



ELECTRONIC SUPPLEMENTARY MATERIAL

Zorko DJ *et al.*: Autoresuscitation after circulatory arrest: an updated systematic review

Disclaimer: Electronic Supplementary Material (ESM) is supplied by the authors for the benefit of readers. This feature is intended to provide additional information, context, and/or dimension to complement articles. Readers should be aware that unlike the main print manuscript, ESM may not undergo extensive peer review and typically is posted as supplied by the authors without editing, proofreading, accuracy checking, copyediting, or typesetting; it is published online only.

TABLE OF CONTENTS

eAppendix 1 PRISMA Checklist*

eAppendix 2 Search strategy output

eAppendix 1 PRISMA checklist*

Section/Topic	Item	Checklist Item	Reporting
TITLE			
Title	1	Identify the report as a systematic review.	Title Page
ABSTRACT			
Title	2.1	Identify the report as a systematic review.	Page 2
Objectives	2.2	Provide an explicit statement of the main objective(s) or question(s) the review addresses.	
Methods: Eligibility criteria	2.3	Specify the inclusion and exclusion criteria for the review.	
Methods: Information sources	2.4	Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.	
Methods: Risk of bias	2.5	Specify the methods used to assess risk of bias in the included studies.	
Methods: Synthesis of results	2.6	Specify the methods used to present and synthesise results.	
Results: Included studies	2.7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	
Results: Synthesis of results	2.8	Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If comparing groups, indicate the direction of the effect (i.e. which group is favoured).	
Discussion: Limitations of evidence	2.9	Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).	
Discussion: Interpretation	2.10	Provide a general interpretation of the results and important implications.	
Funding	2.11	Specify the primary source of funding for the review.	
Registration	2.12	Provide the register name and registration number.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 3
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 3-4

METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 4-5
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 5 Appendix B
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 5-6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 6
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 6
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 6
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6-7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 7
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 7-8

	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 7-8
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 7-8
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 7-8
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	n/a
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	n/a
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	n/a
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 7
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 8 Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	n/a
Study characteristics	17	Cite each included study and present its characteristics.	Page 8-9 Table 1 Table 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Table 4
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 1 Table 2
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 10-12

			Table 3 Table 4
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	n/a
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	n/a
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	n/a
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	n/a
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Table 4
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 12-15
	23b	Discuss any limitations of the evidence included in the review.	Page 15
	23c	Discuss any limitations of the review processes used.	Page 15
	23d	Discuss implications of the results for practice, policy, and future research.	Page 13-15
FUNDING			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 4
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	n/a
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Title Page
Competing interests	26	Declare any competing interests of review authors.	Title Page

Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	n/a
--	----	--	-----

*Checklist adapted from Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

eAppendix 2 Search strategy output

i. MEDLINE (Ovid)

Date search conducted: August 28, 2021

Strategy:

1. Death/ and Blood Circulation/ (55)
2. Death/ and exp Heart Arrest/ (388)
3. (((arrest\$1 or flat-lin* or flatlin*) adj2 (cardi* or circulat* or heart)) and (dead or death\$1)).tw,kf. (10363)
4. ((dead or death\$1) adj2 (cardi* or circulat* or heart)).tw,kf. (50272)
5. asystol*.tw,kf. (4494)
6. (cessation adj5 (cardiac rhythm\$1 or circulat* or heart function*)).tw,kf. (240)
7. ((cessation or terminat*) adj3 cardi* resuscitation).tw,kf. (43)
8. or/1-7 [Set 1: cardiac death] (62288)
9. Donor Selection/ (3551)
10. exp Organ Transplantation/ (220173)
11. "Tissue and Organ Harvesting"/ (9490)
12. exp "Tissue and Organ Procurement"/ (22407)
13. exp Tissue Transplantation/ (194018)
14. exp Tissue Donors/ (77186)
15. (allocat* adj2 (organ\$1 or tissue*)).tw,kf. (1784)
16. ((body or organ\$1 or tissue*) adj2 (donor* or donation*)).tw,kf. (20853)
17. ((cardiac or heart\$1 or heart-lung or hepatic or intestin\$ or kidney\$1 or kidney-pancreas or liver\$1 or lung\$1 or lung-heart or multiorgan or organ\$1 or pancreas or renal or thoracic or tissue\$1) adj2 transplant*).tw,kf. (234761)
18. (cDCD or DCD or DCDD).ti. (345)
19. dead donor rule*.tw,kf. (162)
20. deceased donor*.tw,kf. (6666)
21. "donation after circulatory death".tw,kf. (946)
22. ((donor* or donation*) adj3 non heart beating).tw,kf. (1173)
23. (donor adj2 (exclu* or select* or screen*)).tw,kf. (4684)
24. (organ\$1 adj2 (harvest* or procur* or retriev* or scarc*)).tw,kf. (5973)
25. (tissue adj2 (harvest* or procur* or retriev*)).tw,kf. (3541)
26. or/9-25 [Set 2: Organ donation] (476087)
27. (auto-resuscitat* or autoresuscitat*).tw,kf. (169)
28. Lazarus.ti. (165)
29. Lazarus phenomen*.tw,kf. (48)
30. Lazarus syndrome*.tw,kf. (20)
31. (("return of" or recover* or restor* or resum*) adj2 (cardiac activity or circulation)).ti. (97)
32. or/27-31 [Set 3: autoresuscitation] (427)
33. ((confirm* or criteri* or declar* or determin* or diagnos*) adj2 death\$1).tw,kf. [Set 4: death determination] (10028)
34. *Time Factors/ (3017)
35. ("5 minute" or "5 minutes" or "5 min" or "5 mins" or five min*).tw,kf. (91753)
36. delay*.ti. (78230)

