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| Question |
| **Should CPR commence with compressions (30:2) or ventilations (2:30)?** |
| **Problem:** | Adults and children in cardiac arrest in any setting |
| **Option:** | commencing CPR beginning with compressions first (30:2) |
| **Comparison:** | commencing CPR with ventilation first (2:30) |
| **Main 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
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| **Setting:** | OOHCA / IHCA |
| **Perspective:** |  |
| **Background:** | CPR compression—ventilation sequences CAB versus ABC represents a compromise between the need to generate blood flow and the need to supply oxygen to the lungs.  |
| **Conflict of interests:** | Julie Considine COI#207: no conflicts to declareMary E. Mancini COI#87: no conflicts to declare |

# Assessment

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| ProblemIs the problem a priority? |
| Judgement | Research evidence | Additional considerations |
| ○ No● Probably no○ Probably yes○ Yes○ Varies○ Don't know | There is ongoing debate in the scientific literature regarding the merits of commencing resuscitation with chest compressions prior to ventilations. Internationally, most adult BLS guidelines commence chest compressions prior to ventilations however there is variability in paediatrics and aquatic rescue with different approaches in various jurisdictions.  |  |
| Desirable EffectsHow substantial are the desirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial● Small○ Moderate○ Large○ Varies○ Don't know | Delivering high-quality chest compressions as early as possible is vital to high-quality CPR and optimizes the chance of ROSC and survival after cardiac arrest. However, victims who suffer cardiac arrest from respiratory or asphyxia causes (eg. children, drowning) will benefit from additional ventilatory support.  |  |
| Undesirable EffectsHow substantial are the undesirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Large○ Moderate● Small○ Trivial○ Varies○ Don't know | If CPR commences with chest compressions at a rate of 100-120 per minute, 30 chest compression will delay ventilation by less than 20 seconds. If CPR commences with ventilations, the delay to chest compressions will also be a matter of seconds.  | Coronary perfusion pressure greater than 15 mmHg is associated with increased ROSC and survival to hospital discharge. Coronary perfusion pressure is generated by effective chest compressions and is cumulative, therefore when chest compressions stop, it falls to near zero. Early effective chest compressions are vital to establishing and maintaining coronary perfusion pressure. [Nassar and Kerber, 2017: 1061-1069] |
| Certainty of evidenceWhat is the overall certainty of the evidence of effects? |
| Judgement | Research evidence | Additional considerations |
| ● Very low○ Low○ Moderate○ High○ No included studies | This systematic review did not identify any human studies, but identified 4 manikin studies; 1 randomized study [Marsch et al., 2013: w13856] focused on adult resuscitation, 1 randomized study focused on pediatric resuscitation, [Lubrano et al., 2012: 1473-1477]and 2 observational studies focused on adult resuscitation [Kobayashi et al., 2008: 333-339, Sekiguchi et al., 2013: 1248-1250].

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| **Outcome** | **Relative importance**  | **Certainty of the evidence (GRADE)**  |
| Time to commencement of chest compressions - RCTs | IMPORTANT | ⨁◯◯◯VERY LOW |
| Time to commencement of chest compressions - non RCTs | IMPORTANT | ⨁◯◯◯VERY LOW |
| Time to commencement of rescue breaths - RCTs | IMPORTANT | ⨁◯◯◯VERY LOW |
| Time to completion of first CPR cycle - RCT | IMPORTANT | ⨁⨁◯◯LOW |
| Time to diagnosis of need for resuscitation (unresponsive, respiratory arrest, cardiac arrest) - RCT | IMPORTANT | ⨁◯◯◯VERY LOW |

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| ValuesIs there important uncertainty about or variability in how much people value the main outcomes? |
| Judgement | Research evidence | Additional considerations |
| ○ Important uncertainty or variability○ Possibly important uncertainty or variability●  Probably no important uncertainty or variability○ No important uncertainty or variability | The outcomes of interest are * 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

