment Recommendation: There were no studies reporting the critical outcomes of favorable neurological outcome, survival, or the important outcome of ROSC. For the important outcome of physiological end points, we identified 3 very-low certainty studies (downgraded for bias, indirectness, and imprecision). One crossover study in 17 adults with prolonged resuscitation from nontraumatic cardiac arrest observed improved peak arterial pressure during compression systole (114±51 mm Hg compared with 95±42 mm Hg) and ETCO2 (11.0±6.7 mm Hg compared with 9.6±6.9 mm Hg) when compressions were performed over the lower third of the sternum compared with the center of the chest, but arterial pressure during compression recoil, peak right atrial pressure, and coronary perfusion pressure did not differ. A second crossover study in 30 adults with cardiac arrest observed no difference in ETCO2 values resulting from changes in hand placement. A third crossover study in 10 children observed higher peak systolic pressure and higher mean arterial pressure when compressions were performed on the lower third of the sternum compared with the middle of the sternum.

This treatment recommendation (below) is unchanged from 2015. We suggest performing chest compressions on the lower half of the sternum on adults in cardiac arrest (weak recommendation, very-low-certainty evidence).

2010/2015 Search Strategy:
2019 Search Strategy: ("hand"[Mesh] OR "Hand placement"[TIAB] OR "hand position"[TIAB] OR "hand positioning"[TIAB] OR "finger placement"[TIAB] OR "finger position"[TIAB] OR "finger positioning"[TIAB] OR "alternative position" OR "alternative compression") AND ("Resuscitation"[Mesh] OR resuscitat*[TIAB] OR "cardiopulmonary resuscitation"[Mesh] OR "heart massage"[Mesh] OR "cardiopulmonary resuscitation"[TIAB] OR CPR[TIAB] OR "chest compression"[TIAB] OR "chest compressions"[TIAB] OR "heart massage"[TIAB] OR "cardiac

massage"[TIAB] OR "cardiac compression"[TIAB] OR "cardiac compressions"[TIAB] OR "thoracic compression"[TIAB] OR "thoracic compressions"[TIAB]) NOT (animal[Mesh] NOT humans[Mesh]) NOT ("News" [Publication Type] OR "letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])

Database searched: Pubmed

Date Search Completed: February 14th, 2021

Search Results (Number of articles identified / number identified as relevant): 40 articles identified / 2 relevant (systematic reviews on pediatric population)

Inclusion/Exclusion Criteria: RCTs and nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion. Unpublished studies (eg, conference abstracts, trial protocols) were excluded.

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

- https://pubmed.ncbi.nlm.nih.gov/32707697/
- https://pubmed.ncbi.nlm.nih.gov/32516929/

Summary of Evidence Update: No compelling clinical data suggesting the need to change the recommended hand placement for performing chest compressions were identified. Update systematic review for 2021 is not needed.

Evidence Update Process for topics not covered by ILCOR Task Forces

3. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

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**
ILCOR; Olasveengen 2020	Systematic review	Hand Position During Compressions (BLS 357: SysRev)	3	absence of compelling clinical data suggesting the need to change the recommended hand placement for performing chest compressions	We suggest performing chest compressions on the lower half of the sternum on adults in cardiac arrest (weak recommendation, very-low-certainty evidence).
Chang 2020	Systematic review on infants	2-thumb (TT) vs 2-finger (TF) CPR techniques	13	TT technique was associated with higher proportion of adequate compression depth (Mean difference (MD): 19.99%; 95%, Confidence interval (CI): 9.77 to 30.22; $p < 0.01$) than the TF technique.	n.a.

Chang 2020	Systematic review on infants	2-thumb (TT) vs 2-finger (TF) CPR techniques	12	The TT technique was associated with deeper chest-compression depth (mean difference: 4.71 mm; 95% confidence interval: 3.61 to 5.81; $p < 0.001$) compared with the TF technique. The TF technique was better in terms of the proportion of complete chest recoil (mean difference: -11.73%; 95% confidence interval: -20.29 to -3.17; $p = 0.007$).	n.a.

The 2 systematic reviews identified are from the same authors (Chang et al) and at a first look seem to report the same data (same articles included).

RCT: N.A.

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**
	Study Aim: **Study Type:**	**Inclusion Criteria:**	**Intervention:** **Comparison:**	**1° endpoint:**	**Study Limitations:**

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)**
	Study Type:	**Inclusion Criteria:**	**1° endpoint:**	

Reviewer Comments (including whether meet criteria for formal review):
No new evidence was identified.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 13

Worksheet author(s): Katie Dainty, PhD
Date Submitted: Feb 5 2021

PICO / Research Question:

PICOST ((Population, Intervention, Control, Outcomes, Study design and Timeframe) were:

Population: Adults and children with presumed cardiac arrest in out-of-hospital settings.

Intervention: Patients/cases or EMS systems where dispatch assisted CPR is offered.

Comparators: Studies with comparators where either EMS systems or specific cardiac arrest cases are not offered dispatch assisted CPR are included
.

Outcomes: All clinical outcomes.

Study Designs: 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.

Timeframe: All years and all languages are included as long as there is an English abstract; Unpublished studies (e.g., conference abstracts, trial protocols, methods papers).

Outcomes: All clinical outcomes.
Type (intervention, diagnosis, prognosis): Intervention – Dispatcher assisted CPR

Additional Evidence Reviewer(s): Not applicable
Conflicts of Interest (financial/intellectual, specific to this question): None to declare

Year of last full review: 2010 / 2015 / New question: 2019

Last ILCOR Consensus on Science and Treatment Recommendation: 2019
Nikolaou N, Dainty KN, Couper K, Morley P, Tijssen J, Vaillancourt C; International Liaison Committee on Resuscitation's (ILCOR) Basic Life Support and Pediatric Task Forces. A systematic review and meta-analysis of the effect of dispatcher-assisted CPR on outcomes from sudden cardiac arrest in adults and children. Resuscitation. 2019 May;138:82-105.

2019 Search Strategy:

PubMed	2187	(((((Emergency Medical Service Communication Systems[mesh] OR 911[TIAB] OR 999[TIAB] OR 9-1-1[TIAB] OR 9-9-9[TIAB] OR Emergency Medical Services[mesh] OR "Telephone"[Mesh] OR telephone[TIAB] OR dispatch-assisted[TIAB] OR dispatcher-assisted[TIAB] OR dispatch*[TIAB] OR "call-taker"[TIAB] OR operator*[TIAB] OR "Hotlines"[Mesh])))) AND (Instruct*[TIAB] OR direct*[TIAB] OR Guide*[TIAB] OR lead*[TIAB] OR assist*[TIAB] OR bystander[TIAB])) AND (("Out-of-Hospital Cardiac Arrest"[Mesh] OR "Heart Arrest"[Mesh] OR "cardiac arrest"[TIAB] OR "cardiac arrests"[TIAB] OR "cardiovascular arrest"[TIAB] OR "cardiovascular arrests"[TIAB] OR "heart arrest"[TIAB] OR "heart arrests"[TIAB] OR "asystole"[TIAB] OR "pulseless electrical activity"[TIAB] OR "cardiopulmonary arrest"[TIAB] OR "cardiopulmonary arrests"[TIAB] OR "cardiopulmonary resuscitation"[Mesh] OR "cardiopulmonary resuscitation"[TIAB] OR CPR[TIAB] OR "Heart Massage"[Mesh])))) NOT ((editorial /lim OR letter /lim OR case report/de)	Medical Service Communication Systems 911 999 Emergency Medical Services Telephone dispatch* Call-taker operator Hotlines	Instruct* direct* Guide* lead* assist* bystander	Out-of-Hospital Cardiac Arrest Heart Arrest cardiac arrest cardiac arrests cardiovascular "heart arrest asystole pulseless electrical activity cardiopulmonary arrest cardiopulmonary arrests cardiopulmonary resuscitation CPR[Heart Massage
EMBASE	71	(Emergency Medical Service Communication Systems.mp. or exp Emergency Medical Service Communication Systems/ or 9-1-1.ti,ab. or 9-9-9.ab,ti. or exp Emergency Medical Services/ or exp Telephone/ or telephone.ab,ti. or dispatch-assist*:.ab,ti. or dispatcher-assisted:.ab,ti. or dispatch*.ab,ti. or call-taker.ab,ti. or operator*.ab,ti. or exp Hotlines/) and ((bystander or coach* or guide* or instruct* or lead*).mp. or teach*.mp..) and (exp Out-of-Hospital Cardiac Arrest/ or exp Heart Arrest/ or cardiac arrest.ab,ti. or cardiac arrests.ab,ti. or cardiovascular arrest.ab,ti. or cardiovascular arrest*.ab,ti. or heart arrest.ab,ti. or heart arrests.ab,ti. or asystole.ab,ti. or pulseless electrical activity.ab,ti. or cardiopulmonary arrest*.ab,ti. or cardiopulmonary arrests.ab,ti. or exp cardiopulmonary resuscitation/ or cardiopulmonary resuscitation.ti,ab. or CPR.ab,ti. or exp Heart Massage/)	Emergency Medical Service Communication Systems Emergency Medical Service Communication Systems 9-1-1 9-9-9 Emergency Medical Services/ Telephone/ or telephone.ab,ti. or dispatch* assist*: call-taker operator Hotlines	bystander coach* guide* instruct* lead* teach*	Out-of-Hospital Cardiac Arrest Heart Arrest cardiac arrest. cardiac arrests. cardiovascular arrest. heart arrests asystole pulseless electrical activity. cardiopulmonary arrests cardiopulmonary resuscitation CPR Heart Massage

Cochrane	43	((hotlines or "911" or 9-1-1 or 9-9-9 or "999" or Emergency Medical Services or telephone or dispatch-assisted or dispatcher-assisted or dispatch* or "call-taker" or operator* or Hotline) and (bystander or coach* or guide* or instruct* or lead* or teach*) and (Out-of-Hospital Cardiac Arrest or Heart Arrest or cardiac arrests or cardiovascular arrest* or heart arrest or heart arrests or asystole or pulseless electrical activity or cardiopulmonary arrest* or cardiopulmonary arrests or cardiopulmonary resuscitation or cardiopulmonary resuscitation or CPR or Heart Massage)).mp.	hotlines 911 9-1-1 999 9-9-9 Emergency Medical Services telephone dispatch*-assisted dispatcher dispatch* "call-taker" operator* Hotline	bystander coach* guide* instruct* lead* teach*	Out-of-Hospital Cardiac cardiovascular arrest* heart arrests or asystole pulseless electrical activity cardiopulmonary arrest cardiopulmonary resuscitation r CPR Heart Massage

2020 Search Strategy:

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1 exp Cardiopulmonary Resuscitation/
2 (cardiopulmonary respiratory resuscitation$ or cardiopulmonary resuscitation$ or cardio pulmonary resuscitation$ or cardio-pulmonary resuscitation$ or CPR or Advanced Cardiac Life Support or basic cardiac life support or code blue or resuscitation$ mouth-to-mouth or mouth-to-mouth resuscitation$ or mouth to mouth resuscitation$).tw.
3 Resuscitation/
4 limit 3 to yr=1978-1991
5 1 or 2 or 4
6 mt.fs.
7 method$.tw.
8 6 or 7
9 5 and 8
10 randomized controlled trial.pt.
11 (randomized or placebo).mp.
12 clinical trial.pt.
13 Comparative Study.pt.
14 cross-over studies/
15 controlled clinical trial.pt.

16 (time adj series).tw.
17 (pre test or pretest or (posttest or post test)).tw.
18 random allocation/
19 (controlled adj before).tw.
20 exp epidemiologic studies/
21 ((case* adj3 control*) or (case adj3 comparison*) or control group*).tw.
22 or/10-21
23 9 and 22
24 (control$ or compar$ or random$).tw.
25 9 and 24
26 23 or 25
27 animals/ not humans/
28 26 not 27
29 (editorial or letter).pt.
30 28 not 29
31 ("18334691" or "19660833" or "16564776" or "18374452" or "20370759" or "26550795").ui.
32 30 or 31
33 comment.pt.
34 32 not 33
35 remove duplicates from 34

Database searched: Medline
Date Search Completed: Jan 28th 2021
Search Results (Number of articles identified / number identified as relevant): 814 / 8
Inclusion/Exclusion Criteria: Any clinical study that included both intervention and control group were reviewed, animal and simulation studies were excluded.

Link to Article Titles and Abstracts (if available on PubMed):
https://pubmed.ncbi.nlm.nih.gov/31542238/
https://pubmed.ncbi.nlm.nih.gov/33221356/
https://pubmed.ncbi.nlm.nih.gov/33151108/
https://pubmed.ncbi.nlm.nih.gov/32918983/
https://pubmed.ncbi.nlm.nih.gov/31956145/
https://pubmed.ncbi.nlm.nih.gov/32336582/
https://pubmed.ncbi.nlm.nih.gov/32466824/
https://pubmed.ncbi.nlm.nih.gov/32998954/

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

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
Wang; Prehospital & Disaster Medicine. 35(4):372-381, 2020 Aug.	Systematic Review and Meta-analysis	Impact of Dispatcher-Assisted Bystander Cardiopulmonary Resuscitation with Out-of-Hospital Cardiac Arrest	13 studies; 235,550 patients	Compared with no dispatcher instruction, DA-BCPR tended to be effective in improving BCPR rate (I2 = 98.2%; OR = 5.84; 95% CI, 4.58-7.46; P <.01), return of spontaneous circulation (ROSC) before admission (I2 = 36.0%; OR = 1.17; 95% CI, 1.06-1.29; P <.01), discharge or 30-day survival rate (I2 = 47.7%; OR = 1.25; 95% CI, 1.06-1.46; P <.01), and good neurological outcome (I2 = 30.9%; OR = 1.24; 95% CI, 1.04-1.48; P = .01). However, no significant difference in hospital admission was found (I2 = 29.0%; OR = 1.09; 95% CI, 0.91-1.30; P = .36).	This review shows DA-BPCR plays a positive role for OHCA as a critical section in the life chain. It is effective in improving the probability of BCPR, survival, ROSC before admission, and neurological outcome.

RCT: None

Non-randomized 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)
Pek PP et al Improved Out-of-Hospital Cardiac Arrest Survival with a	**Study Type:** Before-after analysis;	**Inclusion Criteria:**	**1° endpoint:** Survival-to-discharge/30 days	In the post-intervention group, there was an increase in BCPR rates from 24.8% to 53.8% (p < 0.001), adjusted OR 3.67 (aOR; 95%CI: 3.26-4.13). OHCA outcomes also improved with survival-

Comprehensive Dispatcher-Assisted CPR Program in a Developing Emergency Care System. Prehosp Emerg Care. 2020 Dec 4:1-10. SINGAPORE	national database 2012-2015; n=6365	OHCA cases with cardiac etiology conveyed by EMS	post-arrest and favorable cerebral performance (Glasgow-Pittsburgh CPC 1 or 2).	to-discharge rates increasing from 3.0%-4.5% (p<0.01), aOR 2.10 (95%CI: 1.40-3.17) and favorable CPC increasing from 1.6% to 2.7% (p<0.05), aOR 2.82 (95%CI: 1.65-4.82).
Zhang L et al. When dispatcher assistance is not saving lives: assessment of process compliance, barriers and outcomes in out-of-hospital cardiac arrest in a metropolitan city in China. Emerg Med J. 2020 Sep 30:emermed-2019-209291 CHINA	Observational cohort study ; n=151	Adult OHCA victims with a bystander-witnessed atraumatic OHCA that was subsequently confirmed by on-site emergency physician	Survival; time to EMS arrival; B-CPR; barriers to DA-CPR	The median time from patient collapse to call for emergency services and that from call to provision of cardiopulmonary resuscitation instructions was 30 (IQR 20-60) min and 115 (IQR 90-153) s, respectively. Only 110 (80.3%) bystanders/rescuers followed the dispatcher instructions; of these, 51 (46.3%) undertook persistent chest compressions. Major barriers to following the DA-CPR instructions were present in 104 (68.9%) cases, including caller disconnection of the call, distraught mood or refusal to carry out either compressions or ventilations.
Siman-Tov M et al. Impact of dispatcher assisted CPR on ROSC rates: A National Cohort Study. Am J Emerg Med. 2020 Apr 15:S0735-6757(20)30269-2 ISRAEL	Observational cohort study (2018);n=2,310	All 2018 OHCA incidents in Israel's national EMS database were studied retrospectively	ROSC; rates of rates and reasons of DA-CPR acceptance	DA-CPR was accepted by caller 76.5% of incidents. In group 1, ROSC rates were significantly lower compared to patients in group 2 (12.4% vs. 21.3% p < .001). Group 1 had 12.4% shockable rhythms vs. 17.1% in group 2 (DA-CPR and team CPR). Of the total 369 shockable cases, 42.3% (156) achieved ROSC, in the non-shockable rhythms only 14.8% achieved ROSC.

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)**
Kim MW et al. Comparison between dispatcher-assisted bystander CPR and self-led bystander CPR in out-of-hospital cardiac arrest (OHCA). Resuscitation. 2021 Jan; 158:64-70. KOREA	Observational cohort study (2014-2018); n=91,557	Adult EMS-treated OHCA patients with presumed cardiac origin were enrolled	Good neurologic recovery at hospital discharge	A total of 91,557 eligible OHCA patients was enrolled in the final analysis. The proportion of patients with favorable neurologic outcomes was highest with self-led bystander CPR (9.0% for self-led bystander CPR, 5.2% for DA bystander CPR and 3.2% for no bystander CPR, $p < 0.01$). Self-led bystander CPR was associated with better neurological recovery than DA bystander CPR (aOR with 95% CI (DA-CPR as reference): 0.63 (0.58-0.69) for no bystander CPR, 1.28 (1.17-1.40) for self-led bystander CPR).
Hatakeyama T et al. Effectiveness of dispatcher instructions-dependent or independent bystander cardiopulmonary resuscitation on neurological survival among patients with out-of-hospital cardiac arrest. J Cardiol. 2020 Mar;75(3):315-322. JAPAN	Observational cohort study (2009-2015); n=10,925	Patients with medical cause-related out-of-hospital cardiac arrest who were ≥18 years old	One-month favorable neurological survival.	For analyses 10,925 individuals were eligible. Independent CPR had a significantly higher one-month favorable neurological survival than no CPR whereas there was no significant difference between DI-dependent CPR and no CPR (AOR, 1.90 [1.47-2.46] and 1.16 [0.91-1.47], respectively). The estimated "time to EMS arrival" for a one-month favorable neurological survival after independent CPR was ≤13min.
Shimamoto T et al. Impact of Bystander Cardiopulmonary Resuscitation and Dispatcher Assistance on Survival After Out-of-Hospital Cardiac Arrest Among Adult Patients by Location of Arrest. Int	Observational cohort study (2013-2015); n=104,621	Adult patients with bystander-witnessed OHCA of medical origin between 2013 and 2015	Neurologically favorable outcome, defined by cerebral performance category 1 or 2	A total of 104,621 cases; In public locations, both the bystander-CPR-with-DA group (22.9% [1,068/4,665]; adjusted odds ratio (AOR), 1.62; 95% confidence interval (CI), 1.43-1.85) and the bystander-CPR-without-DA group (25.8% [918/3,557]; AOR, 1.43; 95% CI, 1.24-1.65) had neurologically favorable outcomes compared with the no-bystander-CPR group (9.9% [610/6,133]). In residential locations, the AORs were 1.44 (95% CI, 1.22-1.70) in the bystander-CPR-without-DA group and 1.60 (95% CI, 1.45-1.77) in the bystander-CPR-with-DA group.

Heart J. 2020 Jan 31;61(1):46-53 JAPAN				

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)**
Riva G et al. Survival after dispatcher-assisted cardiopulmonary resuscitation in out-of-hospital cardiac arrest. Resuscitation. 2020 Dec;157:195-201. SWEDEN	Observational cohort study 2010-2017; n=15,471	All consecutive lay bystander witnessed OHCAs reported to the Swedish Register for CPR 2010-2017	30-day survival	A total of 15 471 patients were included and distributed as follows: NO-CPR 6440 (41.6%), DA-CPR 4793 (31.0%) and SP-CPR 4238 (27.4%). Survival rates to 30 days were 7.1%, 13.0% and 18.3%, respectively. In propensity-score matched analysis (DA-CPR as reference), NO-CPR was associated with lower survival (conditional OR 0.61, 95% CI 0.52-0.72) and SP-CPR was associated with higher survival (conditional OR 1.21 (95% CI 1.05-1.39).

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

The Basic Life Support Task Force did not find the results of the observational studies sufficient to challenge current guidelines and warrant a full review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

Hatakeyama T et al. Effectiveness of dispatcher instructions-dependent or independent bystander cardiopulmonary resuscitation on neurological survival among patients with out-of-hospital cardiac arrest. J Cardiol. 2020 Mar;75(3):315-322.

Kim MW et al. Comparison between dispatcher-assisted bystander CPR and self-led bystander CPR in out-of-hospital cardiac arrest (OHCA). Resuscitation. 2021 Jan; 158:64-70.

Pek PP et al Improved Out-of-Hospital Cardiac Arrest Survival with a Comprehensive Dispatcher-Assisted CPR Program in a Developing Emergency Care System. Prehosp Emerg Care. 2020 Dec 4:1-10.

Riva G et al. Survival after dispatcher-assisted cardiopulmonary resuscitation in out-of-hospital cardiac arrest. Resuscitation. 2020 Dec; 157:195-201.