37. delay*.ab. /freq=2 (117261)
38. hands off tim*.tw,kf. (120)
39. "how long".tw,kf. (7340)
40. (min or mins or minute\$1).ti. (11955)
41. (min or mins or minute\$1).ab. /freq=2 (424344)
42. ((observ* or wait*) adj3 (period\$1 or tim*)).tw,kf. (103509)
43. (time or timing\$1).ti. (290834)
44. time point\$1.tw,kf. (127558)
45. or/34-44 [Set 5: time factors] (1103701)
46. and/8,26,45 [Sets 1 and 2 and 5] (932)
47. 33 and 45 [Sets 4 and 5] (654)
48. or/32,46-47 (1913)
49. (exp animals/ or exp animal experimentation/ or exp models animal/ or exp vertebrates/) not (exp humans/ or exp human experimentation/) (4881364)
50. ((ape or apes or animal* or baboon* or beagle* or cat or cats or chicken or chickens or chimp* or dog or dogs or feline* or fish or hamster or hamsters or horse or horses or lapin* or macaque* or mouse or mice or nonhuman* or non human* or pig or piglet* or pigs or porcine or rabbit or rabbit or raccoon or raccoons or racehorse or racehorses or rat or rats or rodent* or swine* or sheep or zebrafish*) not (adults or children or human or humans or infants or patient or patients or people or seniors)).ti,kf. (2202025)
51. 49 or 50 [animal filter] (5251161)
52. 48 not 51 [exclude animal studies] (1534)
53. remove duplicates from 52 [MEDLINE results for export] (1531)

ii. Embase (Ovid)

Date search conducted: August 28, 2021

Strategy:

1. heart death/ (29614)
2. (((arrest\$1 or flat-lin* or flatlin*) adj2 (cardi* or circulat* or heart)) and (dead or death\$1)).tw,kw. (18876)
3. ((dead or death\$1) adj2 (cardi* or circulat* or heart)).tw,kw. (86468)
4. asystol*.tw,kw. (7898)
5. (cessation adj5 (cardiac rhythm\$1 or circulat* or heart function*)).tw,kw. (373)
6. ((cessation or terminat*) adj3 cardi* resuscitation).tw,kw. (64)
7. or/1-6 [Set 1: cardiac death] (116278)
8. deceased donor/ (4317)
9. donor selection/ (6338)
10. non heart beating donor/ (924)
11. exp organ transplantation/ (428590)
12. exp tissue transplantation/ (560385)
13. (allocat* adj2 (organ\$1 or tissue*)).tw,kw. (3080)
14. ((body or organ\$1 or tissue*) adj2 (donor* or donation*)).tw,kw. (31850)
15. ((cardiac or heart\$1 or heart-lung or hepatic or intestin\$ or kidney\$1 or kidney-pancreas or liver\$1 or lung\$1 or lung-heart or multiorgan or organ\$1 or pancreas or renal or thoracic or tissue\$1) adj2 transplant*).tw,kw. (378229)
16. (cDCD or DCD or DCDD).ti. (1205)