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| Balance of effectsDoes the balance between desirable and undesirable effects favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○  Probably favors the comparison○ Does not favor either the intervention or the comparison● Probably favors the intervention ○ Favors the intervention○ Varies○ Don't know |

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| **Outcome** | **Without CPR beginning with compressions first (30:2)** | **With CPR beginning with compressions first (30:2)** |
| Time to commencement of chest compressions - RCTs | Lubrano [2012 p1473] Time to commencement of chest compressions in cardiac arrest: 19.27±2.64 vs 43.40 ± 5.05 (p<0.05). 95% CI -23.58 to -24.82, difference 24.13 seconds in favour of CAB |
| Time to commencement of chest compressions - non RCTs | Sekiguchi [2013 p1248]Time to commencement of chest compressions: 15.4 ± 3.0 vs 36.0 ± 4.1 (p<0.001). Mean difference 20.6 seconds in favour of CAB.Kobayash [2008, p333]Median time to commencement of chest compressions: 16 (IQR=14-26) vs 442 (IQR=41.5-59), p<0.001) Median difference 26 seconds in favour of CAB. |
| Time to commencement of rescue breaths - RCTs | Lubrano [2012 p1473] Time to commencement of ventilation in respiratory arrest: 19.13 ± 1.47 vs 22.66 ± 3.07 (p<0.05). 95% CI −3.00 to −3.86, difference 3.53 seconds in favour of CAB. Time to commencement of rescue breaths in CARDIAC ARREST: 28.40±3.07 vs 22.66 ± 3.07 (p<0.05). 95% CI 5.76 to 6.15, difference 5.74 seconds in favour of ABCMarsch [2013 p w13856] Time to commencement of rescue breaths: 3 ±2 vs 6 ± 8 vs, p=0.03). Mean difference 5 seconds in favour of CAB.  |
| Time to completion of first CPR cycle - RCT | Marsch [2013 p w13856] Time to completion of first CPR cycle (30 CC & 2 V): 48 ±10 vs 63±17, p<0.001). Mean difference 15 seconds in favour of CAB.  |
| Time to diagnosis of need for resuscitation (unresponsive, respiratory arrest, cardiac arrest) - RCT | Lubrano [2012 p1473] Time to evaluation of response: 3.26 ±0.63 vs 3.2 ±0.73, p=NS). No difference. Time to diagnosis of respiratory arrest: 17.48 ±2.19 vs 19.17±2.38, p<0.05). 95% CI -1.37 to -2.08, difference 1.69 seconds in favour of CAB. Time to diagnosis of cardiac arrest: 17.48 ±2.19 vs 41.67±4.95, p<0.05). 95% CI -23.65 to -24.84, difference 24.19 seconds in favour of CAB |