Shimamoto T et al. Impact of Bystander Cardiopulmonary Resuscitation and Dispatcher Assistance on Survival After Out-of-Hospital Cardiac Arrest Among Adult Patients by Location of Arrest. Int Heart J. 2020 Jan 31;61(1):46-53

Siman-Tov M et al. Impact of dispatcher assisted CPR on ROSC rates: A National Cohort Study. Am J Emerg Med. 2020 Apr 15: S0735-6757(20)30269-2

Wang J, Zhang H, Zhao Z, Wen K, Xu Y, Wang D, Ma Q. Impact of Dispatcher-Assisted Bystander Cardiopulmonary Resuscitation with Out-of-Hospital Cardiac Arrest: A Systemic Review and Meta-Analysis. Prehosp Disaster Med. 2020 Aug;35(4):372-381

Zhang L et al. When dispatcher assistance is not saving lives: assessment of process compliance, barriers and outcomes in out-of-hospital cardiac arrest in a metropolitan city in China. Emerg Med J. 2020 Sep 30: emermed-2019-209291.

2021 Evidence Update Worksheet
Appendix B1 BLS 14

Worksheet author(s): Peter J. Kudenchuk, MD
Date Submitted: 2/5/2021

BLS 360
PICO / Research Question: Among adults who are in cardiac arrest outside of a hospital (population), does provision of chest compressions with delayed ventilation by Emergency Medical Services (EMS) (intervention) compared with chest compressions with early ventilations by EMS (comparison) change outcome (outcome)?
Outcomes: Not specified by PICOST, but evaluated for evidence of return of spontaneous circulation, admission alive to hospital, survival to hospital discharge, and survival with favorable neurological outcome
Type (intervention, diagnosis, prognosis): Intervention

Additional Evidence Reviewer(s): NA
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation: 2020

- We recommend that EMS providers perform CPR with 30 compressions to 2 breaths (30:2 ratio) or continuous chest compressions with positive pressure ventilation delivered without pausing chest compressions until a tracheal tube or supraglottic device has been placed (strong recommendation, high-certainty evidence)
- We suggest that, when EMS systems have adopted minimally interrupted cardiac resuscitation, this strategy is a reasonable alternative to conventional CPR for witnessed shockable OHCA (weak recommendation, very low-certainty evidence)

2010/2015 Search Strategy: NA
2020 Search Strategy:

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1 exp Cardiopulmonary Resuscitation/
2 (cardiopulmonary respiratory resuscitation$ or cardiopulmonary resuscitation$ or cardio pulmonary resuscitation$ or cardio-pulmonary resuscitation$ or CPR or Advanced Cardiac Life Support or basic cardiac life support or code blue or resuscitation$ mouth-to-mouth or mouth-to-mouth resuscitation$ or mouth to mouth resuscitation$).tw.
3 Resuscitation/
4 limit 3 to yr=1978-1991
5 1 or 2 or 4

6 mt.fs.
7 method$.tw.
8 6 or 7
9 5 and 8
10 randomized controlled trial.pt.
11 (randomized or placebo).mp.
12 clinical trial.pt.
13 Comparative Study.pt.
14 cross-over studies/
15 controlled clinical trial.pt.
16 (time adj series).tw.
17 (pre test or pretest or (posttest or post test)).tw.
18 random allocation/
19 (controlled adj before).tw.
20 exp epidemiologic studies/
21 ((case* adj3 control*) or (case adj3 comparison*) or control group*).tw.
22 or/10-21
23 9 and 22
24 (control$ or compar$ or random$).tw.
25 9 and 24
26 23 or 25
27 animals/ not humans/
28 26 not 27
29 (editorial or letter).pt.
30 28 not 29
31 ("18334691" or "19660833" or "16564776" or "18374452" or "20370759" or "26550795").ui.
32 30 or 31
33 comment.pt.
34 32 not 33
35 remove duplicates from 34

Database searched: Medline
Date Search Completed: 1/1/2020- 1/28/2021
Search Results (Number of articles identified / number identified as relevant): 815 articles retrieved from search → only 1 indirectly relevant to EMS arena and did not provide outcome data.
Inclusion/Exclusion Criteria: Manikin and clinical studies addressing adult resuscitation

Link to Article Titles and Abstracts (if available on PubMed):
https://pubmed.ncbi.nlm.nih.gov/33039236/

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

4. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies:

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**
Ventilation by Chest Compressions Vanwulpen 2021	**Study Type:** Observational (10 patients, 5 female, median age 64 yrs, median compressions 111/min, median depth 5.6 cm.	**Inclusion Criteria:** Adult, endotracheally intubated, nontraumatic out-of-hospital cardiac arrest	**1° endpoint:** Inspiratory tidal volume generated by first 30 manual chest compressions following intubation (without simultaneous manual ventilation)	Median inspiratory tidal volume generated by manual chest compressions without ventilation was 20 mL (IQR 13, 28 mL) which were judged inadequate to provide adequate alveolar ventilation.

Reviewer Comments (including whether meet criteria for formal review): Only a single study identified during the specified time window addressing provision of chest compressions with ventilation versus chest compressions alone in intubated patients, indicating that the tidal volume generated by chest compressions in an open airway is insufficient to provide alveolar ventilation. The study did not address arterial blood gas content nor EtCO2, nor ventilation in the non-intubated patient (although this would be expected to be either no different or resulting in lower tidal volumes if there is airway occlusion), nor clinical outcome. As such, the data would support provision of manual ventilation during the course of EMS CPR in order to achieve volumes sufficient to support alveolar ventilation, but not permit further extrapolation from this information. In sum, the interim evidence does not provide sufficient information to warrant updating this topic with a full systematic review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

Vanwulpen M, Wolfskeil M, Duchatelet C, Hachimi-Idrissi S. Do manual chest compressions provide substantial ventilation during prehospital cardiopulmonary resuscitation? Am J Emerg Med 2021;39:129-131.

2021 Evidence Update Worksheet
Appendix B1 BLS 15

Worksheet author(s): Theresa M. Olasveengen
Date Submitted: Feb 16th 2021

PICO / Research Question:

PICOST	Description
Population	Among adults and children who are in cardiac arrest in any setting
Intervention	does real-time feedback and prompt device regarding the mechanics of CPR quality (e.g. rate and depth of compressions and/or ventilations)
Comparison	compared with no feedback
Outcomes	Any clinical outcome (Survival with favorable neurologic outcome, Survival only at discharge, 30 days, 60 days, 180 days AND/OR 1 year, ROSC, bystander CPR rates, time to first compressions, time to first shock, CPR quality)
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.
Exclusion criteria	Animal studies Manikin / simulation / training studies Studies of post cardiac arrest debriefing or post cardiac arrest feedback Studies of dispatcher or telephone assisted CPR
Timeframe	2020, and all languages are included as long as there is an English abstract

Outcomes: Survival outcomes and CPR quality.
Type (intervention, diagnosis, prognosis): Intervention

Additional Evidence Reviewer(s): None
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:
Treatment recommendation:

We suggest the use of real-time audiovisual feedback and prompt devices during CPR in clinical practice as part of a comprehensive quality improvement program for cardiac arrest designed to ensure high-quality CPR delivery and resuscitation care across an EMS system (weak recommendation, very-low-certainty evidence).

We suggest against the use of real-time audiovisual feedback and prompt devices in isolation (ie, not part of a comprehensive quality improvement program) (weak recommendation, very-low-certainty evidence).

2020 Search Strategy:
Pubmed:
((((((((((heart arrest[MH] OR cardiopulmonary resuscitation[MH] OR "cardiac arrest"[TIAB] OR CPR[TIAB] OR "cardiopulmonary resuscitation"[TIAB] OR "advanced cardiac life support"[TIAB] OR "basic life support"[TIAB] OR "heart arrest"[TIAB] OR "ventricular fibrillation"[TIAB] OR ACLS[TIAB] OR Ventricular Fibrillation[MH]) AND ("Feedback"[Mesh] OR feed-back[TW] OR "feed back"[TW] OR feedback[TW] OR prompt*[TI] OR CPR-sensing[TW] OR Q-CPR[TW] OR CPR-plus[TW] OR CPREzy[TW] OR CPR-Ezy[TW]OR sensor*[TI] OR metronome*[TW] OR rate-directed[TW] OR depth-directed[TW] OR guidance[TI] OR real-time[TI] OR audio-visual[TI] OR audio[TI] OR visual[TI]))))) NOT ((("animals"[MH] NOT (animals[MH] AND "humans"[MH])))))) NOT ((("letter"[pt] OR "comment"[pt] OR "editorial"[pt])))))) AND (English[lang])))

Embase:
('heart arrest'/exp OR 'basic life support':ab,ti) OR 'cardiopulmonary resuscitation':ab,ti OR 'cardiac arrest':ab,ti OR 'cpr':ab,ti OR 'heart massage'/exp OR 'chest compression':ti OR 'chest compressions':ti AND ('feed back':ab,ti OR 'feedback':ab,ti OR prompt*:ti OR sensor*:ti OR metronome:ab,ti OR 'rate directed':ab,ti OR 'depth directed':ab,ti OR guidance:ti OR 'real time':ti OR 'cpr sensing':ab,ti OR 'q cpr':ab,ti OR 'audio visual':ti OR audio:ti OR visual:ti OR 'cpr plus':ab,ti OR cprezy:ab,ti OR 'cpr ezy':ab,ti) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim) AND [english]/lim AND [embase]/lim

Cochrane:
("cardiac arrest":ti,ab,kw or CPR:ti,ab,kw or "cardiopulmonary resuscitation":ti,ab,kw or "advanced cardiac life support":ti,ab,kw or "basic life support":ti,ab,kw or "heart arrest":ti,ab,kw or "ventricular fibrillation":ti,ab,kw or [mh "Heart Arrest"] or ACLS:ti,ab or [mh ^"Ventricular Fibrillation"]) and ([mh feedback] or (feedback:ti,ab,kw or feed-back:ti,ab,kw or "feed back":ti,ab,kw or prompt*:ti or feedback-sensor:ti,ab or guided:ti or video:ti or audio*:ti or CPR-plus:ti,ab,kw or CPREzy:ti,ab,kw or CPR-Ezy:ti,ab,kw or advisory:ti or telephone:ti or phone:ti or performance:ti or Q-CPR:ti,ab,kw or CPR-sensing:ti,ab,kw or CPR-sensor*:ti,ab,kw or sensor*:ti or metronome*:ti,ab,kw or rate-directed:ti,ab,kw or depth-directed:ti,ab,kw or guidance:ti or real-time:ti or audio-visual:ti or audio:ti or visual:ti))

Current Search Strategy: Pubmed search as above.
Database searched: Pubmed
Date Search Completed: Feb 16th 2021
Search Results (Number of articles identified / number identified as relevant): 112 /

Inclusion/Exclusion Criteria: Clinical studies comparing any type of feedback device was included, animal and simulation studies were excluded.

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

https://pubmed.ncbi.nlm.nih.gov/31325556/
https://pubmed.ncbi.nlm.nih.gov/32092113/
https://pubmed.ncbi.nlm.nih.gov/33456145/

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

Organisation (if relevant); Author; Year Published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
An 2019	Systematic review	Effect of smart devices on the quality of CPR training	11 articles (5 randomised controlled trials, 1 randomised trial, and 5 randomised cross-over trials)	Eight of these studies used smartphones and three used smartwatches. This review did not find an apparent benefit from smart device use during CPR in terms of maintaining the recommended compression rates and depths of chest compressions. However, all three smartwatch studies reported that the proportion of chest compressions of adequate depth was significantly improved with smartwatch use (smartwatch group vs. non-smartwatch group in the three studies: 65.01% vs. 45.15%, p = 0.01; 64.6% vs. 43.1%, p = 0.049; 98.7% vs. 79.3%, p = 0.002).	Author conclusion: This review does not find durable evidence for usefulness of smart devices in CPR training. However, the smartwatches may improve the accuracy of chest compression depth. Future studies with larger sample sizes might be necessary before reaching a firm conclusion.

RCT: None

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Lakomek 2020	Observational study (n=292)	Out-of-hospital cardiac arrest, three groups: 1. Historical control 2. Sensor only CPR group (measuring CPR quality but without feedback) 3. Sensor-feedback CPR group (measuring CPR quality with feedback)	The compression fraction increased with sensor-only CPR (group 2) in comparison with no-sensor CPR (group 1) (80.1% vs. 87.49%; P < 0.001), but there were no further differences belonging compression fraction after activation of sensor-feedback CPR (group 3) (P = 1.00). Compression frequency declined over the three study groups, reaching the guideline recommendations (127.81 comp/min vs. 122.96 comp/min, P = 0.02 vs. 119.15 comp/min, P = 0.008) after activation of sensor-feedback CPR (group 3). Mean compression depth only changed minimally with sensor-feedback (52.49 mm vs. 54.66 mm; P = 0.16), but the fraction of compressions with sufficient depth (at least 5 cm) and compressions within the recommended 5-6 cm increased significantly with sensor-feedback CPR (56.90% vs. 71.03%; P = 0.003 and 28.74% vs. 43.97%; P < 0.001).	Author conclusion: The real-time feedback system improved chest compression quality regarding pauses in compression and compression frequency and facilitated compliance with the guideline recommendations. Compression depth did not change significantly after activation of the real-time feedback. Even the sole use of a CPR-feedback-sensor ("sensor-only CPR") improved performance regarding pauses in compression and compression frequency, a phenomenon known as the 'Hawthorne effect'. Based on this data real-time feedback systems can be expected to raise the quality level in some parts of chest compression quality.
Khorasani-Zadeh 2020	Observational study (n=292)	In-hospital cardiac arrest 1. Historical control 2. Cardiac arrests after implementation of metronome device	Compared to control, the metronome group had a statistically significant improvement of the mean percent compression rate within 100 to 120 beats per minute: 28.16% vs. 71.14% (P < 0.001) and a statistically significant improvement of the mean percent compression depth within 2.0 to 2.4 inches: 29.35% vs. 34.84% (P = 0.03). However, there was no statistically significant improvement of mean percent release velocity >=400 mm/second: 47.41% vs. 51.09% (P = 0.38).	Author conclusion: Our data suggest that an inexpensive and widely available intervention may improve the quality of CPR

Reviewer Comments (including whether meet criteria for formal review):
New observational evidence was identified during the evidence update process, and the BLS Task Force will be prioritizing this question for full systematic review in 2021.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

An M, Kim Y, Cho WK. Effect of smart devices on the quality of CPR training: A systematic review. Resuscitation. 2019 Nov;144:145-156. doi: 10.1016/j.resuscitation.2019.07.011. Epub 2019 Jul 17.

Lakomek F, Lukas RP, Brinkrolf P, Mennewisch A, Steinsiek N, Gutendorf P, Sudowe H, Heller M, Kwiecien R, Zarbock A, Bohn A. Real-time feedback improves chest compression quality in out-of-hospital cardiac arrest: A prospective cohort study. PLoS One. 2020 Feb 24;15(2):e0229431. doi: 10.1371/journal.pone.0229431. eCollection 2020.

Khorasani-Zadeh A, Krowl LE, Chowdhry AK, Hantzidiamantis P, Hantzidiamantis K, Siciliano R, Grover MA, Dhamoon AS. Usefulness of a metronome to improve quality of chest compressions during cardiopulmonary resuscitation. Proc (Bayl Univ Med Cent). 2020 Aug 24;34(1):54-55. doi: 10.1080/08998280.2020.1805840.

2021 Evidence Update Worksheet
Appendix B1 BLS 16

Worksheet author(s): Chika Nishiyama
Date Submitted: Feb/11/2021

PICO / Research Question:
Adults and children with OHCA (P), Any compression-to-ventilation ratio other than 30:2 (I), Compression-to-ventilation ratio of 30:2 (C), change outcomes (O)
T: Search completed on February 6, 2021

Outcomes:
The primary outcome was favourable neurological outcomes, measured by cerebral performance or a modified Rankin Scale.
Secondary outcomes were Survival to hospital admission, survival to any time interval within hospital, survival to discharge, survival to 30 days, survival to any time interval after 30 days functional survival; Return of spontaneous circulation (ROSC); quality of life as measured by any indicator or score.

Type (intervention, diagnosis, prognosis): intervention

Additional Evidence Reviewer(s): None

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

Year of last full review: 2017
Note: KSU performed the systematic review in 2017

Last ILCOR Consensus on Science and Treatment Recommendation:
Consensus on Science (2017):
The 30:2 CV ratio was compared with a different CV ratio in 2 observational cohort studies that generated very-low-quality evidence for the critical outcome of favourable neurological function (Olasveengen TM et al. Resuscitation 2009;80:407–11, Kudenchuk PJ et al. Circulation 2012;125:1787–94). In a meta-analysis of these studies, the 30:2 CV ratio demonstrated benefit for favourable neurological function (RR, 1.34[95% CI, 1.02–1.76]; RD, 1.72 percentage points [95% CI, 0.52–2.91]) compared with the CV ratio of 15:2. The quality of evidence was downgraded for serious indirectness because these studies were before-and-after investigations that evaluated the bundle-of-care interventions implemented after the “2005 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations,” (International Liaison Committee on Resuscitation. Part 2: adult basic life support: 2005 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. Resuscitation 2005;67:187–201, International Liaison Committee on Resuscitation. Part 2: adult basic life support: 2005 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment

Recommendations. Circulation 2005;112(suppl):III-5–16), in which the change in CV ratio was just 1 aspect. Seven observational cohort studies provided very-low-quality evidence for the critical outcome of survival. (Olasveengen TM et al. Resuscitation 2009;80:407–11, Kudenchuk PJ et al. Circulation 2012;125:1787–94, Steinmetz J et al. Acta AnaesthesiolScand 2008;52:908–13, Garza AG et al. Circulation 2009;119:2597–605, Sayre MR et al. Prehosp Emerg Care 2009;13:469–77, Robinson S et al. Resuscitation 2010;81:1648–51, Deasy C et al. Resuscitation 2011;82:984–8). The quality of evidence was downgraded for serious indirectness because the CV ratio was not the only aspect evaluated in these studies. In a meta-analysis of 6 cohort studies, the survival rate was higher in the group of patients who received 30:2 CPR compared with the group who received 15:2 CPR (RR, 1.37 [95% CI, 1.19–1.59]; RD, 2.48 percentage points [95% CI, 1.57–3.38]). (Olasveengen TM et al. Resuscitation 2009;80:407–11, Kudenchuk PJ et al. Circulation 2012;125:1787–94, Steinmetz J et al. Acta Anaesthesiol Scand 2008;52:908–13, Sayre MR et al. Prehosp Emerg Care 2009;13:469–77, Robinson S et al. Resuscitation 2010;81:1648–51, Deasy C et al. Resuscitation 2011;82:984–8). One retrospective cohort showed improved survival with the 50:2 CV ratio compared with the 15:2 ratio (RR, 1.96 [95% CI, 1.28–2.99]; RD, 21.48 percentage points [95% CI, 6.90–36.06]) (Garza AG et al. Circulation 2009;119:2597–605). The quality of evidence was downgraded for serious risk of bias and indirectness. Risk of bias included high risk that the cohorts were not comparable on the basis of design or analysis and moderate risk of inadequate follow-up. The study was also considered indirect because of its before-and-after design potentially evaluating several changes to practice.

Treatment Recommendation (2017):

We suggest a CV ratio of 30:2 compared with any other CV ratio in patients with cardiac arrest (weak recommendation, very-low-quality evidence).

2017 Search Strategy:

Ovid MEDLINE(R) and Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations

1 exp Cardiopulmonary Resuscitation/
2 (cardiopulmonary respiratory resuscitation$ or cardiopulmonary resuscitation$ or cardio pulmonary resuscitation$ or cardio-pulmonary resuscitation$ or CPR or Advanced Cardiac Life Support or basic cardiac life support or code blue or resuscitation$ mouth-to-mouth or mouth-to-mouth resuscitation$ or mouth to mouth resuscitation$).tw.
3 Resuscitation/
4 limit 3 to yr=1978-1991
5 1 or 2 or 4
6 mt.fs.
7 method$.tw.
8 6 or 7
9 5 and 8
10 randomized controlled trial.pt.
11 (randomized or placebo).mp.
12 clinical trial.pt.
13 Comparative Study.pt.

14 cross-over studies/
15 controlled clinical trial.pt.
16 (time adj series).tw.
17 (pre test or pretest or (posttest or post test)).tw.
18 random allocation/
19 (controlled adj before).tw.
20 exp epidemiologic studies/
21 ((case* adj3 control*) or (case adj3 comparison*) or control group*).tw.
22 or/10-21
23 9 and 22
24 (control$ or compar$ or random$).tw.
25 9 and 24
26 23 or 25
27 animals/ not humans/
28 26 not 27
29 (editorial or letter).pt.
30 28 not 29
31 ("18334691" or "19660833" or "16564776" or "18374452" or "20370759" or "26550795").ui.
32 30 or 31
33 comment.pt.
34 32 not 33
35 remove duplicates from 34

2020 Search Strategy:

Based on the 2017 search strategies, BLS TF rerun literature review between 1 Jan 2020 to 6 Feb 2021.