17. dead donor rule*.tw,kw. (177)
18. deceased donor*.tw,kw. (15424)
19. "donation after circulatory death".tw,kw. (1642)
20. ((donor* or donation*) adj3 non heart beating).tw,kw. (1639)
21. (donor adj2 (exclu* or select* or screen*)).tw,kw. (8779)
22. (organ\$1 adj2 (harvest* or procur* or retriev* or scarc*)).tw,kw. (9625)
23. (organ\$1 adj2 (harvest* or procur* or retriev* or scarc*)).tw,kw. (9625)
24. (tissue adj2 (harvest* or procur* or retriev*)).tw,kw. (6132)
25. or/8-24 [Set 2: organ donation] (1050829)
26. autoresuscitation/ (31)
27. (auto-resuscitat* or autoresuscitat*).tw,kw. (229)
28. Lazarus.ti. (176)
29. Lazarus phenomem*.tw,kw. (65)
30. Lazarus syndrome*.tw,kw. (24)
31. ("return of" or recover* or restor* or resum*) adj2 (cardiac activity or circulation)).ti. (103)
32. or/26-31 [Set 3: autoresuscitation] (509)
33. ((confirm* or criteri* or declar* or determin* or diagnos*) adj2 death\$1).tw,kw. [Set 4: death determination] (16163)
34. *time factor/ (1401)
35. ("5 minute" or "5 minutes" or "5 min" or "5 mins" or five min*).tw,kw. (133074)
36. delay*.ti. (97886)
37. delay*.ab. /freq=2 (170163)
38. hands off tim*.tw,kw. (211)
39. "how long".tw,kw. (10649)
40. (min or mins or minute\$1).ti. (15267)
41. (min or mins or minute\$1).ab. /freq=2 (634806)
42. ((observ* or wait*) adj3 (period\$1 or tim*)).tw,kw. (158339)
43. (time or timing\$1).ti. (348621)
44. time point\$1.tw,kw. (203433)
45. or/34-44 [Set 5: time factors] (1551907)
46. and/7,25,45 [Sets 1 and 2 and 5] (2501)
47. 33 and 45 [Sets 4 and 5] (1241)
48. or/32,46-47 (4037)
49. (exp animals/ or exp animal experimentation/ or exp models animal/ or exp vertebrates/) not (exp humans/ or exp human experimentation/) (5942339)
50. ((ape or apes or animal* or baboon* or beagle* or cat or cats or chicken or chickens or chimp* or dog or dogs or feline* or fish or hamster or hamsters or horse or horses or lapin* or macaque* or mouse or mice or nonhuman* or non human* or pig or piglet* or pigs or porcine or rabbit or rabbit or raccoon or raccoons or racehorse or racehorses or rat or rats or rodent* or swine* or sheep or zebrafish*) not (adults or children or human or humans or infants or patient or patients or people or seniors)).ti. (2584704)
51. 49 or 50 [animal filter] (6287819)
52. 48 not 51 [exclude animal studies] (3342)
53. (Conference Abstract or Conference Paper or Conference Review).pt. (4933664)
54. 52 and 53 (1586)
55. limit 54 to yr="2018-2021" (468)

56. 52 not 53 [exclude conference proceedings] (1756)
57. 55 or 56 [add proceedings from last 3 yrs] (2224)
58. remove duplicates from 57 [Embase results for export] (2183)

iii. Cochrane CENTRAL (EBM Reviews Ovid)

Date search conducted: August 28, 2021

Strategy:

1. Death/ and Blood Circulation/ (0)
2. Death/ and exp Heart Arrest/ (51)
3. (((arrest\$1 or flat-lin* or flatlin*) adj2 (cardi* or circulat* or heart)) and (dead or death\$1)).tw. (1187)
4. ((dead or death\$1) adj2 (cardi* or circulat* or heart)).tw. (10789)
5. asystol*.tw. (317)
6. (cessation adj5 (cardiac rhythm\$1 or circulat* or heart function*)).tw. (16)
7. ((cessation or terminat*) adj3 cardi* resuscitation).tw. (1)
8. or/1-7 [Set 1: cardiac death] (11842)
9. Donor Selection/ (38)
10. exp Organ Transplantation/ (5723)
11. "Tissue and Organ Harvesting"/ (391)
12. exp "Tissue and Organ Procurement"/ (141)
13. exp Tissue Transplantation/ (4399)
14. exp Tissue Donors/ (1285)
15. (allocat* adj2 (organ\$1 or tissue*)).tw. (56)
16. ((body or organ\$1 or tissue*) adj2 (donor* or donation*)).tw. (773)
17. ((cardiac or heart\$1 or heart-lung or hepatic or intestin\$ or kidney\$1 or kidney-pancreas or liver\$1 or lung\$1 or lung-heart or multiorgan or organ\$1 or pancreas or renal or thoracic or tissue\$1) adj2 transplant*).tw. (18304)
18. (cDCD or DCD or DCDD).ti. (54)
19. dead donor rule*.tw. (0)
20. deceased donor*.tw. (688)
21. "donation after circulatory death".tw. (48)
22. ((donor* or donation*) adj3 non heart beating).tw. (39)
23. (donor adj2 (exclu* or select* or screen*)).tw. (274)
24. (organ\$1 adj2 (harvest* or procur* or retriev* or scarc*)).tw. (173)
25. (tissue adj2 (harvest* or procur* or retriev*)).tw. (283)
26. or/9-25 [Set 2: Organ donation] (23725)
27. (auto-resuscitat* or autoresuscitat*).tw. (1)
28. Lazarus.ti. (10)
29. Lazarus phenomenon*.tw. (0)
30. Lazarus syndrom*.tw. (0)
31. (("return of" or recover* or restor* or resum*) adj2 (cardiac activity or circulation)).ti. (22)
32. or/27-31 [Set 3: autoresuscitation] (33)
33. ((declar* or determin*) adj2 death\$1).tw. [Set 4: death determination] (334)
34. Time Factors/ (66356)
35. ("5 minute" or "5 minutes" or "5 min" or "5 mins" or five min*).tw. (355818)
36. delay*.ti. (6328)