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| Resources requiredHow large are the resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ○ Large costs○ Moderate costs○ Negligible costs and savings○ Moderate savings○ Large savings○ Varies● Don't know | No relevant published data was identified that answers this question.In many jurisdictions, CAB is already in place in adult BLS so resource requirements are small. In jurisdictions where ABC is used, there are a number of resources required to implement CAB in preference to ABC including investments required to train rescuers, reconfiguration of CPR feedback devices and AEDs, and production of educational materials. |  |
| Certainty of evidence of required resourcesWhat is the certainty of the evidence of resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ○ Very low○ Low○ Moderate○ High● No included studies | No relevant published data was identified for review so unable to provide any certainty here.  |  |
| Cost effectivenessDoes the cost-effectiveness of the intervention favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○ Probably favors the comparison○ Does not favor either the intervention or the comparison○ Probably favors the intervention○ Favors the intervention○ Varies● No included studies | No relevant published data was identified that answers this question |  |
| EquityWhat would be the impact on health equity? |
| Judgement | Research evidence | Additional considerations |
| ○ Reduced○ Probably reduced○ Probably no impact○ Probably increased○ Increased○ Varies● Don't know | No relevant published data was identified that answers this question |  |
| AcceptabilityIs the intervention acceptable to key stakeholders? |
| Judgement | Research evidence – CHECK current flow charts | Additional considerations |
| ○ No○ Probably no● Probably yes○ Yes○ Varies○ Don't know | In adults, the recommendation of CAB in preference to ABC will be acceptable to resuscitation key stakeholders as there is no significant deviation from current practice. In children, there is international variability so a recommendation of CAB in preference to ABC may create some debate. ANZCOR BLS flowchart recommends assessing response, open airway, assess breathing if unresponsive and not breathing normally, commence 30 chest compressions followed by 2 rescue breaths and continue 2V:30CC BLS for both ADULTS and CHILDREN.ERC BLS flowchart for ADULTS recommends assessing response, open airway, assess breathing and if not breathing normally to commence 30 chest compressions followed by 2 rescue breaths, then continue with 2V:30CC BLS. In CHILDREN ERC recommends assessing response, open airway, assess breathing and if not breathing normally to deliver 5 rescue breaths, assess for signs of life and if absent, commence 15 chest compressions and continue with 2V:15CC BLS.  AHA BLS flowchart for ADULTS recommends assessing response, assess breathing, commence chest compressions followed by 2 rescue breaths, then continue with 2V:30CC BLS. In CHILDREN, assess response, assess breathing, check pulse. If lone rescuer, commence 30 chest compressions followed by 2 rescue breaths and continue 2V:30CC BLS. If two rescuers, 15 compressions followed by 2 ventilations and continue 2V:15CC BLS.   |  |
| FeasibilityIs the intervention feasible to implement? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no● Probably yes○ Yes○ Varies○ Don't know | Current BLS guidelines recommend CAB in preference to ABC thus the intervention (CAB) presents no significant deviation from current practices. In children, feasibility will be more problematic given the degree of international variation in BLS guidelines.  |  |

# Summary of judgements

|  | **Judgement** |
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| **Problem** | No | **Probably no** | Probably yes | Yes |  | Varies | Don't know |
| **Desirable Effects** | Trivial | **Small** | Moderate | Large |  | Varies | Don't know |
| **Undesirable Effects** | Large | Moderate | **Small** | Trivial |  | Varies | Don't know |
| **Certainty of evidence** | **Very low** | Low | Moderate | High |  |  | No included studies |
| **Values** | Important uncertainty or variability | Possibly important uncertainty or variability | **Probably no important uncertainty or variability** | No important uncertainty or variability |  |  |  |
| **Balance of effects** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | **Probably favors the intervention** | Favors the intervention | Varies | Don't know |
| **Resources required** | Large costs | Moderate costs | Negligible costs and savings | Moderate savings | Large savings | Varies | **Don't know** |
| **Certainty of evidence of required resources** | Very low | Low | Moderate | High |  |  | **No included studies** |
| **Cost effectiveness** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | Probably favors the intervention | Favors the intervention | Varies | **No included studies** |
| **Equity** | Reduced | Probably reduced | Probably no impact | Probably increased | Increased | Varies | **Don't know** |
| **Acceptability** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |
| **Feasibility** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |

# Type of recommendation

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| Strong recommendation against the option | Conditional recommendation against the option | Conditional recommendation for either the option or the comparison | Conditional recommendation for the option | Strong recommendation for the option |
| ○  | ○  | ○  | ○  | ●  |

# Conclusions

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| Recommendation |
| We suggest commencing CPR with compressions rather than ventilations (weak recommendation, very-low-certainty evidence). |
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| Justification |
| For all outcomes CAB resulted in faster times to key elements of resuscitation (rescue breaths, chest compressions, completion of first CPR cycle) across the four papers reviewed, with the exception of simulated paediatric resuscitation where CAB delayed time to commencement of rescue breaths in cardiac arrest by 5.74 seconds: this difference was statistically significant but of questionable clinical significance [Lubrano 2012 p1473]. This delay in commencing rescue breaths may be acceptable given the decreased time to other elements of resuscitation, however it should be noted that the certainty of the evidence is very low and all studies reviewed were manikin studies. There should also be consideration given to training requirements of a single approach versus separate approaches for adults and children. |

**References**

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