1. exp Cardiopulmonary Resuscitation/
2. (cardiopulmonary respiratory resuscitation$ or cardiopulmonary resuscitation$ or cardio pulmonary resuscitation$ or cardio-pulmonary resuscitation$ or CPR or Advanced Cardiac Life Support or basic cardiac life support or code blue or resuscitation$ mouth-to-mouth or mouth-to-mouth resuscitation$ or mouth to mouth resuscitation$).tw.
3. Resuscitation/
4. limit 3 to yr=1978-1991
5. 1 or 2 or 4
6. mt.fs.
7. method$.tw.
8. 6 or 7
9. 5 and 8

10. randomized controlled trial.pt.
11. (randomized or placebo).mp.
12. clinical trial.pt.
13. Comparative Study.pt.
14. cross-over studies/
15. controlled clinical trial.pt.
16. (time adj series).tw.
17. (pre test or pretest or (posttest or post test)).tw.
18. random allocation/
19. (controlled adj before).tw.
20. exp epidemiologic studies/
21. ((case* adj3 control*) or (case adj3 comparison*) or control group*).tw.
22. or/10-21
23. 9 and 22
24. (control$ or compar$ or random$).tw.
25. 9 and 24
26. 23 or 25
27. animals/ not humans/
28. 26 not 27
29. (editorial or letter).pt.
30. 28 not 29
31. ("18334691" or "19660833" or "16564776" or "18374452" or "20370759" or "26550795").ui.
32. 30 or 31
33. comment.pt.
34. 32 not 33
35. limit 34 to yr="2020 -Current"

Database searched:

Ovid MEDLINE(R) and Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations

Date Search Completed:

6 February 2021

Search Results (Number of articles identified / number identified as relevant):

813 articles identified

Inclusion/Exclusion Criteria:

Inclusion Criteria

RCTs and non randomised studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies).

Exclusion Criteria

Study designs without a comparator group (eg, case series, cross-sectional studies), reviews, and pooled analyses.

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

No

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

5. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

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

RCT: None

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
	Study Aim: **Study Type:**	**Inclusion Criteria:**	**Intervention:** **Comparison:**	**1° endpoint:**	**Study Limitations:**

Nonrandomized Trials, Observational Studies: None

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)
	Study Type:	**Inclusion Criteria:**	**1° endpoint:**	

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

There is no new study to justify a scoping review or a systematic review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 17

Worksheet author(s): Olasveengen
Date Submitted: 14.02.2021

PICO / Research Question:

The PICOST (Population, Intervention, Comparator, Outcome, Study Designs and Timeframe)

Population: Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest and a shockable rhythm at initiation of cardiopulmonary resuscitation (CPR)

Intervention: A prolonged period of chest compressions before defibrillation

Comparators: A short period of chest compressions before defibrillation

Outcomes: Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. Return of spontaneous circulation (ROSC) was ranked as an important outcome.

Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) are eligible for inclusion.

Timeframe: All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded. Literature search updated to Feb 14th 2021.

Type (intervention, diagnosis, prognosis): intervention

Additional Evidence Reviewer(s): None
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:
We suggest a short period of CPR until the defibrillator is ready for analysis and/or defibrillation in unmonitored cardiac arrest. (weak recommendation, low-certainty evidence).

2010/2015 Search Strategy:
((((((((((("Ventricular Fibrillation"[Mesh] OR "Ventricular Fibrillation"[TW] OR "pulseless VT"[TW] OR "pulseless ventricular tachycardia"[TW] OR "Electrocardiography"[Mesh:NoExp]) AND (("Cardiopulmonary Resuscitation"[Mesh] OR "chest compressions"[TW]

OR "chest compression"[TW] OR "thorax compression"[TW] OR "Heart Massage"[Mesh] OR "cardiopulmonary resuscitation"[TW] OR "cardio-pulmonary resuscitation"[TW] OR CPR[TW]) AND ("Electric Countershock"[Mesh] OR "Defibrillators"[Mesh:NoExp] OR "electric countershock"[TW] OR "cardiac electroversion"[TW] OR defibrillator*[TW] OR defibrillation*[TW])))) NOT ("Defibrillators, Implantable"[Mesh])) NOT "Atrial Fibrillation"[Mesh])))) AND (("Time Factors"[Mesh] OR "Emergencies"[Mesh] OR "Emergency Medical Services"[Mesh:NoExp] OR "Emergency Medical Technicians"[Mesh] OR "Treatment Outcome"[Mesh] OR "Fatal Outcome"[Mesh] OR "Outcome Assessment (Health Care)"[Mesh] OR "Outcome and Process Assessment (Health Care)"[Mesh] OR "Survival"[Mesh] OR "Mortality"[Mesh] OR "mortality"[Subheading] OR "Disease-Free Survival"[Mesh] OR "Survival Analysis"[Mesh] OR "Survival Rate"[Mesh] OR “Outcome”[All Fields] OR "outcomes"[All Fields] OR "Survivors"[Mesh] OR "return of spontaneous circulation"[TIAB] OR "ROSC"[TIAB])))) NOT (((animals[mh] NOT humans[mh]) NOT ("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp]))))

2020 Search Strategy: Pubmed search as above.
Database searched: Pubmed
Date Search Completed: 14.02.2021
Search Results (Number of articles identified / number identified as relevant): 0
Inclusion/Exclusion Criteria: Animal studies, conference abstracts, trial protocols
Link to Article Titles and Abstracts (if available on PubMed):
None

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies: None

Reviewer Comments (including whether meet criteria for formal review):
No new evidence was identified.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 18

Worksheet author(s): Julie Considine
Date Submitted: 15 February 2021

PICO / Research Question:
Population: Adults in any setting (in-hospital or out-of-hospital) with (cardiac arrest)

Intervention: Different chest compression rate, depth and incomplete chest wall recoil during CPR,

Comparators: Standard chest compression rate, depth and incomplete chest wall recoil during CPR

Outcomes: Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. Return of spontaneous circulation (ROSC) and physiological measures (e.g., blood pressure and end-tidal PCO2) were ranked as a important outcomes.

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.

Timeframe: All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded. Literature search updated to February 2021.

Additional Evidence Reviewer(s): N/A
Conflicts of Interest (financial/intellectual, specific to this question): Nil

Year of last full review: 2015

Last ILCOR Consensus on Science and Treatment Recommendation: Taskforce Insights (2019)
This scoping review demonstrated that the majority of studies focused on a single chest compression component, whereas a number of studies suggest the presence of confounding interactions that prompt caution when evaluating any chest compression component in isolation.

The majority of the studies identified in this review were focused on out-of-hospital cardiac arrest highlighting a major gap in research in the in-hospital context.

This scoping review has not identified sufficient new evidence to prompt new systematic review.

The information from the studies identified was considered insufficient to alter existing recommendations

2019 Search Strategy:

PubMed

((((“Resuscitation" [Mesh] OR resuscitation[TIAB] OR “Cardiopulmonary Resuscitation”[MeSH] OR CPR[TI] OR “Heart Massage”[MeSH] OR compression*[TIAB] OR “heart massage”[TIAB] OR “cardiac massage”[TIAB] OR "Advanced Cardiac Life Support"[TIAB] OR “high-quality CPR”[TIAB] OR “high quality CPR”[TIAB] OR “CPR metrics”[TIAB] OR “CPR quality”[TIAB] OR “compression quality”[TIAB]) AND (lean*[TIAB] OR “chest recoil”[TIAB] OR recoil*[TIAB] OR (("Thoracic Wall"[Mesh] OR “thoracic wall”[TIAB] OR “chest wall”[TIAB] OR mm/s[TIAB]) AND (Recoil*[TIAB] OR decompress*[TIAB] OR release*[TIAB]))) NOT (animals[Mesh] NOT humans[Mesh]) NOT ("letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])) OR ((((((((((((((((((((Heart Arrest[MeSH Terms]) OR Ventricular Fibrillation[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR "advanced cardiac life support"[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract] OR Basic Life Support[Title/Abstract] OR BLS[Title/Abstract])) AND ((((((((((((((((((((compression rate*[Title/Abstract]) OR cc rate*[Title/Abstract]) OR fast compression[Title/Abstract]) OR slow compression[Title/Abstract]) OR compression ratio[Title/Abstract]) OR compression ratios[Title/Abstract]) OR "compression-decompression ratio"[Title/Abstract]) OR "compression-to-ventilation ratio"[Title/Abstract]) OR "compression-to ventilation ratios"[Title/Abstract]) OR compression-ventilation ratio[Title/Abstract]) OR compression ventilation ratios[Title/Abstract]) OR compression fraction[Title/Abstract]) OR rate directed[Title/Abstract]) OR high impulse[Title/Abstract]) OR CPR rate*[Title/Abstract]) OR fast rate*[Title/Abstract]) OR time dependent[Title/Abstract]) OR interruption*[Title/Abstract]) OR pause*[Title/Abstract]) OR hands off[Title/Abstract]) OR per minute[Title/Abstract]) OR rest[Title/Abstract]))) NOT ((animals[mh] NOT humans[mh])))) NOT (("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp])))) OR ((((((((((((((((((((Heart Arrest[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole*[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Ventricular Fibrillation[MeSH Terms]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR pulseless electrical activity[Title/Abstract]) OR advanced cardiac life support[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract]) OR chest compression*[Title/Abstract]) OR cardiac compression*[Title/Abstract])) AND ((((((((((depth[Title/Abstract]) OR recoil[Title/Abstract]) OR decompression[Title/Abstract]) OR elasticity[Title/Abstract]) OR inches[Title/Abstract]) OR centimetres[Title/Abstract]) OR centimeters[Title/Abstract]) OR depress[Title/Abstract]) OR relaxation[Title/Abstract]) OR chest wall compression[Title/Abstract]) OR chest compression quality[Title/Abstract]) OR compression force[Title/Abstract]))

Embase

('resuscitation'/exp OR resuscitation:ti,ab OR CPR:ti OR 'heart massage'/exp OR compression*:ti,ab OR “heart massage”:ti,ab OR “cardiac massage”:ti,ab OR "Advanced Cardiac Life Support":ti,ab OR “high-quality CPR”:ti,ab OR “high quality CPR”:ti,ab OR “CPR metrics”:ti,ab OR “CPR quality”:ti,ab OR “compression quality”:ti,ab) AND (lean*:ti,ab OR “chest recoil”:ti,ab OR recoil*:ti,ab OR (('thorax wall'/exp OR “thoracic wall”:ti,ab OR “chest wall”:ti,ab OR “mm/s”:ti,ab) AND (Recoil*:ti,ab OR decompress*:ti,ab OR release*:ti,ab))) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim OR 'heart arrest'/exp OR 'heart ventricular

fibrillation'/de OR 'heart arrest':ab,ti OR 'cardiac arrest':ab,ti OR asystole:ab,ti OR 'cardiopulmonary arrest':ab,ti OR 'cardiovascular arrest':ab,ti OR 'cardiopulmonary resuscitation':ab,ti OR cpr:ab,ti OR 'advanced cardiac life support':ab,ti OR acls:ab,ti OR 'basic life support':ab,ti OR bls:ab,ti OR 'heart massage'/de OR 'heart massage':ab,ti OR 'cardiac massage':ab,ti AND ((compression NEAR/3 rate*):ab,ti OR 'cc rate':ab,ti OR 'cc rates':ab,ti OR 'fast compression':ab,ti OR 'slow compression':ab,ti OR (compression NEAR/3 ratio):ab,ti OR (compression NEAR/3 ratios):ab,ti OR 'compression fraction':ab,ti OR 'rate directed':ab,ti OR 'high impulse':ab,ti OR 'per minute':ab,ti OR 'per min':ab,ti OR 'cpr rate':ab,ti OR 'cpr rates':ab,ti OR 'fast rate':ab,ti OR 'fast rates':ab,ti OR 'time+dependent':ab,ti OR interruption*:ab,ti OR pause*:ab,ti OR 'hands+off':ab,ti OR rest:ab,ti) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim OR (‘Heart Arrest’/exp OR ‘heart arrest’:ab,ti OR ‘cardiac arrest’:ab,ti OR asystole*:ab,ti OR ‘cardiopulmonary arrest’:ab,ti OR ‘cardiovascular arrest’:ab,ti OR ‘Heart Ventricular Fibrillation’/de OR ‘cardiopulmonary resuscitation’:ab,ti OR CPR:ab,ti OR ‘pulseless electrical activity’:ab,ti OR ‘advanced cardiac life support’:ab,ti OR ACLS:ab,ti OR ‘Heart Massage’/de OR ‘heart massage’:ab,ti OR ‘cardiac massage’:ab,ti OR ‘chest compression’:ab,ti OR ‘cardiac compression’:ab,ti) AND (depth:ab,ti OR recoil:ab,ti OR decompression:ab,ti OR elasticity:ab,ti OR inches:ab,ti OR centimetres:ab,ti OR centimeters:ab,ti OR depress:ab,ti OR relaxation:ab,ti OR ‘chest wall compression’:ab,ti OR ‘chest compression quality’:ab,ti OR ‘compression force’:ab,ti) AND [Embase]/lim

Cochrane
([mh ^Resuscitation] OR resuscitation:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR CPR:ab,ti OR [mh “Heart Massage”] OR compression*:ab,ti OR “heart massage”:ab,ti OR “cardiac massage”:ab,ti OR "Advanced Cardiac Life Support":ab,ti OR “high-quality CPR”:ab,ti OR “high quality CPR”:ab,ti OR “CPR metrics”:ab,ti OR “CPR quality”:ab,ti OR “compression quality”:ab,ti) AND ((lean*:ab,ti OR “chest recoil”:ab,ti OR recoil*:ab,ti) OR ([mh "Thoracic Wall"] OR “thoracic wall”:ab,ti OR “chest wall”:ab,ti) AND (Recoil*:ab,ti OR decompress*:ab,ti OR release*:ab,ti)) NOT ([mh animals] NOT [mh humans]) OR ([mh “Heart Arrest”] OR [mh “Ventricular Fibrillation”] OR “heart arrest”:ab,ti OR “cardiac arrest”:ab,ti OR asystole:ab,ti OR “cardiopulmonary arrest”:ab,ti OR “cardiovascular arrest”:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR resuscitation:ab,ti OR CPR:ab,ti OR “advanced cardiac life support”:ab,ti OR ACLS:ab,ti OR “basic life support”:ab,ti OR BLS:ab,ti OR [mh “Heart Massage”] OR “heart massage*”:ab,ti OR “cardiac massage*”:ab,ti) AND ((compression near/3 rate*):ab,ti or "cc rate*":ab,ti or "fast compression":ab,ti or "slow compression":ab,ti or (compression near/3 ratio):ab,ti or (compression near/3 ratios):ab,ti or "compression fraction":ab,ti or "rate directed":ab,ti or "high impulse":ab,ti or "per min*":ab,ti or "CPR rate*":ab,ti or "fast rate*":ab,ti or "time dependent":ab,ti or interruption*:ab,ti or pause*:ab,ti or "hands-off":ab,ti or rest:ab,ti, OR ([mh “Heart Arrest”] or “heart arrest”:ab,ti or “cardiac arrest”:ab,ti or Asystole*:ab,ti or “cardiopulmonary arrest”:ab,ti or “cardiovascular arrest”:ab,ti or [mh “Ventricular Fibrillation”] or [mh “Cardiopulmonary Resuscitation”] or resuscitation:ab,ti or CPR:ab,ti or “pulseless electrical activity”:ab,ti or “advanced cardiac life support”:ab,ti or ACLS:ab,ti or [mh “Heart Massage”] or “heart massage”:ab,ti or “cardiac massage”:ab,ti or “chest compression”:ab,ti or “cardiac compression”:ab,ti) AND (depth:ab,ti or recoil:ab,ti or decompression:ab,ti or elasticity:ab,ti or inches:ab,ti or centimetres:ab,ti or centimeters:ab,ti or depress:ab,ti or relaxation:ab,ti

2020 Search Strategy: as above
Database searched: Medline, Embase, Cochrane
Date Search Completed: 15 February 2021
Search Results (Number of articles identified / number identified as relevant): Nil

Inclusion/Exclusion Criteria: Unpublished studies or studies published in abstract form only, manikin studies, animal studies, and studies that did not specifically address the PICO questions related to CC rate, CC depth, chest wall recoil, and leaning were excluded.
Link to Article Titles and Abstracts (if available on PubMed): N/A

Summary of Evidence Update:
No new papers related to this PICOST have been identified since the 2019 scoping review.

Evidence Update Process for topics not covered by ILCOR Task Forces

6. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies: None

Reviewer Comments (including whether meet criteria for formal review):
No new evidence identified for this question.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

APPENDIX 1: SEARCH STRATEGY

3. MEDLINE

Chest compression depth

((((“Resuscitation" [Mesh] OR resuscitation[TIAB] OR “Cardiopulmonary Resuscitation”[MeSH] OR CPR[TI] OR “Heart Massage”[MeSH] OR compression*[TIAB] OR “heart massage”[TIAB] OR “cardiac massage”[TIAB] OR "Advanced Cardiac Life Support"[TIAB] OR “high-quality CPR”[TIAB] OR “high quality CPR”[TIAB] OR “CPR metrics”[TIAB] OR “CPR quality”[TIAB] OR “compression quality”[TIAB]) AND (lean*[TIAB] OR “chest recoil”[TIAB] OR recoil*[TIAB] OR (("Thoracic Wall"[Mesh] OR “thoracic wall”[TIAB] OR “chest wall”[TIAB] OR mm/s[TIAB]) AND (Recoil*[TIAB] OR decompress*[TIAB] OR release*[TIAB]))) NOT (animals[Mesh] NOT humans[Mesh]) NOT ("letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])))

OR

Chest compression rate

((((((((((((((((((((Heart Arrest[MeSH Terms]) OR Ventricular Fibrillation[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR "advanced cardiac life support"[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract] OR Basic Life Support[Title/Abstract] OR BLS[Title/Abstract])) AND ((((((((((((((((((((compression rate*[Title/Abstract]) OR cc rate*[Title/Abstract]) OR fast compression[Title/Abstract]) OR slow compression[Title/Abstract]) OR compression ratio[Title/Abstract]) OR compression ratios[Title/Abstract]) OR "compression-decompression ratio"[Title/Abstract]) OR "compression-to-ventilation ratio"[Title/Abstract]) OR "compression-to ventilation ratios"[Title/Abstract]) OR compression-ventilation ratio[Title/Abstract]) OR compression ventilation ratios[Title/Abstract]) OR compression fraction[Title/Abstract]) OR rate directed[Title/Abstract]) OR high impulse[Title/Abstract]) OR CPR rate*[Title/Abstract]) OR fast rate*[Title/Abstract]) OR time dependent[Title/Abstract]) OR interruption*[Title/Abstract]) OR pause*[Title/Abstract]) OR hands off[Title/Abstract]) OR per minute[Title/Abstract]) OR rest[Title/Abstract]))) NOT ((animals[mh] NOT humans[mh]))))) NOT (("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp])))))

OR

Leaning and recoil

((((((((((((((((((Heart Arrest[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole*[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Ventricular Fibrillation[MeSH Terms]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR pulseless electrical activity[Title/Abstract]) OR advanced cardiac life support[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract]) OR chest compression*[Title/Abstract]) OR cardiac compression*[Title/Abstract])) AND ((((((((((depth[Title/Abstract]) OR recoil[Title/Abstract]) OR decompression[Title/Abstract]) OR elasticity[Title/Abstract]) OR inches[Title/Abstract]) OR centimetres[Title/Abstract]) OR centimeters[Title/Abstract]) OR depress[Title/Abstract]) OR relaxation[Title/Abstract]) OR chest wall compression[Title/Abstract]) OR chest compression quality[Title/Abstract]) OR compression force[Title/Abstract]))

4. EMBASE

Chest compression depth

('resuscitation'/exp OR resuscitation:ti,ab OR CPR:ti OR 'heart massage'/exp OR compression*:ti,ab OR “heart massage”:ti,ab OR “cardiac massage”:ti,ab OR "Advanced Cardiac Life Support":ti,ab OR “high-quality CPR”:ti,ab OR “high quality CPR”:ti,ab OR “CPR metrics”:ti,ab OR “CPR quality”:ti,ab OR “compression quality”:ti,ab) AND (lean*:ti,ab OR “chest recoil”:ti,ab OR recoil*:ti,ab OR (('thorax wall'/exp OR “thoracic wall”:ti,ab OR “chest wall”:ti,ab OR “mm/s”:ti,ab) AND (Recoil*:ti,ab OR decompress*:ti,ab OR release*:ti,ab))) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim

OR

Chest compression rate

'heart arrest'/exp OR 'heart ventricular fibrillation'/de OR 'heart arrest':ab,ti OR 'cardiac arrest':ab,ti OR asystole:ab,ti OR 'cardiopulmonary arrest':ab,ti OR 'cardiovascular arrest':ab,ti OR 'cardiopulmonary resuscitation':ab,ti OR cpr:ab,ti OR 'advanced cardiac life support':ab,ti OR acls:ab,ti OR 'basic life support':ab,ti OR bls:ab,ti OR 'heart massage'/de OR 'heart massage':ab,ti OR 'cardiac massage':ab,ti AND ((compression NEAR/3 rate*):ab,ti OR 'cc rate':ab,ti OR 'cc rates':ab,ti OR 'fast compression':ab,ti OR 'slow compression':ab,ti OR (compression NEAR/3 ratio):ab,ti OR (compression NEAR/3 ratios):ab,ti OR 'compression fraction':ab,ti OR 'rate directed':ab,ti OR 'high impulse':ab,ti OR 'per minute':ab,ti OR 'per min':ab,ti OR 'cpr rate':ab,ti OR 'cpr rates':ab,ti OR 'fast rate':ab,ti OR 'fast rates':ab,ti OR 'time+dependent':ab,ti OR interruption*:ab,ti OR pause*:ab,ti OR 'hands+off':ab,ti OR rest:ab,ti) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim

OR

Leaning and recoil

(‘Heart Arrest’/exp OR ‘heart arrest’:ab,ti OR ‘cardiac arrest’:ab,ti OR asystole*:ab,ti OR ‘cardiopulmonary arrest’:ab,ti OR ‘cardiovascular arrest’:ab,ti OR ‘Heart Ventricular Fibrillation’/de OR ‘cardiopulmonary resuscitation’:ab,ti OR CPR:ab,ti OR ‘pulseless electrical activity’:ab,ti OR ‘advanced cardiac life support’:ab,ti OR ACLS:ab,ti OR ‘Heart Massage’/de OR ‘heart massage’:ab,ti OR ‘cardiac massage’:ab,ti OR ‘chest compression’:ab,ti OR ‘cardiac compression’:ab,ti) AND (depth:ab,ti OR recoil:ab,ti OR decompression:ab,ti OR elasticity:ab,ti OR inches:ab,ti OR centimetres:ab,ti OR centimeters:ab,ti OR depress:ab,ti OR relaxation:ab,ti OR ‘chest wall compression’:ab,ti OR ‘chest compression quality’:ab,ti OR ‘compression force’:ab,ti) AND [Embase]/lim

5. COCHRANE

Chest compression depth

([mh ^Resuscitation] OR resuscitation:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR CPR:ab,ti OR [mh “Heart Massage”] OR compression*:ab,ti OR “heart massage”:ab,ti OR “cardiac massage”:ab,ti OR "Advanced Cardiac Life Support":ab,ti OR “high-quality CPR”:ab,ti OR “high quality CPR”:ab,ti OR “CPR metrics”:ab,ti OR “CPR quality”:ab,ti OR “compression quality”:ab,ti) AND ((lean*:ab,ti OR “chest recoil”:ab,ti OR recoil*:ab,ti) OR ([mh "Thoracic Wall"] OR “thoracic wall”:ab,ti OR “chest wall”:ab,ti) AND (Recoil*:ab,ti OR decompress*:ab,ti OR release*:ab,ti)) NOT ([mh animals] NOT [mh humans])

OR

Chest compression rate

([mh “Heart Arrest”] OR [mh “Ventricular Fibrillation”] OR “heart arrest”:ab,ti OR “cardiac arrest”:ab,ti OR asystole:ab,ti OR “cardiopulmonary arrest”:ab,ti OR “cardiovascular arrest”:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR resuscitation:ab,ti OR CPR:ab,ti OR “advanced cardiac life support”:ab,ti OR ACLS:ab,ti OR “basic life support”:ab,ti OR BLS:ab,ti OR [mh “Heart Massage”] OR “heart massage*”:ab,ti OR “cardiac massage*”:ab,ti) AND ((compression near/3 rate*):ab,ti or "cc rate*":ab,ti or "fast compression":ab,ti or "slow compression":ab,ti or (compression near/3 ratio):ab,ti or (compression near/3 ratios):ab,ti or "compression fraction":ab,ti or "rate directed":ab,ti or "high impulse":ab,ti or "per min*":ab,ti or "CPR rate*":ab,ti or "fast rate*":ab,ti or "time dependent":ab,ti or interruption*:ab,ti or pause*:ab,ti or "hands-off":ab,ti or rest:ab,ti,

OR

Leaning and recoil

([mh “Heart Arrest”] or “heart arrest”:ab,ti or “cardiac arrest”:ab,ti or Asystole*:ab,ti or “cardiopulmonary arrest”:ab,ti or “cardiovascular arrest”:ab,ti or [mh “Ventricular Fibrillation”] or [mh “Cardiopulmonary Resuscitation”] or resuscitation:ab,ti or CPR:ab,ti or “pulseless electrical activity”:ab,ti or “advanced cardiac life support”:ab,ti or ACLS:ab,ti or [mh “Heart Massage”] or “heart massage”:ab,ti or “cardiac massage”:ab,ti or “chest compression”:ab,ti or “cardiac compression”:ab,ti) AND (depth:ab,ti or recoil:ab,ti or decompression:ab,ti or elasticity:ab,ti or inches:ab,ti or centimetres:ab,ti or centimeters:ab,ti or depress:ab,ti or relaxation:ab,ti

2021 Evidence Update Worksheet
Appendix B1 BLS 19

Worksheet author(s): Julie Considine
Date Submitted: 15 February 2021

PICO / Research Question:
Population: Adults in any setting (in-hospital or out-of-hospital) with (cardiac arrest)

Intervention: Different chest compression rate, depth and incomplete chest wall recoil during CPR,

Comparators: Standard chest compression rate, depth and incomplete chest wall recoil during CPR

Outcomes: Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. Return of spontaneous circulation (ROSC) and physiological measures (e.g., blood pressure and end-tidal PCO2) were ranked as a important outcomes.

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.

Timeframe: All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded. Literature search updated to February 2021.

Additional Evidence Reviewer(s): N/A
Conflicts of Interest (financial/intellectual, specific to this question): Nil

Year of last full review: 2015

Last ILCOR Consensus on Science and Treatment Recommendation: Taskforce Insights (2019)
This scoping review demonstrated that the majority of studies focused on a single chest compression component, whereas a number of studies suggest the presence of confounding interactions that prompt caution when evaluating any chest compression component in isolation.

The majority of the studies identified in this review were focused on out-of-hospital cardiac arrest highlighting a major gap in research in the in-hospital context.

This scoping review has not identified sufficient new evidence to prompt new systematic review.

The information from the studies identified was considered insufficient to alter existing recommendations

2019 Search Strategy:

PubMed

((((“Resuscitation" [Mesh] OR resuscitation[TIAB] OR “Cardiopulmonary Resuscitation”[MeSH] OR CPR[TI] OR “Heart Massage”[MeSH] OR compression*[TIAB] OR “heart massage”[TIAB] OR “cardiac massage”[TIAB] OR "Advanced Cardiac Life Support"[TIAB] OR “high-quality CPR”[TIAB] OR “high quality CPR”[TIAB] OR “CPR metrics”[TIAB] OR “CPR quality”[TIAB] OR “compression quality”[TIAB]) AND (lean*[TIAB] OR “chest recoil”[TIAB] OR recoil*[TIAB] OR (("Thoracic Wall"[Mesh] OR “thoracic wall”[TIAB] OR “chest wall”[TIAB] OR mm/s[TIAB]) AND (Recoil*[TIAB] OR decompress*[TIAB] OR release*[TIAB]))) NOT (animals[Mesh] NOT humans[Mesh]) NOT ("letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])) OR ((((((((((((((((((((Heart Arrest[MeSH Terms]) OR Ventricular Fibrillation[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR "advanced cardiac life support"[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract] OR Basic Life Support[Title/Abstract] OR BLS[Title/Abstract])) AND ((((((((((((((((((((compression rate*[Title/Abstract]) OR cc rate*[Title/Abstract]) OR fast compression[Title/Abstract]) OR slow compression[Title/Abstract]) OR compression ratio[Title/Abstract]) OR compression ratios[Title/Abstract]) OR "compression-decompression ratio"[Title/Abstract]) OR "compression-to-ventilation ratio"[Title/Abstract]) OR "compression-to ventilation ratios"[Title/Abstract]) OR compression-ventilation ratio[Title/Abstract]) OR compression ventilation ratios[Title/Abstract]) OR compression fraction[Title/Abstract]) OR rate directed[Title/Abstract]) OR high impulse[Title/Abstract]) OR CPR rate*[Title/Abstract]) OR fast rate*[Title/Abstract]) OR time dependent[Title/Abstract]) OR interruption*[Title/Abstract]) OR pause*[Title/Abstract]) OR hands off[Title/Abstract]) OR per minute[Title/Abstract]) OR rest[Title/Abstract]))) NOT ((animals[mh] NOT humans[mh])))) NOT (("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp])))) OR ((((((((((((((((((((Heart Arrest[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole*[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Ventricular Fibrillation[MeSH Terms]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR pulseless electrical activity[Title/Abstract]) OR advanced cardiac life support[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract]) OR chest compression*[Title/Abstract]) OR cardiac compression*[Title/Abstract])) AND ((((((((((depth[Title/Abstract]) OR recoil[Title/Abstract]) OR decompression[Title/Abstract]) OR elasticity[Title/Abstract]) OR inches[Title/Abstract]) OR centimetres[Title/Abstract]) OR centimeters[Title/Abstract]) OR depress[Title/Abstract]) OR relaxation[Title/Abstract]) OR chest wall compression[Title/Abstract]) OR chest compression quality[Title/Abstract]) OR compression force[Title/Abstract]))

Embase

('resuscitation'/exp OR resuscitation:ti,ab OR CPR:ti OR 'heart massage'/exp OR compression*:ti,ab OR “heart massage”:ti,ab OR “cardiac massage”:ti,ab OR "Advanced Cardiac Life Support":ti,ab OR “high-quality CPR”:ti,ab OR “high quality CPR”:ti,ab OR “CPR metrics”:ti,ab OR “CPR quality”:ti,ab OR “compression quality”:ti,ab) AND (lean*:ti,ab OR “chest recoil”:ti,ab OR recoil*:ti,ab OR (('thorax wall'/exp OR “thoracic wall”:ti,ab OR “chest wall”:ti,ab OR “mm/s”:ti,ab) AND (Recoil*:ti,ab OR decompress*:ti,ab OR release*:ti,ab))) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim OR 'heart arrest'/exp OR 'heart ventricular fibrillation'/de OR 'heart arrest':ab,ti OR 'cardiac arrest':ab,ti OR asystole:ab,ti OR 'cardiopulmonary arrest':ab,ti OR 'cardiovascular arrest':ab,ti

OR 'cardiopulmonary resuscitation':ab,ti OR cpr:ab,ti OR 'advanced cardiac life support':ab,ti OR acls:ab,ti OR 'basic life support':ab,ti OR bls:ab,ti OR 'heart massage'/de OR 'heart massage':ab,ti OR 'cardiac massage':ab,ti AND ((compression NEAR/3 rate*):ab,ti OR 'cc rate':ab,ti OR 'cc rates':ab,ti OR 'fast compression':ab,ti OR 'slow compression':ab,ti OR (compression NEAR/3 ratio):ab,ti OR (compression NEAR/3 ratios):ab,ti OR 'compression fraction':ab,ti OR 'rate directed':ab,ti OR 'high impulse':ab,ti OR 'per minute':ab,ti OR 'per min':ab,ti OR 'cpr rate':ab,ti OR 'cpr rates':ab,ti OR 'fast rate':ab,ti OR 'fast rates':ab,ti OR 'time+dependent':ab,ti OR interruption*:ab,ti OR pause*:ab,ti OR 'hands+off':ab,ti OR rest:ab,ti) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim OR (‘Heart Arrest’/exp OR ‘heart arrest’:ab,ti OR ‘cardiac arrest’:ab,ti OR asystole*:ab,ti OR ‘cardiopulmonary arrest’:ab,ti OR ‘cardiovascular arrest’:ab,ti OR ‘Heart Ventricular Fibrillation’/de OR ‘cardiopulmonary resuscitation’:ab,ti OR CPR:ab,ti OR ‘pulseless electrical activity’:ab,ti OR ‘advanced cardiac life support’:ab,ti OR ACLS:ab,ti OR ‘Heart Massage’/de OR ‘heart massage’:ab,ti OR ‘cardiac massage’:ab,ti OR ‘chest compression’:ab,ti OR ‘cardiac compression’:ab,ti) AND (depth:ab,ti OR recoil:ab,ti OR decompression:ab,ti OR elasticity:ab,ti OR inches:ab,ti OR centimetres:ab,ti OR centimeters:ab,ti OR depress:ab,ti OR relaxation:ab,ti OR ‘chest wall compression’:ab,ti OR ‘chest compression quality’:ab,ti OR ‘compression force’:ab,ti) AND [Embase]/lim

Cochrane
([mh ^Resuscitation] OR resuscitation:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR CPR:ab,ti OR [mh “Heart Massage”] OR compression*:ab,ti OR “heart massage”:ab,ti OR “cardiac massage”:ab,ti OR "Advanced Cardiac Life Support":ab,ti OR “high-quality CPR”:ab,ti OR “high quality CPR”:ab,ti OR “CPR metrics”:ab,ti OR “CPR quality”:ab,ti OR “compression quality”:ab,ti) AND ((lean*:ab,ti OR “chest recoil”:ab,ti OR recoil*:ab,ti) OR ([mh "Thoracic Wall"] OR “thoracic wall”:ab,ti OR “chest wall”:ab,ti) AND (Recoil*:ab,ti OR decompress*:ab,ti OR release*:ab,ti)) NOT ([mh animals] NOT [mh humans]) OR ([mh “Heart Arrest”] OR [mh “Ventricular Fibrillation”] OR “heart arrest”:ab,ti OR “cardiac arrest”:ab,ti OR asystole:ab,ti OR “cardiopulmonary arrest”:ab,ti OR “cardiovascular arrest”:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR resuscitation:ab,ti OR CPR:ab,ti OR “advanced cardiac life support”:ab,ti OR ACLS:ab,ti OR “basic life support”:ab,ti OR BLS:ab,ti OR [mh “Heart Massage”] OR “heart massage*”:ab,ti OR “cardiac massage*”:ab,ti) AND ((compression near/3 rate*):ab,ti or "cc rate*":ab,ti or "fast compression":ab,ti or "slow compression":ab,ti or (compression near/3 ratio):ab,ti or (compression near/3 ratios):ab,ti or "compression fraction":ab,ti or "rate directed":ab,ti or "high impulse":ab,ti or "per min*":ab,ti or "CPR rate*":ab,ti or "fast rate*":ab,ti or "time dependent":ab,ti or interruption*:ab,ti or pause*:ab,ti or "hands-off":ab,ti or rest:ab,ti, OR ([mh “Heart Arrest”] or “heart arrest”:ab,ti or “cardiac arrest”:ab,ti or Asystole*:ab,ti or “cardiopulmonary arrest”:ab,ti or “cardiovascular arrest”:ab,ti or [mh “Ventricular Fibrillation”] or [mh “Cardiopulmonary Resuscitation”] or resuscitation:ab,ti or CPR:ab,ti or “pulseless electrical activity”:ab,ti or “advanced cardiac life support”:ab,ti or ACLS:ab,ti or [mh “Heart Massage”] or “heart massage”:ab,ti or “cardiac massage”:ab,ti or “chest compression”:ab,ti or “cardiac compression”:ab,ti) AND (depth:ab,ti or recoil:ab,ti or decompression:ab,ti or elasticity:ab,ti or inches:ab,ti or centimetres:ab,ti or centimeters:ab,ti or depress:ab,ti or relaxation:ab,ti

2020 Search Strategy: as above
Database searched: Medline, Embase, Cochrane
Date Search Completed: 15 February 2021
Search Results (Number of articles identified / number identified as relevant): Nil

Inclusion/Exclusion Criteria: Unpublished studies or studies published in abstract form only, manikin studies, animal studies, and studies that did not specifically address the PICO questions related to CC rate, CC depth, chest wall recoil, and leaning were excluded.
Link to Article Titles and Abstracts (if available on PubMed): N/A

Summary of Evidence Update:
No new papers related to this PICOST have been identified since the 2019 scoping review.

Evidence Update Process for topics not covered by ILCOR Task Forces

7. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies: None

Reviewer Comments (including whether meet criteria for formal review):
No new evidence identified for this question.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

APPENDIX 1: SEARCH STRATEGY

6. MEDLINE

Chest compression depth

((((“Resuscitation" [Mesh] OR resuscitation[TIAB] OR “Cardiopulmonary Resuscitation”[MeSH] OR CPR[TI] OR “Heart Massage”[MeSH] OR compression*[TIAB] OR “heart massage”[TIAB] OR “cardiac massage”[TIAB] OR "Advanced Cardiac Life Support"[TIAB] OR “high-quality CPR”[TIAB] OR “high quality CPR”[TIAB] OR “CPR metrics”[TIAB] OR “CPR quality”[TIAB] OR “compression quality”[TIAB]) AND (lean*[TIAB] OR “chest recoil”[TIAB] OR recoil*[TIAB] OR (("Thoracic Wall"[Mesh] OR “thoracic wall”[TIAB] OR “chest wall”[TIAB] OR mm/s[TIAB]) AND (Recoil*[TIAB] OR decompress*[TIAB] OR release*[TIAB]))) NOT (animals[Mesh] NOT humans[Mesh]) NOT ("letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])))

OR

Chest compression rate

((((((((((((((((((((Heart Arrest[MeSH Terms]) OR Ventricular Fibrillation[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR "advanced cardiac life support"[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract] OR Basic Life Support[Title/Abstract] OR BLS[Title/Abstract])) AND ((((((((((((((((((((compression rate*[Title/Abstract]) OR cc rate*[Title/Abstract]) OR fast compression[Title/Abstract]) OR slow compression[Title/Abstract]) OR compression ratio[Title/Abstract]) OR compression ratios[Title/Abstract]) OR "compression-decompression ratio"[Title/Abstract]) OR "compression-to-ventilation ratio"[Title/Abstract]) OR "compression-to ventilation ratios"[Title/Abstract]) OR compression-ventilation ratio[Title/Abstract]) OR compression ventilation ratios[Title/Abstract]) OR compression fraction[Title/Abstract]) OR rate directed[Title/Abstract]) OR high impulse[Title/Abstract]) OR CPR rate*[Title/Abstract]) OR fast rate*[Title/Abstract]) OR time dependent[Title/Abstract]) OR interruption*[Title/Abstract]) OR pause*[Title/Abstract]) OR hands off[Title/Abstract]) OR per minute[Title/Abstract]) OR rest[Title/Abstract]))) NOT ((animals[mh] NOT humans[mh]))))) NOT (("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp])))))

OR

Leaning and recoil

((((((((((((((((((((Heart Arrest[MeSH Terms]) OR heart arrest[Title/Abstract]) OR cardiac arrest[Title/Abstract]) OR asystole*[Title/Abstract]) OR cardiopulmonary arrest[Title/Abstract]) OR cardiovascular arrest[Title/Abstract]) OR Ventricular Fibrillation[MeSH Terms]) OR Cardiopulmonary Resuscitation[MeSH Terms]) OR resuscitation[Title/Abstract]) OR CPR[Title/Abstract]) OR pulseless electrical activity[Title/Abstract]) OR advanced cardiac life support[Title/Abstract]) OR ACLS[Title/Abstract]) OR Heart Massage[MeSH Terms]) OR heart massage*[Title/Abstract]) OR cardiac massage*[Title/Abstract]) OR chest compression*[Title/Abstract]) OR cardiac compression*[Title/Abstract])) AND ((((((((((depth[Title/Abstract]) OR recoil[Title/Abstract]) OR decompression[Title/Abstract]) OR elasticity[Title/Abstract]) OR inches[Title/Abstract]) OR centimetres[Title/Abstract]) OR centimeters[Title/Abstract]) OR depress[Title/Abstract]) OR relaxation[Title/Abstract]) OR chest wall compression[Title/Abstract]) OR chest compression quality[Title/Abstract]) OR compression force[Title/Abstract]))

7. EMBASE

Chest compression depth

('resuscitation'/exp OR resuscitation:ti,ab OR CPR:ti OR 'heart massage'/exp OR compression*:ti,ab OR “heart massage”:ti,ab OR “cardiac massage”:ti,ab OR "Advanced Cardiac Life Support":ti,ab OR “high-quality CPR”:ti,ab OR “high quality CPR”:ti,ab OR “CPR metrics”:ti,ab OR “CPR quality”:ti,ab OR “compression quality”:ti,ab) AND (lean*:ti,ab OR “chest recoil”:ti,ab OR recoil*:ti,ab OR (('thorax wall'/exp OR “thoracic wall”:ti,ab OR “chest wall”:ti,ab OR “mm/s”:ti,ab) AND (Recoil*:ti,ab OR decompress*:ti,ab OR release*:ti,ab))) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim

OR

Chest compression rate

'heart arrest'/exp OR 'heart ventricular fibrillation'/de OR 'heart arrest':ab,ti OR 'cardiac arrest':ab,ti OR asystole:ab,ti OR 'cardiopulmonary arrest':ab,ti OR 'cardiovascular arrest':ab,ti OR 'cardiopulmonary resuscitation':ab,ti OR cpr:ab,ti OR 'advanced cardiac life support':ab,ti OR acls:ab,ti OR 'basic life support':ab,ti OR bls:ab,ti OR 'heart massage'/de OR 'heart massage':ab,ti OR 'cardiac massage':ab,ti AND ((compression NEAR/3 rate*):ab,ti OR 'cc rate':ab,ti OR 'cc rates':ab,ti OR 'fast compression':ab,ti OR 'slow compression':ab,ti OR (compression NEAR/3 ratio):ab,ti OR (compression NEAR/3 ratios):ab,ti OR 'compression fraction':ab,ti OR 'rate directed':ab,ti OR 'high impulse':ab,ti OR 'per minute':ab,ti OR 'per min':ab,ti OR 'cpr rate':ab,ti OR 'cpr rates':ab,ti OR 'fast rate':ab,ti OR 'fast rates':ab,ti OR 'time+dependent':ab,ti OR interruption*:ab,ti OR pause*:ab,ti OR 'hands+off':ab,ti OR rest:ab,ti) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim

OR

Leaning and recoil

(‘Heart Arrest’/exp OR ‘heart arrest’:ab,ti OR ‘cardiac arrest’:ab,ti OR asystole*:ab,ti OR ‘cardiopulmonary arrest’:ab,ti OR ‘cardiovascular arrest’:ab,ti OR ‘Heart Ventricular Fibrillation’/de OR ‘cardiopulmonary resuscitation’:ab,ti OR CPR:ab,ti OR ‘pulseless electrical activity’:ab,ti OR ‘advanced cardiac life support’:ab,ti OR ACLS:ab,ti OR ‘Heart Massage’/de OR ‘heart massage’:ab,ti OR ‘cardiac massage’:ab,ti OR ‘chest compression’:ab,ti OR ‘cardiac compression’:ab,ti) AND (depth:ab,ti OR recoil:ab,ti OR decompression:ab,ti OR elasticity:ab,ti OR inches:ab,ti OR centimetres:ab,ti OR centimeters:ab,ti OR depress:ab,ti OR relaxation:ab,ti OR ‘chest wall compression’:ab,ti OR ‘chest compression quality’:ab,ti OR ‘compression force’:ab,ti) AND [Embase]/lim