37. delay*.ab. /freq=2 (11625)
38. hands off tim*.tw. (113)
39. "how long".tw. (143531)
40. (min or mins or minute\$1).ti. (1100)
41. (min or mins or minute\$1).ab. /freq=2 (50554)
42. ((observ* or wait*) adj3 (period\$1 or tim*)).tw. (21725)
43. (time or timing\$1).ti. (19567)
44. time point\$1.tw. (32665)
45. or/34-44 [Set 5: time factors] (581458)
46. and/8,26,45 [Sets 1 and 2 and 5] (246)
47. 33 and 45 [Sets 4 and 5] (158)
48. or/32,46-47 (431)
49. (exp animals/ or exp animal experimentation/ or exp models animal/ or exp vertebrates/) not (exp humans/ or exp human experimentation/) (16)
50. ((ape or apes or animal* or baboon* or beagle* or cat or cats or chicken or chickens or chimp* or dog or dogs or feline* or fish or hamster or hamsters or horse or horses or lapin* or macaque* or mouse or mice or nonhuman* or non human* or pig or piglet* or pigs or porcine or rabbit or rabbit or raccoon or raccoons or racehorse or racehorses or rat or rats or rodent* or swine* or sheep or zebrafish*) not (adults or children or human or humans or infants or patient or patients or people or seniors)).ti. (5196)
51. 49 or 50 (5212)
52. 48 not 51 [exclude animal studies] (431)
53. remove duplicates from 52 [CENTRAL records for export] (422)

iv. Web of Science

Date search conducted: August 28, 2021

Strategy:

1. TS=((arrest* or dead or death* or "flat lin*" or flatlin*) NEAR/2 (cardi* or circulat* or heart)) or asystol* or (cessation NEAR/5 ("cardiac rhythm*" or circulat* or "heart function*")) or ((cessation or terminat*) NEAR/3 "cardi* resuscitation")) (114878)
2. TS=((allocat* NEAR/2 (organ* or tissue*)) or ((body or organ* or tissue*) NEAR/2 (donor* or donation*)) or ((cardiac or heart* or "heart-lung" or hepatic or intestin* or kidney* or "kidney-pancreas" or liver* or lung* or "lung-heart" or multiorgan or organ* or pancreas or renal or thoracic or tissue*) NEAR/2 transplant*) or "dead donor rule*" or "deceased donor*" or "donation after circulatory death" or ((donor* or donation*) NEAR/3 "non heart beating") or (donor NEAR/2 (exclu* or select* or screen*)) or (organ* NEAR/2 (harvest* or procur* or retriev* or scarc*)) or (tissue NEAR/2 (harvest* or procur* or retriev*))) or TI=(cDCD or DCD or DCDD) (349249)
3. TS=("auto-resuscitat*" or autoresuscitat* or "Lazarus phenomen*" or "Lazarus syndrome*") or TI=((("return of" or recover* or restor* or resum*) NEAR/2 ("cardiac activity" or circulation)) or Lazarus) (979)
4. TS=((confirm* or criteri* or declar* or determin* or diagnos*) NEAR/2 death*) (12922)
5. TS=("5 minute" or "5 minutes" or "5 min" or "5 mins" or "five min*" or "hands off tim*" or "how long" or ((observ* or wait*) NEAR/3 (period* or tim*)) or "time point*") or TI=(delay* or min or mins or minute* or time or timing*) (1248020)

6. 5 and 2 and 1 (698)
7. 5 and 4 (611)
8. 7 or 6 or 3 (2218)
9. TI=((ape or apes or animal* or baboon* or beagle* or cat or cats or chicken or chickens or chimp* or dog or dogs or feline* or fish or hamster or hamsters or horse or horses or lapin* or mouse or mice or nonhuman* or "non human*" or pig or piglet* or pigs or porcine or rabbit or rabbit or raccoon or raccoons or racehorse or racehorses or rat or rats or rodent* or swine* or sheep) not (adults or children or human or humans or infants or patient or patients or people or seniors)) (2792881)
10. 8 not 9 (1984)