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| Question |
| **Should CPR commence with compressions (30:2) or ventilations (2:30)?** |
| **Problem:** | Adults and children in any setting (in-hospital or out-of-hospital) with cardiac arrest |
| **Option:** | commencing CPR with compressions first (30:2) |
| **Comparison:** | commencing CPR with ventilation first (2:30) |
| **Main outcomes:** | *Critical*: Survival with favorable neurological outcome at hospital discharge or 30-days, Survival at hospital discharge or 30 days, Survival with favourable neurological outcome to one-year, Survival to one-year, Event survival, Any ROSC. *Important*: Time to commencement of rescue breaths, Time to commencement of first compression, Time to completion of first CPR cycle, Ventilation rate, Compression rate, Chest compression fraction, Minute ventilation |
| **Setting:** | in-hospital or out-of-hospital |
| **Perspective:** | Traditionally, cardiopulmonary resuscitation (CPR) commenced with opening the airway and ventilations then, chest compressions (i.e. A-B-C). However, airway and breathing are technical skills and previous systematic reviews by the International Liaison Committee on Resuscitation (ILCOR) have found that starting CPR with compressions in simulation studies resulted in faster times to key elements of resuscitation (rescue breaths, chest compressions, completion of first CPR cycle). |
| **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:** | 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 | Since the 2020 ILCOR review of this PICOST,(1, 2) 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 pediatrics 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, patients who suffer cardiac arrest from respiratory or asphyxia causes (eg. children, drowning) will benefit from additional ventilatory support.  | Indirect evidence from before-and-after OHCA registry studies in adults, which examined changes in dispatcher telephone CPR instructions(3) and the implementation of guideline changes(4, 5), suggests that switching from the A-B-C to C-A-B approach was associated with increased rates of bystander CPR(3) and improved patient outcomes.(3),(4, 5) Similar data on in-hospital cardiac arrest show conflicting evidence in patient outcomes.(6, 7)One large registry study from Japan demonstrated increased bystander CPR rates in children with bystander-witnessed OHCAs after compression-only CPR  was introduced.(8) Whether the change in sequence to CAB by some ILCOR member councils has resulted in more infants and children receiving compression-only CPR overall is unknown, although available data continues to support the combination of compressions and breaths is needed for optimal pediatric CPR.(9, 10)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. (11)Time to first compression is associated with better patient outcomes, including good neurological outcomes in adults.(12) |
| Undesirable EffectsHow substantial are the undesirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Large○ Moderate● Small○ Trivial○ Varies○ Don't know | Starting CPR with compressions first results in faster times to key elements of resuscitation, such as time to commencement of chest compressions, time to start and complete the first cycle of compressions, and a higher chest compression fraction.One simulated study in pediatric resuscitation found starting with compressions delayed time to commencement of rescue breaths in cardiac arrest, but the differences was of questionable clinical significance. | Opening the airway and delivery of ventilations is technical, and bystanders, especially if untrained or minimally trained, are typically unable to deliver effective ventilations during simulated CPR.(13)Further evidence suggests that delivering the A-B-C approach has more errors in CPR(14); and that lay-bystanders prefer C-A-B, and it is easier to learn and retain(14).The delivery of non-mouth-to-mouth ventilation requires the retrieval and preparation of equipment (e.g. bag-valve-mask, pocket mask), which, when multiple rescuers are present, can occur during chest compressions. |
| 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 5 manikin studies; 1 randomized study (15) focused on adult resuscitation, 2 randomized studies focused on pediatric resuscitation, (16, 17)and 2 observational studies focused on adult resuscitation (18, 19).

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| **Outcome** | **Relative importance**  | **Certainty of the evidence (GRADE)**  |
| Time to commencement of chest compressions – RCTs and non RCTs | IMPORTANT | ⨁◯◯◯VERY LOW |
| Time to commencement of rescue breaths – RCTs | IMPORTANT | ⨁◯◯◯VERY LOW |
| Time to completion of first CPR cycle - RCT | IMPORTANT | ⨁◯◯◯VERY LOW |
| Ventilation rate -RCT | IMPORTANT | ⨁◯◯◯VERY LOW |
| Compression rate -RCT and non RCTs | IMPORTANT | ⨁◯◯◯VERY LOW |
| Chest compression fraction (CCF) -RCT and non RCTs | IMPORTANT | ⨁◯◯◯VERY LOW |
| Minute alveolar ventilation in the first minute of resuscitation | IMPORTANT | ⨁◯◯◯VERY 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 | There is no data on critical patient outcomes.  |  |
| 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 | Mankin studies show minimal differences in times to key resuscitation elements, but most favour commencing with compressions.  |  |
| 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 and paedatric 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 Europe, the current pediatric guidelines recommend an ABC approach in preference to CAB. In other parts of the world (eg AHA and ANZCOR) the approach of CAB in preference to ABC is in place. Therefore recommendations of one approach in preference to another may have significant impact on education and approach to resuscitation training. In adults a CAB approach in preference to ABC has been in place. In children, there is international variability so a recommendation of CAB in preference to ABC may create some debate.  | Due to the public’s concerns with mouth-to-mouth ventilations,(20) commencing CPR with airway and ventilations may result in no bystander CPR being provided. |
| FeasibilityIs the intervention feasible to implement? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no● Probably yes○ Yes○ Varies○ Don't know | In adults, many 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** |
| --- | --- |
| **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 |
| The following treatment recommendations are for children.Recommendations for adults are posted separately. <https://costr.ilcor.org/document/starting-cpr-abc-vs-cab-bls-2201-tf-sr>There is insufficient evidence to support a treatment recommendation regarding the optimal order of commencing CPR in children (ie ventilation or compressions first).The task force considers that both an A-B-C (ventilation followed by compression) and a C-A-B (compression followed by ventilation) approach are acceptable and that both ventilation and chest compressions are important components of CPR in children (good practice statement). |
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| Justification |
| The majority of the existing evidence (5 manikin studies) (17, 21-24) suggests that starting CPR with compressions results in faster times to key elements of resuscitation. One simulated study in pediatric resuscitation found that starting with compressions delayed the commencement of rescue breaths in cardiac arrest by six seconds.(24) This delay may be clinically acceptable. However, alveolar minute ventilation and the number of ventilations delivered in the first minute of resuscitation were higher with the A-B-C (delivering 5 rescue breaths before commencing chest compressions) sequence. Indirect evidence from before-and-after OHCA registry studies in adults, examining changes in dispatcher telephone CPR instructions(3) and implementation of guideline changes(4, 5), suggests that switching from the A-B-C to C-A-B approach was associated with increased rates of bystander CPR(3) and improved patient outcomes.(3-5) Similar data on in-hospital cardiac arrest show conflicting evidence in patient outcomes.(6, 7) One large registry study from Japan demonstrated increased bystander CPR rates in children with bystander-witnessed OHCA after compression-only CPR  was introduced.(8) Whether the change in sequence to C-A-B by some ILCOR member councils has resulted in more infants and children receiving compression-only CPR overall is unknown, although available data continues to support the combination of compressions and breaths is needed for optimal pediatric CPR.(9, 10)While important uncertainties regarding timing and delays in initiation of the components of CPR (chest compressions, opening airway, and rescue breaths) remain and may not be readily extrapolated from manikin studies, the BLS and PLS task forces also considered:  |

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