8. COCHRANE

Chest compression depth

([mh ^Resuscitation] OR resuscitation:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR CPR:ab,ti OR [mh “Heart Massage”] OR compression*:ab,ti OR “heart massage”:ab,ti OR “cardiac massage”:ab,ti OR "Advanced Cardiac Life Support":ab,ti OR “high-quality CPR”:ab,ti OR “high quality CPR”:ab,ti OR “CPR metrics”:ab,ti OR “CPR quality”:ab,ti OR “compression quality”:ab,ti) AND ((lean*:ab,ti OR “chest recoil”:ab,ti OR recoil*:ab,ti) OR ([mh "Thoracic Wall"] OR “thoracic wall”:ab,ti OR “chest wall”:ab,ti) AND (Recoil*:ab,ti OR decompress*:ab,ti OR release*:ab,ti)) NOT ([mh animals] NOT [mh humans])

OR

Chest compression rate

([mh “Heart Arrest”] OR [mh “Ventricular Fibrillation”] OR “heart arrest”:ab,ti OR “cardiac arrest”:ab,ti OR asystole:ab,ti OR “cardiopulmonary arrest”:ab,ti OR “cardiovascular arrest”:ab,ti OR [mh “Cardiopulmonary Resuscitation”] OR resuscitation:ab,ti OR CPR:ab,ti OR “advanced cardiac life support”:ab,ti OR ACLS:ab,ti OR “basic life support”:ab,ti OR BLS:ab,ti OR [mh “Heart Massage”] OR “heart massage*”:ab,ti OR “cardiac massage*”:ab,ti) AND ((compression near/3 rate*):ab,ti or "cc rate*":ab,ti or "fast compression":ab,ti or "slow compression":ab,ti or (compression near/3 ratio):ab,ti or (compression near/3 ratios):ab,ti or "compression fraction":ab,ti or "rate directed":ab,ti or "high impulse":ab,ti or "per min*":ab,ti or "CPR rate*":ab,ti or "fast rate*":ab,ti or "time dependent":ab,ti or interruption*:ab,ti or pause*:ab,ti or "hands-off":ab,ti or rest:ab,ti,

OR

Leaning and recoil

([mh “Heart Arrest”] or “heart arrest”:ab,ti or “cardiac arrest”:ab,ti or Asystole*:ab,ti or “cardiopulmonary arrest”:ab,ti or “cardiovascular arrest”:ab,ti or [mh “Ventricular Fibrillation”] or [mh “Cardiopulmonary Resuscitation”] or resuscitation:ab,ti or CPR:ab,ti or “pulseless electrical activity”:ab,ti or “advanced cardiac life support”:ab,ti or ACLS:ab,ti or [mh “Heart Massage”] or “heart massage”:ab,ti or “cardiac massage”:ab,ti or “chest compression”:ab,ti or “cardiac compression”:ab,ti) AND (depth:ab,ti or recoil:ab,ti or decompression:ab,ti or elasticity:ab,ti or inches:ab,ti or centimetres:ab,ti or centimeters:ab,ti or depress:ab,ti or relaxation:ab,ti

2021 Evidence Update Worksheet
Appendix B1 BLS 20

Worksheet author(s): Gavin Perkins
Date Submitted: 28 January 2021

The PICOST (Population, Intervention, Comparator, Outcome, Study Designs and Timeframe)

Population: Adults and children with foreign body airway obstruction in any setting.

Intervention: Interventions to remove foreign body airway obstruction, such as finger sweep, back slaps, abdominal thrusts, chest thrusts, and suction-based airway clearance devices.

Comparators: No action.

Outcomes: Survival with good neurological outcome, survival, return of spontaneous circulation, relief of airway obstruction, harms/ complications.

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 (≥5 cases) are eligible for inclusion. Case reports of injuries/ complications will be eligible.

Timeframe: All years and all languages were included as long as there was an English abstract. Unpublished studies (e.g., conference abstracts, trial protocols), animal studies, manikin studies, cadaver studies were excluded. Literature searched to September 2019.

PROSPERO Registration CRD42019154784

Additional Evidence Reviewer(s): Keith Couper
Conflicts of Interest (financial/intellectual, specific to this question):

Nil

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:

We suggest that back slaps are used initially in adults and children with an FBAO and an ineffective cough (weak recommendation, very-low certainty evidence).

We suggest that abdominal thrusts are used in adults and children (older than 1 year) with an FBAO and an ineffective cough when back slaps are ineffective (weak recommendation, very-low-certainty evidence).

We suggest that rescuers consider the manual extraction of visible items in the mouth (weak recommendation, very-low-certainty evidence).

We suggest against the use of blind finger sweeps in patients with an FBAO (weak recommendation, very-low-certainty evidence).
We suggest that appropriately skilled healthcare providers use Magill forceps to remove an FBAO in patients with OHCA from FBAO (weak recommendation, very-low-certainty evidence).

We suggest that chest thrusts be used in unconscious adults and children with an FBAO (weak recommendation, very-low-certainty evidence).
We suggest that bystanders undertake interventions to support FBAO removal as soon as possible after recognition (weak recommendation, very-low-certainty evidence).

We suggest against the routine use of suction-based airway clearance devices (weak recommendation, very-low-certainty evidence).

2010/2015 Search Strategy:
2021 Search Strategy: See below
Database searched: Medline, Cochrane, Embase
Date Search Completed: 27 January 2021
Search Results (Number of articles identified / number identified as relevant):
Inclusion/Exclusion Criteria: As above

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

https://pubmed.ncbi.nlm.nih.gov/32949674/

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7793855/

https://pubmed.ncbi.nlm.nih.gov/31745894/

https://pubmed.ncbi.nlm.nih.gov/33036850/

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

8. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

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
ILCOR **Couper 2020**	**Systematic review**	**As above**	**69**	For all interventions and associated outcomes, evidence certainty was very low. Early removal of FBAO by bystanders was associated with improved neurological survival (odds ratio 6.0, 95% confidence interval 1.5 to 23.4). Identified evidence showed that key interventions (back blows, abdominal thrusts, chest thrusts/compressions, Magill forceps, manual removal of obstructions from the mouth, suction-based airway clearance devices) are effective in relieving FBAO. We identified reports of harm in relation to back blows, abdominal thrusts, chest thrusts/compressions, and blind finger sweeps.	**As above**

RCT:

Nil

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

	Study Aim: **Study Type:**	**Inclusion Criteria:**	**Intervention:** **Comparison:**	**1° endpoint:**	**Study Limitations:**

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)**
	Study Type:	**Inclusion Criteria:**	**1° endpoint:**	
Bhanderi 2020	Case series	• Care home management and staff involved in choking incident completed and returned PMCF form • Care home management and staff consent to allow the research team access to site • Care home staff able and willing to participate in semi-structured interviews • Care home consent to allow the	FBAO removal Airway clearance device successful at removal of FBAO in 26/27 cases (96% (95% CI 81.0% to 99.9%) Adverse events: Mouth bleeding reported in 2 out of 4 interviews. One case probably related, the other case causation uncertain.	Case series reporting on 27 cases of use of airway clearance device. Retrospective design, use limited to nursing homes. Data obtained from Post Market Clinical Follow-Up (PMCF) Forms. Independent research funded by the device manufacturer

		research team access to incident report book/system. • Exclusion Criteria • Care home lack of consent to participate • Care home staff did not consent to participate.		
Gutierrez 2020	Case report			Case report of gastric perforation after abdominal thrust
Pawlukiewicz 2020	Case report			Cholesterol embolization syndrome resulting in ischaemic leg of person providing abdominal thrusts.

Reviewer Comments (including whether meet criteria for formal review):
The Basic Life Support Task Force did not find the results of the three case series/case reports sufficient to challenge current guidelines and warrant a full review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

Bhavik G. Bhanderi, Sue Palmer Hill. Evaluation of DeChoker, an Airway Clearance Device (ACD) Used in Adult Choking Emergencies Within the Adult Care Home Sector: A Mixed Methods Case Study. Front Public Health. 2020; 8: 541885. Published online 2020 Dec 9. doi: 10.3389/fpubh.2020.541885

Gutierrez A, Strickland M. Gastric Perforation After Abdominal Thrusts for Choking: a Case of Heimlich Harm. J Gastrointest Surg. 2020 Jul;24(7):1704-1706. doi: 10.1007/s11605-019-04451-2. Epub 2019 Nov 19.

Pawlukiewicz AJ, Merrill DR, Griffiths SA, Frantz G, Bridwell RE. Cholesterol embolization and arterial occlusion from the Heimlich maneuver: A case report. Am J Emerg Med. 2020 Sep 30:S0735-6757(20)30875-5. doi: 10.1016/j.ajem.2020.09.079. Online ahead of print.

2021 Evidence Update Worksheet
Appendix B1 BLS 21

Worksheet author(s): Takanari Ikeyama
Date Submitted: 2021/02/15

PICO / Research Question:
Population: Adults or children in cardiac arrest on a bed (out-of-hospital and in-hospital),
Intervention: CPR on a hard surface e.g. backboard, floor, deflatable or specialist mattress,
***Comparators*:** CPR on a regular mattress
Outcomes: Survival, survival with a favourable neurological outcome, ROSC, CPR quality
Type (intervention, diagnosis, prognosis): Intervention

Additional Evidence Reviewer(s):
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:
We suggest performing manual chest compressions on a firm surface when possible (weak recommendation, very-low-certainty evidence)
During IHCA, we suggest that, when a bed has a CPR mode that increases mattress stiffness, it should be activated (weak recommendation, very-low-certainty evidence).
During IHCA, we suggest against moving a patient from a bed to the floor to improve chest compression depth (weak recommendation, very-low-certainty evidence).
The confidence in effect estimates is so low that the task force was unable to make a recommendation about the use of a backboard strategy.

2020 Search Strategy:
Database: Ovid MEDLINE(R) Daily Update, Ovid MEDLINE(R) Epub Ahead of Print and In-Process & Other Non-Indexed Citations
1 exp Death, sudden, cardiac/ or sudden death.ti,ab. (1772)
2 cardiopulmonary resuscitation.ti,ab. or exp Cardiopulmonary Resuscitation/ (1768)
3 cpr.ti,ab. (1420)
4 exp heart massage/ or heart massage*.ti,ab. (11)
5 chest compression*.ti,ab. (448)
6 resuscitat*.ti,ab. (6834)
7 or/2-6 (7484)

8 exp Beds/ (5)
9 (bed not capacity).ti,ab. (9556)
10 mattress*.ti,ab. (347)
11 (backboard* or back-board* or back board*).ti,ab. (29)
12 exp stretchers/ or stretcher*.ti,ab. (246)
13 8 or 9 or 10 or 11 or 12 (10121)
14 7 and 13 (72)

Database: Embase Classic+Embase
1 exp resuscitation/ (112831)
2 resus*.ti,ab. (97271)
3 cardiopulmonary resuscitation.ti,ab. (18974)
4 cpr.ti,ab. (20402)
5 exp heart massage/ (3873)
6 chest compression*.ti,ab. (5892)
7 1 or 2 or 3 or 4 or 5 or 6 (158673)
8 exp bed/ (11228)
9 (bed not capacity).ti,ab. (133002)
10 mattress*.ti,ab. (5231)
11 (backboard* or back-board* or back board*).ti,ab. (246)
12 exp stretcher/ (431)
13 stretcher*.ti,ab. (1197)
14 8 or 9 or 10 or 11 or 12 or 13 (145431)
15 7 and 14 (1760)
16 limit 15 to yr="2009 -Current" (1168)
17 exp animals/ not human.sh. (5468825)
18 16 not 17 (1145)
19 limit 18 to (article or article in press or "review") (476)

The Cochrane Library
ID Search Hits
#1 MeSH descriptor: [Cardiopulmonary Resuscitation] explode all trees 990
#2 ("cardiopulmonary resuscitation"):ti,ab,kw 1935
#3 ("CPR"):ti,ab,kw 2012
#4 MeSH descriptor: [Heart Massage] explode all trees 144
#5 (chest compression*):ti,ab,kw 1214

#6 (resus*):ti,ab,kw 7333
#7 #1 or #2 or #3 or #4 or #5 or #6 8248
#8 MeSH descriptor: [Beds] explode all trees 286
#9 ((bed not capacity)):ti,ab,kw 8546
#10 (mattress*):ti,ab,kw 774
#11 ((backboard* or back-board* or back board*)):ti,ab,kw 321
#12 MeSH descriptor: [Stretchers] explode all trees 6
#13 (stretcher*):ti,ab,kw 129
#14 #8 or #9 or #10 or #11 or #12 or #13 9595
#15 #7 and #14 176

2020 Search Strategy: Medline search, same as above
Database searched: PubMed/Medline
Date Search Completed: 2021/02/05
Search Results (Number of articles identified / number identified as relevant):1
Inclusion/Exclusion Criteria: 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. Randomised manikin / simulation / cadaver studies will only be included if insufficient human studies are identified. Unpublished studies (e.g., conference abstracts, trial protocols), non-randomised manikin / simulation / cadaver studies, animal studies, experimental / lab models, mathematical models, narrative reviews, editorials and opinions with no primary data were excluded.
Timeframe: 1st Nov 2020 to 5th Feb 2021
Link to Article Titles and Abstracts (if available on PubMed):
https://pubmed.ncbi.nlm.nih.gov/33417354/

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

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

University of Padova; Matteo P; 2021	**Systematic review**	Participants include humans (adults and pediatrics) and simulation manikins as receivers of CPR. Humans performing CPR also included. Intervention was the placement of a backboard during real or simulated CPR. Comparison: CPR performed without a backboard. Outcomes: Achievement of the target depth of chest compression (sternal-spine displacement) (compliance with international guidelines at the time of the study). Study: prospective, cross-sectional and retrospective studies on humans as well as simulation manikins. Timeframe: till 31st Jan 2019.	**15**	**Use of backboards during CPR increases chest compression depth by 1.46cm in manikins, though the substantial heterogeneity of experimental conditions and the scarcity of other CPR quality indicators.**	**No clear recommendation on use of backboards during CPR**

RCT: None

Nonrandomized Trials, Observational Studies: None

Reviewer Comments (including whether meet criteria for formal review):
No new evidence was identified addressing this question, the identified systematic review included science revied for the 2020 ILCOR Consensus on Science and Treatment recommendations.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

Paganini M, Mormando G, Carfagna F, Ingrassia PL. Use of backboards in cardiopulmonary resuscitation: a systematic review and meta-analysis. Eur J Emerg Med. 2021 Jan 6;Publish Ahead of Print. doi: 10.1097/MEJ.0000000000000784.

2021 Evidence Update Worksheet
Appendix B1 BLS 22

Worksheet author(s): Olasveengen
Date Submitted: 14.02.2021

PICO / Research Question:

The PICOST (Population, Intervention, Comparator, Outcome, Study Designs and Timeframe)

Population: Adults in any setting (in-hospital or out-of-hospital) with cardiac arrest

Intervention: Analysis of cardiac rhythm during chest compressions

Comparators: Standard care (analysis of cardiac rhythm during pauses in chest compressions).

Outcomes: Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. Return of spontaneous circulation (ROSC) was ranked as an important outcome. CPR quality metrics such time chest compression fraction, pauses in compressions, compressions per minute, time to commencing CPR, or time to first shock etc. were included as important outcomes.

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.

It is anticipated that there will be insufficient studies from which to draw a conclusion; case series will be included in the initial search and included as long as they contain ≥ 5 cases.

Timeframe: All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded. Literature search updated to Feb 14, 2020.

Outcomes: Any survival and CPR quality metrics.
Type (intervention, diagnosis, prognosis): intervention

Additional Evidence Reviewer(s): None
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:
We suggest against the routine use of artifact-filtering algorithms for analysis of electrocardiographic rhythm during CPR (weak recommendation, very-low-certainty evidence).

We suggest that the usefulness of artifact-filtering algorithms for analysis of electrocardiographic rhythm during CPR be assessed in clinical trials or research initiatives (weak recommendation, very-low-certainty evidence).

2010/2015 Search Strategy:
((((((((((("continuous compressions"[TIAB] OR "Continuous chest compression"[TIAB] OR "Continuous chest-compressions"[TIAB] OR "uninterrupted compressions"[TIAB] OR "uninterrupted chest compression"[TIAB] OR "uninterrupted chest-compressions"[TIAB] OR "ongoing compressions"[TIAB] OR "ongoing chest compression"[TIAB] OR "ongoing chest-compressions"[TIAB] OR "instantaneous chest compression"[TIAB] OR "instantaneous chest compression"[TIAB]))) OR ((("Heart Arrest"[Mesh] OR "cardiac arrest"[TIAB] OR "cardiovascular arrest"[TIAB] OR "heart arrest"[TIAB] OR "asystole"[TIAB] OR "pulseless electrical activity"[TIAB] OR "Ventricular Fibrillation"[Mesh:noexp] OR "cardiopulmonary arrest"[TIAB]) AND ("cardiopulmonary resuscitation"[TIAB] OR "Advanced Cardiac Life Support"[TIAB] OR "ACLS"[TIAB] OR "cardiopulmonary resuscitation"[Mesh] OR "advanced cardiac life support"[Mesh] OR "Heart Massage"[Mesh] OR cardiac massage[ti] OR CPR[ti] OR "basic life support"[ti] OR chest compression[TIAB] OR chest compressions[TIAB])))))) AND (("Electrocardiography/instrumentation"[Mesh:NoExp] OR "Electrocardiography/methods"[Mesh:NoExp] OR "Artifacts"[Mesh] OR "Continuous ECG monitoring"[TIAB] OR "ECG analysis"[TIAB] OR "ECG rhythm analysis"[TIAB] OR "Electrocardiogram analysis"[TIAB] OR "rhythm analyses"[TIAB] OR "rhythm analysis"[TIAB] OR "rhythm assessment"[TIAB] OR "rhythm check"[TIAB] OR "rhythm evaluation"[TIAB] OR "rhythm monitoring"[TIAB] OR "shock advisory system"[TIAB] OR"nonshockable rhythm"[TIAB] OR "non-shockable rhythms"[TIAB] OR "non-shockable rhythm"[TIAB] OR "shockable rhythm"[TIAB] OR "nonshockable rhythms"[TIAB] OR "shockable rhythms"[TIAB]))) OR (("rhythm analysis"[TIAB] AND algorithm[TIAB])))))) NOT ((((animals[mh] NOT humans[mh]) NOT ("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp])))

2020 Search Strategy: Same
Database searched: Pubmed
Date Search Completed: 14.02.2021
Search Results (Number of articles identified / number identified as relevant): 2
Inclusion/Exclusion Criteria: Animal studies and unpublished studies (e.g., conference abstracts, trial protocols) are excluded.
Link to Article Titles and Abstracts (if available on PubMed):
https://pubmed.ncbi.nlm.nih.gov/33460749/
https://pubmed.ncbi.nlm.nih.gov/33524490/

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
	Study Type:	**Inclusion Criteria:**	**1° endpoint:**	
De Graaf 2021	Observational (before and after) (n=890)	Cardiac arrest victims treated by Amsterdam Police and Fire Fighters between 2016-2017 (control) and 2018-2019 (intervention).	Sensitivity of the intervention AED was 96%, (LCL 93%) and specificity was 98% (LCL 97%), both not significantly different from control. Intervention cases had a shorter median pre-shock pause compared to control cases (8 s vs 22 s, $p < 0.001$) and higher median CCF (86% vs 80%, $P < 0.001$).	CONCLUSION: Compared to conventional AEDs, cprINSIGHT leads to a significantly shorter pre-shock pause and a significant increase in CCF.
Didon 2021	Observational (n=2916)	Out-of-hospital cardiac arrest (OHCA) patients treated with AEDs (DEFIGARD TOUCH7, Schiller Médical, France) were subjected patient-wise to Analyze Whilst Compressing (AWC) training (8559 strips, 1604 patients) and validation (7498 strips, 1312 patients).	"Standard Analysis Stage" presented ventricular fibrillation (VF) sensitivity Se = 98.3% and non-shockable rhythm specificity Sp>99%; "AWC Stage" decision after Step2 reconfirmation achieved Se = 92.1%, Sp>99%. AWC required hands-off reconfirmation in 34.4% of cases	AWC presented similar performances to other AED algorithms during CPR, fulfilling performance goals recommended by standards. AWC provided advances in the challenge for

Reviewer Comments (including whether meet criteria for formal review):
The last title screening performed Feb 14th identified two observational studies evaluating analysis during compressions in clinical settings. These are the first two clinical studies identified, and this topic will therefore be prioritized for full systematic review in 2021.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

de Graaf C, Beesems SG, Oud S, Stickney RE, Piraino DW, Chapman FW, Koster RW. Analyzing the heart rhythm during chest compressions: Performance and clinical value of a new AED algorithm. Resuscitation. 2021 Jan 16:S0300-9572(21)00009-5. doi: 10.1016/j.resuscitation.2021.01.003. Online ahead of print.

Didon JP, Ménétré S, Jekova I, Stoyanov T, Krasteva V. Analyze Whilst Compressing algorithm for detection of ventricular fibrillation during CPR: A comparative performance evaluation for automated external defibrillators. Resuscitation. 2021 Jan 30;160:94-102. doi: 10.1016/j.resuscitation.2021.01.018. Online ahead of print.

2021 Evidence Update Worksheet
Appendix B1 BLS 23

Worksheet author(s): Christopher M Smith

Date Submitted: 16th February 2021

PICO / Research Question: BLS 374, systematic review

In adults or children in cardiac arrest (out-of-hospital and in-hospital) [P] does the use of alternative methods of manual CPR (cough CPR, percussion pacing, precordial thump) [I], compared with standard CPR [C], improve outcomes (restoration of cardiac output/circulation, return of spontaneous circulation (ROSC), survival to 30 days or hospital discharge, survival with favourable neurological outcome) [O].

This was a systematic review and we registered the protocol with the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42019152925)

Outcomes:

ROSC, survival to discharge or 30 days, survival with favorable neurological recovery

Type (intervention, diagnosis, prognosis):

Intervention

Additional Evidence Reviewer(s):

None

Conflicts of Interest (financial/intellectual, specific to this question):

None

Year of last full review: 2020

Our initial search in 30th September 2019 informed the 2020 CoSTR for BLS. We repeated the search on 24th August 2020 as part of the submission for peer-reviewed publication.

This paper has been peer-reviewed and published in *Resuscitation* Journal (Dee R et al *Resuscitation* 2021 epub ahead of print) https://doi.org/10.1016/j.resuscitation.2021.01.027

Last ILCOR Consensus on Science and Treatment Recommendation:

Cough CPR

We recommend against the routine use of cough CPR for cardiac arrest (strong recommendation, very-low-certainty evidence).

We suggest that cough CPR may be considered only as a temporizing measure in exceptional circumstance of a witnessed, monitored IHCA (eg, in a cardiac catheterization laboratory) if a non-perfusing rhythm is recognized promptly before loss of consciousness (weak recommendation, very-low-certainty evidence).

Percussion (fist) pacing

We recommend against fist pacing for cardiac arrest (strong recommendation, very-low-certainty evidence).

We suggest that fist pacing may be considered only as a temporizing measure in the exceptional circumstance of a witnessed, monitored, IHCA (eg, in a cardiac catheterization laboratory) due to bradyasystole if such a nonperfusing rhythm is recognized promptly before loss of consciousness (weak recommendation, very-low-certainty evidence).

Precordial thump

We recommend against the use of a precordial thump for cardiac arrest (strong recommendation, very-low-certainty evidence).

2020 Search Strategy:

Searches conducted on 24th August 2020:

MEDLINE

1.	exp Cardiopulmonary Resuscitation/exp Cardiopulmonary Resuscitation/	18149
2.	cardiopulmonary resuscitation.ab,ti.	12620
3.	CPR.ab,ti	10687
4.	exp Heart Massage/	3126
5.	"chest compression*".ab,ti.	3306
6.	"resus*".ab,ti.	60545
7.	1 or 2 or 3 or 4 or 5 or 6	71754
8.	cough CPR.mp	16
9.	cicpr.mp	1
10.	exp Cough/	15920
11.	"cough*".ab,ti.	43491
12.	10 or 11	47654
13.	7 and 12	184
14.	"precordial thump*".ab,ti.	65
15.	(chest and thump*).ab,ti.	95
16.	fist pacing.ab,ti.	5
17.	percussion pacing.ab,ti.	9
18.	(percussion and (pace or pacing or paced)).ab,ti.	11
19.	(precordial and thump*).ab,ti.	69
20.	8 or 9 or 13 or 14 or 15 or 16 or 17 or 18 or 19	342
21.	manual.ab,ti.	80160
22.	7 and 21	1026
23.	20 or 22	1349
24.	exp animals/ not humans.sh.	4725507
25.	23 not 24	1142

EMBASE

1.	exp resuscitation/	110974
2.	"resus*".ab,ti.	96827
3.	cardiopulmonary resuscitation.ab,ti.	20236
4.	cpr.ab,ti.	21926
5.	exp heart massage/	2231
6.	chest compression*".ab,ti.	6283
7.	1 or 2 or 3 or 4 or 5 or 6	157044
8.	cough CPR.ab,ti.	17
9.	cicpr.ab,ti.	1
10.	exp coughing/	122722

11.	"cough*".ab,ti.	83105
12.	10 or 11	145717
13.	7 and 12	1143
14.	"precordial thump*".ab,ti.	77
15.	(chest and thump*).ab,ti.	125
16.	fist pacing.ab,ti.	5
17.	percussion pacing.ab,ti.	11
18.	(percussion and (pace or pacing or paced)).ab,ti.	18
19.	(precordial and thump*).ab,ti.	80
20.	8 or 9 or 13 or 14 or 15 or 16 or 17 or 18 or 19	1341
21.	manual.ab,ti.	132177
22.	7 and 21	1995
23.	20 or 22	3289
24.	exp animals/ not human.sh.	4811515
25.	23 not 24	3074
26.	limit 25 to (article or article in press or "review")	1856

COCHRANE LIBRARY

#1	MeSH descriptor: [Cardiopulmonary Resuscitation] explode all trees	1050
#2	(cardiopulmonary resuscitation):ti,ab,kw	2069
#3	("CPR"):ti,ab,kw	2174
#4	MeSH descriptor: [Heart Massage] explode all trees	153
#5	(chest compression*):ti,ab,kw	1338
#6	(resus*):ti,ab,kw	7860
#7	#1 or #2 or #3 or #4 or #5 or #6	8850
#8	(cough cpr):ti,ab,kw	1
#9	(cicpr):ti,ab,kw	0
#10	MeSH descriptor: [Cough] explode all trees	1346
#11	(cough*):ti,ab,kw	1325
#12	(precordial thump*):ti,ab,kw	0
#13	(chest thump*):ti,ab,kw	2
#14	(fist pac*):ti,ab,kw	11
#15	(percussion pac*):ti,ab,kw	20
#16	#8 or #9 or #10 or #11 or #12 or #13 or #14 or #15	13361
#17	#7 and #16	56
#18	(manual):ti,ab,kw	18082

#19	#7 and #18	394
#20	#17 or #19	436

Search Results (Number of articles identified / number identified as relevant):

There were 23 included studies (cough CPR n=4; percussion pacing n=4; precordial thump n=16), of which one study reported on both cough CPR and precordial thump.

Inclusion/Exclusion Criteria:

We included RCTs, non-randomised studies, case series with at least five cases. We considered papers in all languages provided there was an English language abstract available for review.

We excluded unpublished studies, conference abstracts, manikin or simulation studies, narrative reviews, editorials or opinions with no primary data, animal studies and experimental / lab models

We set no time limits on our searches

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

Cough CPR

Niemann J.T., Rosborough J., Hausknecht M., Brown D., Criley J.M. Cough-CPR: documentation of systemic perfusion in man and in an experimental model: a "window" to the mechanism of blood flow in external CPR. Crit Care Med. 1980;8:141-6

Caldwell G., Millar G., Quinn E. Simple mechanical methods for cardioversion: Defence of the precordial thump and cough version. Br Med J (Clin Res Ed). 1985;291:627-30.

Petelenz T., Iwinski J., Chlebowczyk J., Czyz Z., Flak Z., Fiutowski L., et al. Self--administered cough cardiopulmonary resuscitation (c-CPR) in patients threatened by MAS events of cardiovascular origin. Wiad Lek. 1998;51:326-36.

Marozsán I., Albared J.L., Szatmáry L.J. Life-threatening arrhythmias stopped by cough. Cor Vasa. 1990;32:401-8

Percussion Pacing

Klumbies A., Paliege R., Volkmann H. Mechanical emergency stimulation in asystole and extreme bradycardia. Z Gesamte Inn Med. 1988;43:348-52.

Scherf D., Bornemann C. Thumping of the precordium in ventricular standstill. Am J Cardiol. 1960;5:30-40.

Iseri L.T., Allen B.J., Baron K., Brodsky M.A. Fist pacing, a forgotten procedure in bradyasystolic cardiac arrest. Am Heart J. 1987;113:1545-50.

Paliege R., Volkmann H., Klumbies A. The first as pace maker for the heart. Investigations about mechanical emergency pacing of the heart. Deut Gesundheitswes. 1982;37:1094-100

Precordial Thump

Caldwell G., Millar G., Quinn E. Simple mechanical methods for cardioversion: Defence of the precordial thump and cough version. Br Med J (Clin Res Ed). 1985;291:627-30.

Nehme Z., Andrew E., Bernard S.A., Smith K. Treatment of monitored out-of-hospital ventricular fibrillation and pulseless ventricular tachycardia utilising the precordial thump. Resuscitation. 2013;84:1691-6.

Pellis T., Kette F., Lovisa D., Franceschino E., Magagnin L., Mercante W.P., et al. Utility of pre-cordial thump for treatment of out of hospital cardiac arrest: a prospective study. Resuscitation. 2009;80:17-23.

Gertsch M., Hottinger S., Hess T. Serial chest thumps for the treatment of ventricular tachycardia in patients with coronary artery disease. Clin Cardiol. 1992;15:181-8.

Rajagopalan R.S., Appu K.S., Sultan S.K., Jagannadhan T.G., Nityanandan K., Sethuraman S. Precordial thump in ventricular tachycardia. J Assoc Physicians India. 1971;19:725-9.

Miller J., Tresch D., Horwitz L., Thompson B.M., Aprahamian C., Darin J.C. The precordial thump. Ann Emerg Med. 1984;13:791-4.

Haman L., Parizek P., Vojacek J. Precordial thump efficacy in termination of induced ventricular arrhythmias. Resuscitation. 2009;80:14-6.

Amir O., Schliamser J.E., Nemer S., Arie M. Ineffectiveness of precordial thump for cardioversion of malignant ventricular tachyarrhythmias. Pacing Clin Electrophysiol. 2007;30:153-6.

Nejima J. Clinical features and treatment of ventricular tachycardia associated with acute myocardial infarction. Nihon Ika Daigaku Zasshi. 1991;58:40-9.

Volkmann H., Klumbies A., Kuhnert H., Paliege R., Dannberg G., Siegert K. Terminating ventricular tachycardias by mechanical cardiac pacing by means of precordial thumps. Z Kardiologie. 1990;79:717-24.

Miller J., Addas A., Akhtar M. Electrophysiology studies: Precordial thumping patients paced into ventricular tachycardia. J Emerg Med. 1985;3:175-9.

Cotoi S., Moldovan D., Carasca E. Precordial thump in the treatment of cardiac arrhythmias (electrophysiologic considerations). Physiologie. 1980;17:285-8.

Morgera T., Baldi N., Chersevani D., Medugno G., Camerini F. Chest thump and ventricular tachycardia. Pacing Clin Electrophysiol. 1979;2:69-75.

Befeler B. Mechanical stimulation of the heart. Its therapeutic value in tachyarrhythmias. Chest. 1978;73:832-8.

Rahner E., Zeh E. Regulation of ventricular tachycardia with precordial fist blow. Med Welt. 1978;29:1659-63.

Pennington J.E., Taylor J., Lown B. Chest thump for reverting ventricular tachycardia. N Engl J Med. 1970;283:1192-5

Summary of Evidence Update:

MEDLINE, EMBASE and Cochrane library searches re-run on 16-February 2021. MEDLINE and EMBASE searches covered the period 2020-2021 (so there will have been some overlap with the 24th August 2020 search) and the Cochrane search covered the period August 2020 – present.

Evidence Update Process for topics not covered by ILCOR Task Forces

9. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

The searches returned:

MEDLINE: 43 articles
EMBASE: 218 articles

Cochrane: 36 articles

There were no new articles for consideration after title and abstract review

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

This does NOT meet criteria for formal review at this point.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

No new papers identified

2021 Evidence Update Worksheet
Appendix B1 BLS 24

Worksheet author: Suzanne Avis
Date Submitted: 16/02/2021

PICO / Research Question:
(NB This is the PICO from C2010 – BLS052, 2020 BLS 524)

Population: In adult and pediatric patients in cardiac arrest (both out-of-hospital and in-hospital) who are NOT endotracheally intubated

Intervention: does providing ventilation with a 1 second inspiratory time and a tidal volume of approximately 600ml

Comparison: compared with any other combination of inspiratory time and tidal volume

Outcomes: clinical outcomes (return of spontaneous circulation, survival to discharge from hospital, oxygenation status, ventilation status, incidence of aspiration).

Type (intervention, diagnosis, prognosis): Intervention

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

Year of last full review: 2010

Last ILCOR Consensus on Science and Treatment Recommendation:

This question was last reviewed in C2010 “Tidal Volumes and Ventilation Rates”; however, was entitled BLS052, and did not comment on ventilation rates (reported on inspiratory time instead).

C2010
Tidal Volumes and Ventilation Rates (BLS-052)
Consensus on Science

In 3 human studies (LOE 5174–176), tidal volumes of 600 mL using room air were sufficient to maintain oxygenation and normocarbia in apneic patients. When tidal volumes less than 500 mL were used, supplementary oxygen was needed to achieve satisfactory oxygenation. Three studies of mechanical
models (LOE 5177–179) found no clinically important difference in tidal volumes when a 1- or 2-second inspiratory time was used. In 1 human study with 8 subjects (LOE 4180), expired air resuscitation using tidal volumes of 500 to 600ml
Treatment Recommendation
For mouth-to-mouth ventilation for adult victims using exhaled air or bag-mask ventilation with room air or oxygen, it is reasonable to give each breath within a 1-second inspiratory time and with an approximate volume of 600 mL to achieve chest rise. It is reasonable to use the same initial tidal volume and rate in patients regardless of the cause of the cardiac arrest.

2010 Search Strategy

Database: All EBM Reviews - Cochrane DSR, ACP Journal Club, DARE, CCTR, CMR, HTA, and NHSEED Search Strategy:
1 exp heart arrest/ (738)
2 exp cardiopulmonary resuscitation/ (326)
3 ventilation.mp. [mp=ti, ot, ab, tx, kw, ct, sh, hw] (8538)
4 bag-valve-mask.mp. [mp=ti, ot, ab, tx, kw, ct, sh, hw] (35)
5 artificial respiration.mp. [mp=ti, ot, ab, tx, kw, ct, sh, hw] (26)
6 assisted ventilation.mp. [mp=ti, ot, ab, tx, kw, ct, sh, hw] (357)
7 manual ventilation.mp. [mp=ti, ot, ab, tx, kw, ct, sh, hw] (47)
8 tidal volume.mp. [mp=ti, ot, ab, tx, kw, ct, sh, hw] (1270)
9 (1 or 2) and (3 or 4 or 5 or 6 or 7 or 8) (89)

(4 potentially relevant studies identified from 89 possible papers; 2 papers finally relevant to the question)

MEDLINE (via OVID SP): Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1950 to Present> Search Strategy:
1 exp heart arrest/ (25324)
2 exp cardiopulmonary resuscitation/ (7526)
3 exp Intermittent Positive-Pressure Ventilation/ or exp Ventilation/ or ventilation.mp. or exp Pulmonary Ventilation/ (98645)
4 artificial respiration.mp. or exp Respiration, Artificial/ (48175)
5 exp Respiration, Artificial/ or exp Positive-Pressure Respiration/ or assisted ventilation.mp. (48591)
6 exp Respiration, Artificial/ or manual ventilation.mp. or exp Positive-Pressure Respiration/ (47755)
7 tidal volume.mp. or exp Tidal Volume/ (11725)
8 exp Respiration, Artificial/ or exp Masks/ or bag-valve-mask.mp. or exp Resuscitation/ (80053)
9 (1 or 2) and (3 or 4 or 5 or 6 or 8) and 7 (148)

(24 potentially relevant papers found from 149 possible papers; 2 papers finally relevant to the question in addition to the 2 above (total 4))

EMBASE (via OVID SP): Database: EMBASE <1980 to 2009 May 29> Search Strategy:
1 exp heart arrest/ (16339)
2 exp cardiopulmonary resuscitation/ (24914)
3 exp Intermittent Positive-Pressure Ventilation/ or exp Ventilation/ or ventilation.mp. or exp Pulmonary Ventilation/ (84755)
4 artificial respiration.mp. or exp Respiration, Artificial/ (55116)
5 exp Respiration, Artificial/ or exp Positive-Pressure Respiration/ or assisted ventilation.mp. (59865)
6 exp Respiration, Artificial/ or manual ventilation.mp. or exp Positive-Pressure Respiration/ (54980)
7 tidal volume.mp. or exp Tidal Volume/ (9716)
8 exp Respiration, Artificial/ or exp Masks/ or bag-valve-mask.mp. or exp Resuscitation/ (82306)
9 (1 or 2) and (3 or 4 or 5 or 6 or 8) and 7 (274)

30 potentially relevant papers from 274 possible papers; 4 papers finally relevant to the question in addition to 3 of the the 4 above (total 8).

2021 Search Strategy

PubMed (31 December 2009 – 15 February 2021)

Tidal Volume search (Date limited 31 December 2009 – 16 February 2021**)**
(tidal volume [MeSH Terms] OR tidal volume[TIAB]) AND ((((((((((life support care[MeSH Terms]) OR "life support"[Title/Abstract]) OR cardiopulmonary resuscitation[MeSH Terms]) OR "cardiopulmonary resuscitation"[Title/Abstract]) OR "CPR"[Title/Abstract]) OR "return of spontaneous circulation"[Title/Abstract]) OR "ROSC"[Title/Abstract]) OR heart arrest[MeSH Terms]) OR "cardiac arrest"[Title/Abstract])) NOT ((animals[MH] NOT humans[MH])))
N=200

Ventilation rate search (Date limited 31 December 2009 – 16 February 2021
(Noninvasive Ventilation [MeSH Terms] OR ventilation [TI]) AND ((((((((((life support care[MeSH Terms]) OR "life support"[Title/Abstract]) OR cardiopulmonary resuscitation[MeSH Terms]) OR "cardiopulmonary resuscitation"[Title/Abstract]) OR "CPR"[Title/Abstract]) OR "return of spontaneous circulation"[Title/Abstract]) OR "ROSC"[Title/Abstract]) OR heart arrest[MeSH Terms]) OR "cardiac arrest"[Title/Abstract])) NOT ((animals[MH] NOT humans[MH])))
N=396

Database searched: PubMed (31 December 2009 – 16 February 2021)

Date Search Completed: 16 February 2021

Search Results (Number of articles identified / number identified as relevant):
Tidal volume: 200 retrieved / 16 full-text retrieved and reviewed / no studies relevant
Ventilation rate: 396 retrieved / no studies relevant

Inclusion/Exclusion Criteria (C2010):
Inclusion:
Include all studies where there was a comparison of 600mL [~500-700mL] tidal volumes (with approximately one second inspiratory time) with any other ventilation mode during cardiopulmonary resuscitation AND an identifiable result showing that reported clinical outcomes (return of spontaneous circulation, survival to discharge from hospital, oxygenation status, ventilation status, incidence of aspiration).
Exclusion:
Exclude all neonatal and infant studies and those studies involving patients or animals that were intubated. Exclude studies where no clinically relevant outcomes were reported. Exclude review articles.

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

Tidal volume search (PubMed link): here
Ventilation rate search (PubMed link): here

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

TIDAL VOLUME

200 studies identified, 16 full texts reviewed, none were found to be relevant (4 x mechanical ventilation (intubated), 1 x post-ROSC, 3 x narrative reviews, 7 x no clinical outcomes)
NO RELEVANT STUDIES

VENTILATION RATE

NO RELEVANT STUDIES

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

This BLS PICOST question was addressed with two separate PubMed searches, one for 'tidal volumes' during CPR and a second for 'ventilation rates'. The searches together identified a total of 596 citations, which were screened initially on title and abstract. Sixteen papers were retrieved for review of the full-text, and all were assessed as not meeting the inclusion/exclusion criteria. This review therefore concludes that there is no new science that would change, or initiate a revision, of the recommendations from the 2010 CoSTR.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 25

Worksheet author(s): Peter J. Kudenchuk, MD
Date Submitted: 2/5/2021

BLS 372 and BLS 547

PICO / Research Question: Among adults who are in cardiac arrest outside of a hospital (population), does provision of chest compressions without ventilation by trained/untrained laypersons (intervention) compared with chest compressions with ventilations (comparison)

- change outcome (outcome) [BLS372]?
- change survival with favorable neurological/functional outcome at discharge, 30 days, 60 days, 180 days and/or 1 year; survival only at discharge, 30 days, 60 days, 180 days and/or 1 year; ROSC, bystander CPR performance, CPR quality (outcome) [BLS 547]?

Outcomes: BLS371 addressed outcome in a generic sense (not specified); BLS 547 specifically addressed short-term and long-term outcomes, as well as CPR performance and quality measures.

Type (intervention, diagnosis, prognosis): Intervention

Additional Evidence Reviewer(s): NA
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation: 2020

- We continue to recommend that bystanders perform chest compressions for all patients in cardiac arrest (good practice statement)
- We suggest that bystanders who are trained, able and willing to give rescue breaths and chst compressions do so for all adults in cardiac arrest (weak recommendation, very-low-certainty evidence)

2010/2015 Search Strategy: NA
2020 Search Strategy:

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1 exp Cardiopulmonary Resuscitation/
2 (cardiopulmonary respiratory resuscitation$ or cardiopulmonary resuscitation$ or cardio pulmonary resuscitation$ or cardio-pulmonary resuscitation$ or CPR or Advanced Cardiac Life Support or basic cardiac life support or code blue or resuscitation$ mouth-to-mouth or mouth-to-mouth resuscitation$ or mouth to mouth resuscitation$).tw.

3 Resuscitation/
4 limit 3 to yr=1978-1991
5 1 or 2 or 4
6 mt.fs.
7 method$.tw.
8 6 or 7
9 5 and 8
10 randomized controlled trial.pt.
11 (randomized or placebo).mp.
12 clinical trial.pt.
13 Comparative Study.pt.
14 cross-over studies/
15 controlled clinical trial.pt.
16 (time adj series).tw.
17 (pre test or pretest or (posttest or post test)).tw.
18 random allocation/
19 (controlled adj before).tw.
20 exp epidemiologic studies/
21 ((case* adj3 control*) or (case adj3 comparison*) or control group*).tw.
22 or/10-21
23 9 and 22
24 (control$ or compar$ or random$).tw.
25 9 and 24
26 23 or 25
27 animals/ not humans/
28 26 not 27
29 (editorial or letter).pt.
30 28 not 29
31 ("18334691" or "19660833" or "16564776" or "18374452" or "20370759" or "26550795").ui.
32 30 or 31
33 comment.pt.
34 32 not 33
35 remove duplicates from 34

Database searched: Medline
Date Search Completed: 1/1/2020- 1/28/2021

Search Results (Number of articles identified / number identified as relevant): 815 articles retrieved from search → 1 "trial sequence analysis review" assessed survival outcome; 1 evaluated 30 day neurological outcome; 2 evaluated bystander CPR quality in manikins
Inclusion/Exclusion Criteria: Manikin and clinical studies addressing adult resuscitation
Link to Article Titles and Abstracts (if available on PubMed):
https://pubmed.ncbi.nlm.nih.gov/32975628/
https://pubmed.ncbi.nlm.nih.gov/10824072/
https://pubmed.ncbi.nlm.nih.gov/20818863/
https://pubmed.ncbi.nlm.nih.gov/20818864/
https://pubmed.ncbi.nlm.nih.gov/32976224/
https://pubmed.ncbi.nlm.nih.gov/32053634/

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

10. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.
11. New information provides additional insights but not sufficient to change 2020 recommendations.

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
Ivan; 2020	Bystander chest compression only versus standard resuscitation in out-of-hospital cardiac arrest	BLS 372 and BLS 547	1 (addressed Hallstrom, Rea and Svensson randomized trials)	Updated systematic review and meta-analysis of randomized human trials between 1985-2019 addressing the question identified 3 such trials. Pooled results from these 3 trials found a risk ratio of 1.21 (1.01, 1.46) favoring chest compression-only CPR over conventional CPR. However trial sequence analysis determined combined trial results had a risk of type 1 error of 10-30% and were therefore inconclusive. An additional 1300 patients would be needed in	Current randomized trial evidence is insufficient to establish the superiority of one CPR method over the other.

				future randomized trials to establish conclusive results.	

RCT:

Randomized non-clinical trials

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**
Adequate CPR performance by bystanders with various pauses between chest compressions vs continuous chest compressions; Baldi; 2020	**Study Aim:** Determine whether incorporating intentional interruptions of different frequency and duration improves layperson CPR quality compared to compression-only CPR **Study Type:** Randomized manikin trial comparing 3 CPR protocols of 30 chest compressions (CC) with 2	n= 517 laypersons trained in BLS/AED and randomized 1:1:1:1 to the various CPR protocols (n=129-130 per group)	**Intervention:** 3 CPR protocols of 30 chest compressions (CC) with 2 second pause; 50 CC with 5 second pause and 100 CC with 10 second pause conducted for 8 min **Comparison:** Endpoint measures evaluated between each CPR strategy	**1° endpoint:** Primary endpoint was % of CC with adequate depth; secondary endpoints CC Fx%, compression rate, interruptions > 10 seconds and correct hand position. **Results:** Adequate depth 30cc:2s 96%; 50cc:5s 96%; 100cc:10s 92%; CCC 79% (p=0.006). Compared to CCC vs 30cc:2s p=0.023; CCC vs 50cc:5s p=0.003; CCC vs 100cc:10s p=0.07. Higher CCFx% in CCC group (p<0.001) and higher rate pauses >10 sec in 100cc:10s. NSD in CC	**Study Limitations:** Pauses (potentially for breaths) may result in higher CC with correct depth but at expense of CCFx%. However study did not take the "work of breaths" into account – which could have altered reported outcomes. Thus findings are non-definitive for interposed breathing versus continue chest compression CPR.

	second pause; 50 CC with 5 second pause and 100 CC with 10 second pause conducted for 8 minutes in 517 laypersons, using Laerdal REsusci Anne QCPR manikin.			rate or leaning/recoil or hand position.	
Flow-chart assisted CPR using standard versus continuous chest compression CPR; Rossler; 2020	**Aim:** Chest compressions more correctly delivered in flowchart-assisted resuscitation using standard CPR than chest compression-only algorithm. **Study type:** Randomized manikin trial	84 adult laypersons randomized to flow-chart assisted standard vs chest compression only CPR (n=41 per group) for 5 minute period.	**Intervention:** Standard versus chest compression only CPR. CPR quality assessed by Laerdal Skill Reporting System.	**1° endpoint:** Total number of CCs achieving correct depth 5-6 cm; secondary endpoints included hands-off-time, time to administration of CCs, total number of CCs, relative number of correct CCs (by depth), CCs > 5 cm, average compression rate. **Results:**	Total number of "correct" (5-6 cm depth) CCs did not differ between the two groups; neither did average depth of CC, number of CCs >5 cm, CC rate per minute, recoil, time to exhaustion or level of exhaustion. Total hands off time was shorter in the chest compression-only group than in standard CPR group. The findings suggest no difference in CPR quality between the two CPR strategies apart from shorter hands-off time. Limitation of trial was manikin-based and relatively small in size to detect differences (underpowered).

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)**
Standard vs chest compression only CPR by bystanders in non-asphyxial and asphyxial cardiac arrest; Javaudin; 2020	**Study Type:** Observational n=8541 OHCA; n=6742 non-asphyxial including n=5904 of cardiac etiology and 1799 asphyxial.	**Inclusion Criteria:** Adult, nontraumatic OHCA that were bystander witnessed with bystander CPR prior to EMS arrival	**1° endpoint:** 30 day neurological outcome (CPC ≤ 2) stratified by asphyxia, non-asphyxial and cardiac causes.	No significant difference in 30 day neurological status between the two CPR methods.

Reviewer Comments (including whether meet criteria for formal review): Two manikin trials addressing CPR quality with interrupted versus continuous chest compression CPR had differing outcomes; reassessment of the pooled results from 3 randomized clinical trials were inconclusive of a benefit of one CPR strategy over the other. And an observation study observed no difference in 30 day neurological outcome between the differing CPR strategies regardless of whether the arrest was due to asphyxia, non-asphyxial or cardiac causes. Interim information is insufficient to warrant updating this topic with a full systematic review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

Ivan I, Budiman F, Ruby R, Wendl IP, Ridjab DA. Current evidence of survival benefit between chest compression only versus standard cardiopulmonary resuscitation in out of hospital cardiac arrest. Herz 2020; https://doi.org/10.1007/s00059-020-04982-4.

Hallstrom A, Cobb L, Johnson E, Copass M. Cardiopulmonary resuscitation by chest compression alone or with mouth-to-mouth ventilation. N Engl J Med. 2000;342(21):1546–53.

Rea TD, Fahrenbruch C, Culley L, Donohoe RT, Hambly C, Innes J, Bloomingdale M, Subido C, Romines S, Eisenberg MS. CPR with chest compression alone or with rescue breathing. N Engl J Med. 2010;363(5):423–33.

Svensson L, Bohm K, Castren M, Pettersson H, Engerstr€om L, Herlitz J, Rosenqvist M. Compression-only CPR or standard CPR in out-of-hospital cardiac arrest. N Engl J Med. 2010;363(5):434–42.

Baldi E, Contri E, Burkart R, Borrelli P, Ferraro OE, Paglinio M, Barbati C, Bertaia D, Tami C, Lopez D, Boldarin S, Denereaz S, Terrapon M, Cortegiani A, MANI-CPR Investigators. A multicenter international randomized controlled manikin study of different protocols of cardiopulmonary resuscitation for Laypeople: The MANI-CPR Trial. Sim Healthcare 2020; DOI: 10.1097/SIH.0000000000000505.

Rossler B, Goschin J, Malezcek M, Priinger F, Thell R, Mittlbock M, Schebesta K. Providing the best chest compression quality: Standard CPR versus chest compressions only in a bystander resuscitation model. Plos One; 2020 http://doi.org/10.1371/journal.pone.0.228702.

2021 Evidence Update Worksheet
Appendix B1 BLS 26

Worksheet author(s): Suzanne Avis
Date Submitted: 15/02/2021

PICO / Research Question:
BLS661 Starting CPR (CAB vs ABC)

Population: Among adults and children who are in cardiac arrest in any setting

Intervention: does commencing CPR beginning with compressions first (30:2)

Comparison: compared with starting CPR beginning with ventilation first (2:30)

Outcomes:

- Survival with favourable neurological / functional outcome at discharge, 30 days, 60 days, 180 days AND/OR 1 year
- Survival only at discharge, 30 days, 60 days, 180 days AND/OR 1 year
- ROSC

Study types: Randomised controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies)

Time: This evidence update will examine studies published between 4 September 2019 and 10 February 2021.

Type: Intervention

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

Year of last full review: 2015

Last ILCOR Consensus on Science and Treatment Recommendation (2015):

We suggest commencing CPR with compressions rather than ventilations (weak recommendation, very-low-quality evidence). Values, Preferences, and Task Force Insights In making this recommendation in the absence of human data, we placed a high value on time to specific elements of CPR (chest compressions, rescue breathing, completion of first CPR cycle). In making this recommendation in the absence of human data, given that most cardiac arrests in adults are cardiac in cause, we placed a high value on reducing time to specific elements of CPR (chest compressions and completion of first CPR cycle). We refer the reader to the systematic review Peds 709 (see "Part 6: Pediatric Basic Life Support and Pediatric Advanced Life Support") for recommendations in children**.**

2015 Search Strategy:

(((((compression:ventilation[Title/Abstract] OR "chest compression fraction"[TIAB]))) OR ((((Heart Massage[MeSH Terms] OR heart massage*[Title/Abstract] OR cardiac massage*[Title/Abstract] OR compression*[Title/Abstract])) AND ("Respiration, Artificial"[Mesh:NoExp] OR ventilation*[Title/Abstract])) AND (ratio[Title/Abstract] OR ratios[Title/Abstract]))))) NOT ((animals[mh] NOT humans[mh]) NOT ("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp])))

Embase:

'compression:ventilation':ab,ti OR 'chest compression fraction':ab,ti OR ('heart massage'/de OR (heart NEAR/1 massage*):ab,ti OR (cardiac NEAR/1 massage*):ab,ti OR compression*:ab,ti AND ('respiration, artificial'/de OR ventilation*:ab,ti) AND (ratio:ab,ti OR ratios:ab,ti)) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim

Cochrane:

("compression:ventilation":ab,ti or "chest compression fraction":ab,ti) or (([mh "Heart Massage"] or "heart massage*":ab,ti or "cardiac massage*":ab,ti or "compression*":ab,ti) and ([mh ^"Respiration, Artificial"] or ventilation*:ab,ti) and (ratio:ab,ti or ratios:ab,ti))

2020 Search Strategy:

The search strategy used in 2015 was re-run through on 4 September 2019 and yielded 491 citations after removal of duplicates (Pubmed 145 citations; Embase 230 citations and Cochrane 116 citations). After duplicates were removed, 340 abstracts were screened by two independent reviewers for applicability to the PICOST. Upon completion of their individual reviews of titles and abstracts, the reviewers concur there was no new science that would change or revise the current treatment recommendations from 2015 CoSTR.

2021 Search Strategy (EvUpdate)

Pubmed:

Re-run on 10 February 2021 date limited 04 September 2019 to 10 February 202: 51 citations

(((((compression:ventilation[Title/Abstract] OR "chest compression fraction"[TIAB]))) OR ((((Heart Massage[MeSH Terms] OR heart massage*[Title/Abstract] OR cardiac massage*[Title/Abstract] OR compression*[Title/Abstract])) AND ("Respiration,

Artificial"[Mesh:NoExp] OR ventilation*[Title/Abstract])) AND (ratio[Title/Abstract] OR ratios[Title/Abstract]))))) NOT ((animals[mh] NOT humans[mh]) NOT ("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp]))

Embase:
Re-run on 10 February 2021 date limited 04 September 2019 to 10 February 2021: 217 citations
'compression:ventilation':ab,ti OR 'chest compression fraction':ab,ti OR ('heart massage'/de OR (heart NEAR/1 massage*):ab,ti OR (cardiac NEAR/1 massage*):ab,ti OR compression*:ab,ti AND ('respiration, artificial'/de OR ventilation*:ab,ti) AND (ratio:ab,ti OR ratios:ab,ti)) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim

Cochrane:
Re-run on 10 February 2021, date limited September 2019 to February 2021: 34 citations
("compression:ventilation":ab,ti or "chest compression fraction":ab,ti) or (([mh "Heart Massage"] or "heart massage*":ab,ti or "cardiac massage*":ab,ti or "compression*":ab,ti) and ([mh ^"Respiration, Artificial"] or ventilation*:ab,ti) and (ratio:ab,ti or ratios:ab,ti))

Databases searched: PubMed, Embase (via OVID), Cochrane

Date Searches Completed: 10 February 2021

Search Results (Number of articles identified / number identified as relevant):

PubMed: 51, **Embase:** 217, **Cochrane:** 34

Total: 302 **After duplicates removed:** 285

Inclusion/Exclusion Criteria:

Inclusion criteria:
Randomised controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) comparing CAB with ABC. All languages included if abstract available in English.

Exclusion criteria:
Animal studies, studies of post cardiac arrest debriefing or post cardiac arrest feedback, studies of dispatcher or telephone assisted CPR. Unpublished studies (e.g., conference abstracts, trial protocols).

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

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

12. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

No Relevant guidelines, systematic reviews, RCTs, non-randomised trials or observational studies were identified.

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

No new evidence was identified for this question.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 27

Worksheet author(s): Carolina Malta Hansen,
Date Submitted: February 17, 2021

PICO / Research Question:
Among adults and children who are in cardiac arrest outside of a hospital (P), does the description of any specific symptoms to the dispatcher (I), compared with the absence of any specific description (C), change the likelihood of cardiac arrest recognition (O)?

Outcomes: Dispatcher recognition of cardiac arrest

Type (intervention, diagnosis, prognosis): diagnosis

Additional Evidence Reviewer(s): Tetsuo Hakanaka, Theresa Olasveengen

Conflicts of Interest (financial/intellectual, specific to this question):

Carolina Malta Hansen: Research grants from TrygFonden, Helsefonden, Laerdal Foundation.

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:
We recommend that dispatch centers implement a standardized algorithm and/or standardized criteria to immediately determine if a patient is in cardiac arrest at the time of emergency call (strong recommendation, very-low-certainty evidence).
We suggest that dispatch centers monitor and track diagnostic capability. We suggest that dispatch centers look for ways to optimize sensitivity (minimize false negatives).
We recommend high-quality research that examines gaps in this area.

2010/2015/2019 Search Strategy:
Database: All Ovid Medline <1946 - present>
---
1 emergency medical service communication systems/ (1758)
2 emergency medical dispatch/ (91)

3 Emergency Medical Dispatcher/ (36)
4 call centers/ (61)
5 hotlines/ (2659)
6 telephone/ or cell phone/ (19468)
7 Telecommunications/ (4760)
8 "911".tw,kf. (9248)
9 "9-1-1".tw,kf. (583)
10 "999".tw,kf. (13411)
11 "9-9-9".tw,kf. (69)
12 dispatch*.tw,kf. (3055)
13 despatch*.tw,kf. (90)
14 (call adj3 take*).tw,kf. (163)
15 (calls adj3 take*).tw,kf. (81)
16 calltaker*.tw,kf. (1)
17 call receiver*.tw,kf. (4)
18 phone*.tw,kf. (35149)
19 telephone*.tw,kf. (56538)
20 telecommunicat*.tw,kf. (4183)
21 "T-CPR".tw,kf. (33)
22 operator*.tw,kf. (56327)
23 emergency call*.tw,kf. (839)
24 emergency medical call*.tw,kf. (26)
25 call centre*.tw,kf. (273)
26 call center*.tw,kf. (573)
27 emd.tw,kf. (2727)
28 hotline*.tw,kf. (1156)
29 or/1-28 (189858)
30 exp Heart Arrest/ (46333)
31 Ventricular Fibrillation/ (16858)
32 Resuscitation/ (25767)
33 Heart Massage/ (3086)
34 exp Cardiopulmonary Resuscitation/ (17214)
35 cardi* arrest*.tw,kf. (37515)
36 heart arrest*.tw,kf. (2265)
37 CPR.tw,kf. (11841)
38 advanced cardiac life support.tw,kf. (1031)

39 ACLS.tw,kf. (1094)
40 basic life support.tw,kf. (1916)
41 BLS.tw,kf. (1820)
42 asystol*.tw,kf. (4149)
43 pulseless electrical activity.tw,kf. (837)
44 (return of circulation or return of spontaneous circulation or ROSC).tw,kf. (3763)
45 resuscitat*.tw,kf. (62496)
46 ventricular fibrillation*.tw,kf. (18508)
47 chest compression*.tw,kf. (3615)
48 agonal breath*.tw,kf. (47)
49 Electric Countershock/ (14530)
50 Defibrillators/ (1736)
51 electric countershock.tw,kf. (397)
52 defibrillat*.tw,kf. (25927)
53 aed.tw,kf. (6084)
54 exp Drowning/ (3934)
55 drown*.tw,kf. (5234)
56 or/30-55 (172390)
57 29 and 56 (2929)
58 Communication/ (81377)
59 communication barriers/ (6343)
60 Linguistics/ (8150)
61 early diagnosis/ (25327)
62 Diagnosis, Differential/ (443460)
63 Delayed Diagnosis/ (5826)
64 exp Diagnostic Errors/ (114204)
65 Clinical Protocols/ (27191)
66 Critical Pathways/ (6464)
67 Risk Assessment/ (252020)
68 (recogni* or identif* or detect* or diagnos*).tw,kf. (6952079)
69 accuracy.tw,kf. (379025)
70 exp "Sensitivity and Specificity"/ (566344)
71 sensitivity.tw,kf. (768683)
72 specificity.tw,kf. (447265)
73 predictive value of test*.tw,kf. (416)
74 positive predictive value.tw,kf. (40115)

75 negative predictive value.tw,kf. (33378)
76 true positive*.tw,kf. (7781)
77 true negative*.tw,kf. (3303)
78 false positive*.tw,kf. (57101)
79 false negative*.tw,kf. (32154)
80 or/58-79 (8250450)
81 57 and 80 (1399)
82 limit 81 to (comment or editorial or letter) (16)
83 81 not 82 (1383)
84 83 not (animals/ not humans/) (1361)
85 remove duplicates from 84 (1357)
86 limit 85 to ed=20190423-20191128 (59)
87 limit 85 to dt=20190423-20191128 (68)
88 limit 85 to ez=20190423-20191128 (51)
89 86 or 87 or 88 (121)
90 remove duplicates from 89 (121)

2020 Search Strategy: Same as above

Database searched: 11/02/21
Date Search Completed: 14/02/21

Search Results (Number of articles identified / number identified as relevant): 369/8

Inclusion/Exclusion Criteria:
Clinical studies reporting sensitivity or specificity were included, simulation studies were excluded.

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

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

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**
Blomberg, 2021[1]	**Study Aim:** To examine how a machine learning model trained to identify OHCA and alert dispatchers during emergency calls affected OHCA recognition and response. **Study Type:** Double-masked, 2-group, randomized clinical trial	**Inclusion Criteria:** All calls to emergency number 112 (equivalent to 911) in Denmark. Calls were processed by a machine learning model using speech recognition software. The machine learning model assessed ongoing calls, and calls in which the model identified OHCA were randomized. The trial was performed at Copenhagen Emergency Medical Services, Denmark, between September 1, 2018, and December 31, 2019	**Intervention:** Dispatchers in the intervention group were alerted when the machine learning model identified out-of-hospital cardiac arrest, **Comparison:** Dispatchers in the control group followed normal protocols without alert.	**1° endpoint:** The primary end point was the rate of dispatcher recognition of subsequently confirmed OHCA. Dispatchers in the intervention group recognized 93.1% vs 90.5% in the control group (P = .15). Machine learning alerts alone had a significantly higher sensitivity than dispatchers without alerts for confirmed OHCA (85.0% vs 77.5%; P < .001) but lower specificity (97.4% vs 99.6%; P < .001) and positive predictive value (17.8% vs 55.8%; P < .001).	**Study Limitations:**

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)
Mao, 2020[2]	**Study Type:** Uncontrolled before/after intervention (put caller's hand on patient abdomen while checking for normal breathing). Dispatch recording review 513 unconscious patients (before N=231, after, N= 282).	**Inclusion Criteria:** All unconscious cases from the national call centre database over a 31-day period in 2018.	**1° endpoint:** In an intention-to-treat analysis, the accuracy, sensitivity and specificity of both protocols for determining CA were compared. ITT Sens: 40.4% vs 75.0% (before vs after) Spec: 75.4% vs 87.9% PP Sens: 69.3% vs 96.5% Spec: 77.2% vs 97.8% Time to Diagnosis: (CA confirmed on scene) 118.5 sec vs 101.0 sec (p=0.74) Time to 1st compression: (CA confirmed on scene) 167.0 sec vs 199.5 sec (p=0.059)	By asking callers to put their hand on patient abdomen while asking about breathing the sensitivity and specificity of CA diagnosis significantly increased. The time to diagnosis did not change, but the time to 1st compression tended to increase.
Derkenne, 2020	Retrospective cohort. Repeated cross-sectional study with retrospective data of four 15-day call samples recorded from 2012 to 2018. N = 321	Included all calls from OHCAs cared for by Basic Life Support (BLS) teams and excluded calls where the dispatcher was not in contact directly with a witness.	Recognition of CA. OR (breathing assessed with vs without hand on patient abdomen) OR 13.1[4.8 - 39.5]	By asking callers to put their hand on patient abdomen while asking about breathing, the dispatchers were more likely to correctly diagnose CA and deliver CPR instructions.
Blomberg, 2020[3]	Retrospective analysis of	All calls to EMS during 2014.	Sensitivity, specificity, and positive predictive value for recognizing out-	A machine learning framework performed better than emergency

	108,607 call recordings to EMS, 918 cardiac arrests and 107,689 non-cardiac arrests.		of-hospital cardiac arrest were calculated. The performance of the machine learning framework was compared to the actual recognition and time-to-recognition of cardiac arrest by medical dispatchers. Compared with medical dispatchers, the machine learning framework had a significantly higher sensitivity (72.5% vs. 84.1%, $p < 0.001$) with lower specificity (98.8% vs. 97.3%, $p < 0.001$). The machine learning framework had a lower positive predictive value than dispatchers (20.9% vs. 33.0%, $p < 0.001$). Time-to-recognition was significantly shorter for the machine learning framework compared to the dispatchers (median 44 seconds vs. 54 s, $p < 0.001$).	medical dispatchers for identifying out-of-hospital cardiac arrest in emergency phone calls. Machine learning may play an important role as a decision support tool for emergency medical dispatcher
Tamminen, 2020[4]	Retrospective cohort study, N = 80, 51 confirmed cardiac arrests and 29 non-cardiac arrests.	Disptacher suspected or EMS-encountered OHCAs between January 1, 2017 and May 31, 2017. Non-traumatic, witnessed cardiac arrests.	Identification of trigger words in emergency calls in order to improve the specificity of out-of-hospital cardiac arrest recognition (association between trigger word and correct identification of cardiac arrest).	No trigger word was associated with confirmed cardiac arrest. 'Is wheezing' was a frequently used spontaneous trigger word among later confirmed cardiac arrest victims.
Schwarzkoph, 2020[5]	Retrospective cohort. N=3,502. non-OHCAs (confirmed)	all adult, non-traumatic OHCAs that occurred prior to emergency medical services	Impact of seizure-like activity on recognition of OHCA among OHCA patients during 9-1-1 calls. The seizure-like activity group had a longer median time to dispatcher	Reported seizure-like activity among patients in cardiac arrest poses a barrier to recognition of cardiac arrests by dispatchers leading to delays in resuscitation instructions.

		(EMS) arrival on scene from 2014-2018.	identification of the cardiac arrest [130 s (72,193) vs 62 s (43,102); $p < 0.05$].	
Riou, 2021[6]	Retrospective cohort, N=422.	Emergency calls where OHCA was recognized by the dispatcher and resuscitation was attempted by paramedics.	Impact of caller perception of patient viability on initial recognition of OHCA by the dispatcher, rates of bystander CPR and early patient survival outcomes. Initial recognition of OHCA by the dispatcher was more frequent in cases with a declaration of death by the caller than in cases without (92%, 73/79 vs. 66%, 227/343, $p < 0.001$).	Caller statements that the patient is dead are helpful for dispatchers to recognize OHCA early, but potentially detrimental when recruiting the caller to perform CPR. There is an opportunity to improve the rate of bystander-CPR and patient outcomes if dispatchers are attentive to caller statements about viability.
Watkins, 2021[7]	Retrospective cohort, mixed methods. N=184	All suspected or confirmed OHCA patients transferred to one acute hospital from its associated regional Emergency Medical Service in England from 1/7/2013 to 30/6/2014.	To identify predictors of recognition of OHCA by call handlers. 'Unconscious' + 1 or more of symptoms 'Not breathing/Ineffective breathing/Noisy breathing' occurred in 79.8% of all OHCAs, but only 72.8% of OHCAs were correctly dispatched as such. 'Not breathing' was associated with recognition of OHCA by call handlers (OR 3.76). The presence of key indicator symptoms 'Breathing' (OR 0.29), 'Reduced or fluctuating level of consciousness' (OR 0.24), abnormal pulse/heart rate (OR 0.26) and the characteristic 'Female patient' (OR 0.40) were associated with lack of recognition of OHCA by call handlers (p-values < 0.05).	Small proportion of calls in which cardiac arrest indicators are described but the call is not dispatched as such. Stricter adherence to dispatch protocols may improve call handlers' OHCA recognition. The existing dispatch protocol would not be improved by the addition of further terms as this would be at the expense of dispatch specificity

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

New evidence, particularly related to using new technology such as artificial intelligence or machine learning to improve recognition of cardiac arrest in emergency medical dispatch is of great interest to the resuscitation community, and the BLS task force will prioritize a full review in 2021.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

1. Blomberg SN, Christensen HC, Lippert F, Ersboll AK, Torp-Petersen C, Sayre MR, Kudenchuk PJ and Folke F. Effect of Machine Learning on Dispatcher Recognition of Out-of-Hospital Cardiac Arrest During Calls to Emergency Medical Services: A Randomized Clinical Trial. *JAMA Netw Open*. 2021;4:e2032320.
2. Mao DR, Ee AZQ, Leong PWK, Leong BS, Arulanandam S, Ng M, Ng YY, Siddiqui FJ and Ong MEH. Is your unconscious patient in cardiac arrest? A New protocol for telephonic diagnosis by emergency medical call-takers: A national study. *Resuscitation*. 2020;155:199-206.
3. Blomberg SN, Folke F, Ersboll AK, Christensen HC, Torp-Pedersen C, Sayre MR, Counts CR and Lippert FK. Machine learning as a supportive tool to recognize cardiac arrest in emergency calls. *Resuscitation*. 2019;138:322-329.
4. Tamminen J, Lyden E, Kurki J, Huhtala H, Kamarainen A and Hoppu S. Spontaneous trigger words associated with confirmed out-of-hospital cardiac arrest: a descriptive pilot study of emergency calls. *Scand J Trauma Resusc Emerg Med*. 2020;28:1.
5. Schwarzkoph M, Yin L, Hergert L, Drucker C, Counts CR and Eisenberg M. Seizure-like presentation in OHCA creates barriers to dispatch recognition of cardiac arrest. *Resuscitation*. 2020;156:230-236.
6. Riou M, Ball S, Morgan A, Gallant S, Perera N, Whiteside A, Bray J, Bailey P and Finn J. 'I think he's dead': A cohort study of the impact of caller declarations of death during the emergency call on bystander CPR. *Resuscitation*. 2021;160:1-6.
7. Watkins CL, Jones SP, Hurley MA, Benedetto V, Price CI, Sutton CJ, Quinn T, Bangee M, Chesworth B, Miller C, Doran D, Siriwardena AN and Gibson JME. Predictors of recognition of out of hospital cardiac arrest by emergency medical services call handlers in England: a mixed methods diagnostic accuracy study. *Scand J Trauma Resusc Emerg Med*. 2021;29:7.

2021 Evidence Update Worksheet
Appendix B1 BLS 28

Worksheet author(s): Maaret Castren
Date Submitted: Feb 17th 2021

PICO / Research Question:

PICOST	**Description** *(with recommended text)*
Population	Adults and children with suspected opioid-associated cardio / respiratory arrest in the pre-hospital setting
Intervention	Bystander naloxone administration (intramuscular or intranasal), in addition to standard CPR
Comparison	compared with Standard CPR only
Outcomes	Any clinical outcome. *(preset text)*
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. *(preset text)* *If it is anticipated that there will be insufficient studies from which to draw a conclusion, case series may be included in the initial search. The minimum number of cases for a case series to be included can be set by the ESR after discussion with the priority team or task force.*
Timeframe	All years and all languages are included as long as there is an English abstract *(preset text)*

Outcomes: Short or long-term survival
Type (intervention, diagnosis, prognosis): intervention

Additional Evidence Reviewer(s): Theresa M. Olasveengen
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2010 / 2015 / New question: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:
Treatment Recommendation

We suggest that CPR be started without delay in any unconscious person not breathing normally and that naloxone be used by lay rescuers in suspected opioid related respiratory or circulatory arrest (weak recommendation based on expert consensus).

2010/2015/2020 Search Strategy:
Pubmed:
(((((("Narcotics"[Mesh] OR "Narcotics" [Pharmacological Action] OR Oxycodone[TIAB] or hydrocodone[TIAB] or heroin[TIAB] or morphine[TIAB] or methadone[TIAB] or codeine[TIAB] or fentanyl[TIAB] or opiate[TIAB] or opiates[TIAB] or opioid[TIAB] or opioids[TIAB] OR Hydromorphone[TIAB] or vicodin[TIAB] or Demerol[TIAB] or oxycontin[TIAB] or Tramadol[TIAB] or Meperidine[TIAB] or opium[TIAB] or narcotic[TIAB] OR narcotics[TIAB] OR "Opioid-Related Disorders"[Mesh]) AND ("Drug Overdose"[Mesh] or "poisoning" [Subheading] or "Poisoning"[Mesh:NoExp] or "toxicity" [Subheading] or overdose[TIAB] OR overdosed[TIAB] or overdosing[TIAB] or toxicity[TIAB] or poisoning[TIAB]))))) AND (("Resuscitation"[Mesh] OR "cardiopulmonary resuscitation"[TIAB] or "cardio-pulmonary resuscitation"[TIAB] or CPR[TIAB] or "chest compression"[TIAB] or "chest compressions"[TIAB] OR "basic life support"[TIAB] or BLS[TIAB] or "cardiac massage"[TIAB] or "heart massage"[TIAB] OR "Naloxone"[Mesh] OR "Narcotic Antagonists"[Mesh] or naloxone[TIAB] or naloxon[TIAB] or narcan[TIAB] or "narcotic antagonist"[TIAB] or "narcotic antagonists"[TIAB] OR "opioid antagonist"[TIAB] OR "opioid antagonists"[TIAB])))) NOT ((animals[mh] NOT humans[mh]) NOT ("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp]))

2020 Search Strategy: Same as above
Database searched: Pubmed
Date Search Completed: Feb 17th 2021
Search Results (Number of articles identified / number identified as relevant): 387 / 0
Inclusion/Exclusion Criteria: Any study including cardiac or respiratory arrest patients treated with naloxone and CPR which includes a control group treated with CPR only is included. Animal studies and simulation studies are excluded. Studies looking at effects of opioid overdose education programs with and without naloxone at the population level is covered by another PICOST handled by the EIT Task Force.
Link to Article Titles and Abstracts (if available on PubMed): None

Summary of Evidence Update:
Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Nonrandomized Trials, Observational Studies: None

Reviewer Comments (including whether meet criteria for formal review):
No new evidence was identified.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 29

Worksheet author(s): Gavin Perkins
Date Submitted: 1 February 2021

PICO / Research Question:

Population: In adults and children who are submerged in water

Intervention: Does any particular factor in search-and-rescue operations (eg, duration of submersion, salinity of water, water temperature, age of victim)

Comparators: compared with no factors

Outcomes: Survival to hospital discharge with good neurological outcome and survival to hospital discharge were ranked as critical outcomes. Return of spontaneous circulation (ROSC) was ranked as an important outcome.

Type (intervention, diagnosis, prognosis):Prognosis

Additional Evidence Reviewer(s):none
Conflicts of Interest (financial/intellectual, specific to this question): None

Year of last full review: 2020

Last ILCOR Consensus on Science and Treatment Recommendation:

We recommend that submersion duration be used as a prognostic indicator when making decisions surrounding search and rescue resource management/operations (strong recommendation, moderate-certainty evidence for prognostic significance).

We suggest against the use of age, EMS response time, water type (fresh or salt), water temperature, and witness status when making prognostic decisions (weak recommendation, very-low-certainty evidence for prognostic significance).

We acknowledge that this review excluded exceptional and rare case reports that identify good outcomes after prolonged submersion in icy cold water.

2010/2015 Search Strategy:
2019 Search Strategy:

(((((((((Drowning[MeSH Terms]) OR Immersion[MeSH Terms]) OR drown*[Title/Abstract]) OR submersion*[Title/Abstract])) AND ((((((((((((((((((((((((((Time Factors[MeSH Terms]) OR Risk Factors[MeSH Terms]) OR "Age Factors"[Mesh:NoExp]) OR Age Distribution[MeSH Terms]) OR Temperature[MeSH Terms]) OR Body Temperature[MeSH Terms]) OR Hypothermia[MeSH Terms]) OR Water[Mesh:NoExp]) OR Seawater[MeSH Terms]) OR Fresh Water[MeSH Terms]) OR Time-to-Treatment[MeSH Terms]) OR timing[Title/Abstract]) OR duration*[Title/Abstract]) OR water temperature*[Title/Abstract]) OR core temperature*[Title/Abstract]) OR body temperature*[Title/Abstract]) OR hypothermia[Title/Abstract]) OR sea water[Title/Abstract]) OR seawater[Title/Abstract]) OR salt water[Title/Abstract]) OR salinity[Title/Abstract]) OR fresh water[Title/Abstract]) OR freshwater[Title/Abstract]) OR cold water[Title/Abstract]) OR warm water[Title/Abstract]) OR submersion time*[Title/Abstract]) OR age[Title/Abstract]) OR ages[Title/Abstract]) OR risk*[Title/Abstract])) AND ((((((((((Treatment Outcome[MeSH Terms]) OR Prognosis[Mesh:NoExp]) OR "Predictive Value of Tests"[MeSH Terms]) OR Forecasting[Title/Abstract]) OR "Quality of Life"[MeSH Terms]) OR Survival Analysis[MeSH Terms]) OR outcome*[Title/Abstract]) OR prognos*[Title/Abstract]) OR predict*[Title/Abstract]) OR forecast*[Title/Abstract]) OR survival[Title/Abstract])))) NOT ((animals[mh] NOT humans[mh])))) NOT (("letter"[pt] OR "comment"[pt] OR "editorial"[pt]))

Embase: (Search Completed: June 21, 2014) Embase

Date Searched: June 13, 2014
Number of Results: 825

'drowning'/exp OR 'immersion'/de OR 'water immersion'/de OR drown*:ab,ti OR submersion:ab,ti AND ('time'/de OR 'risk factor'/de OR 'age'/de OR 'age distribution'/de OR 'water temperature'/de OR 'body temperature'/exp OR 'hypothermia'/de OR 'water'/de OR 'sea water'/de OR 'freshwater'/de OR 'lake water'/de OR 'time to treatment'/de OR 'submersion time':ab,ti OR 'timing':ab,ti OR duration*:ab,ti OR risk*:ab,ti OR age:ab,ti OR ages:ab,ti OR (water NEXT/1 temperature*):ab,ti OR 'temperature of water':ab,ti OR 'cold water':ab,ti OR 'warm water':ab,ti OR (core NEXT/1 temperature*):ab,ti OR (body NEXT/1 temperature*):ab,ti OR hypothermia:ab,ti OR 'sea water':ab,ti OR 'seawater':ab,ti OR 'salt water':ab,ti OR 'salinity':ab,ti OR 'fresh water':ab,ti OR 'freshwater':ab,ti) AND ('treatment outcome'/exp OR 'prediction and forecasting'/exp OR 'quality of life'/de OR 'survival'/exp OR outcome*:ab,ti OR prognos*:ab,ti OR predict*:ab,ti OR forecast*:ab,ti OR survival:ab,ti) NOT ('animal'/exp NOT 'human'/exp) NOT ([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim
Cochrane: (Search Completed: June 21, 2014) Cochrane

Date Searched: June 13, 2014
Number of Results: 59

([mh Drowning] OR [mh Immersion] OR drown*:ab,ti OR submersion*:ab,ti) AND ([mh "Time Factors"] OR [mh "Risk Factors"] OR [mh ^"Age Factors"] OR [mh "Age Distribution"] OR [mh Temperature] OR [mh "Body Temperature"] OR [mh Hypothermia] OR [mh ^Water] OR [mh Seawater] OR [mh "Fresh Water"] OR [mh Time-to-Treatment] OR "submersion time*":ab,ti OR timing:ab,ti OR duration*:ab,ti OR risk*:ab,ti OR age:ab,ti OR ages:ab,ti OR "water temperature*":ab,ti OR "temperature of water":ab,ti OR "cold water":ab,ti OR "warm water":ab,ti OR "core temperature*":ab,ti OR "body

temperature*":ab,ti OR hypothermia:ab,ti OR "sea water":ab,ti OR seawater:ab,ti OR "salt water":ab,ti OR salinity:ab,ti OR "fresh water":ab,ti OR freshwater:ab,ti) AND ([mh "Treatment Outcome"] OR [mh ^Prognosis] OR [mh "Predictive Value of Tests"] OR [mh Forecasting] OR [mh "Quality of Life"] OR [mh "Survival Analysis"] OR outcome:ab,ti OR prognos*:ab,ti OR predict*:ab,ti OR forecast:ab,ti OR survival:ab,ti)

Database searched: Medline (via PubMed)
Date Search Completed: 1 February 2021
Search Results (Number of articles identified / number identified as relevant):
Inclusion/Exclusion Criteria:

Inclusion: 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. It is anticipated that there will be insufficient studies from which to draw a conclusion; case series will be included in the initial search and included as long as they contain ≥ 5 cases.

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

Summary of Evidence Update:

Search yielded 76 hits

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews

None

RCT:

None

Nonrandomized Trials, Observational Studies

None

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

No new evidence identified

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

2021 Evidence Update Worksheet
Appendix B1 BLS 30

Worksheet author(s): Katie Dainty, PhD
Date Submitted: Feb 5 2021

PICO / Research Question: Does dispatcher-assisted cardiopulmonary resuscitation (CPR) instructions using continuous chest compressions vs. standard CPR instructions improve survival in adult out-of-hospital cardiac arrest?
Outcomes: survival from cardiac arrest
Type (intervention, diagnosis, prognosis): Intervention – Dispatcher assisted CPR instructions using continuous chest compressions

Additional Evidence Reviewer(s): Not applicable
Conflicts of Interest (financial/intellectual, specific to this question): None to declare

Year of last full review: 2010 / 2015 / New question: 2017

Last ILCOR Consensus on Science and Treatment Recommendation:
We recommend that dispatchers provide chest compression–only CPR instructions to callers for adults with suspected out-of-hospital cardiac arrest (OHCA) (strong recommendation, low-quality evidence).

2017 Search Strategy:
Medline:
---
1 exp Cardiopulmonary Resuscitation/
2 (cardiopulmonary respiratory resuscitation$ or cardiopulmonary resuscitation$ or cardio pulmonary resuscitation$ or cardio-pulmonary resuscitation$ or CPR or Advanced Cardiac Life Support or basic cardiac life support or code blue or resuscitation$ mouth-to-mouth or mouth-to-mouth resuscitation$ or mouth to mouth resuscitation$).tw.
3 Resuscitation/
4 limit 3 to yr=1978-1991
5 1 or 2 or 4
6 mt.fs.
7 method$.tw.
8 6 or 7
9 5 and 8
10 randomized controlled trial.pt.
11 (randomized or placebo).mp.

12 clinical trial.pt.
13 Comparative Study.pt.
14 cross-over studies/
15 controlled clinical trial.pt.
16 (time adj series).tw.
17 (pre test or pretest or (posttest or post test)).tw.
18 random allocation/
19 (controlled adj before).tw.
20 exp epidemiologic studies/
21 ((case* adj3 control*) or (case adj3 comparison*) or control group*).tw.
22 or/10-21
23 9 and 22
24 (control$ or compar$ or random$).tw.
25 9 and 24
26 23 or 25
27 animals/ not humans/
28 26 not 27
29 (editorial or letter).pt.
30 28 not 29
31 ("18334691" or "19660833" or "16564776" or "18374452" or "20370759" or "26550795").ui.
32 30 or 31
33 comment.pt.
34 32 not 33
35 remove duplicates from 34

2020 Search Strategy: Same as above
Database searched: Medline
Date Search Completed: Jan 28th 2021
Search Results (Number of articles identified / number identified as relevant):
823 Citations reviewed in title and abstract screening
8 selected for full text review
0 articles relevant

Inclusion/Exclusion Criteria: Studies which include a comparison of continuous chest compressions instructions to standard CPR instructions in dispatch
Link to Article Titles and Abstracts (if available on PubMed): Not applicable

Summary of Evidence Update:

Evidence Update Process for topics not covered by ILCOR Task Forces

1. This evidence update process is only applicable to PICOs which are *not* being reviewed as ILCOR systematic and scoping reviews.

Relevant Guidelines or Systematic Reviews: None

RCT: None

Non-randomized Trials, Observational Studies: None

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

No new studies or randomized trials available comparing dispatcher instructions of CCC to standard CPR so would not recommend a formal review at this time. Two studies (Riva 2020 and Hatakeyama 2020) included data on number of cases with continuous chest compressions and standard CPR were performed but these were not stratified by whether it was via dispatcher instructions or independent bystander choice. The Basic Life Support Task Force did not find the results of the three simulation manikin studies sufficient to challenge current guidelines and warrant a full review.

	Approval Date
Evidence Update coordinator	
ILCOR board	

***Once approval has been made by Evidence Update coordinator, worksheet will go to ILCOR Board for acknowledgement.**

Reference list

Hatakeyama T et al. Effectiveness of dispatcher instructions-dependent or independent bystander cardiopulmonary resuscitation on neurological survival among patients with out-of-hospital cardiac arrest. J Cardiol. 2020 Mar;75(3):315-322.

Riva G et al. Survival after dispatcher-assisted cardiopulmonary resuscitation in out-of-hospital cardiac arrest. Resuscitation. 2020 Dec; 157:195-201.