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| Question |
| **Should A prolonged period of chest compressions before defibrillation vs. A short period of chest compressions before defibrillation be used for Adults and children in cardiac arrest and a shockable rhythm at initiation of cardiopulmonary resuscitation (CPR) ?** |
| **Population:** | Adults and children in cardiac arrest and a shockable rhythm at initiation of cardiopulmonary resuscitation (CPR)  |
| **Intervention:** | A prolonged period of chest compressions before defibrillation |
| **Comparison:** | A short period of chest compressions before defibrillation |
| **Main outcomes:** | Survival to 1 year with favorable outcome; Survival to discharge with favorable outcome; Survival to 1 year; Survival to hospital discharge; ROSC; |
| **Setting:** | Any setting (in-hospital or out-of-hospital) |
| **Perspective:** |  |
| **Background:** |  |
| **Conflict of interests:** | None applicable |

# 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 | Increasing survival after sudden cardiac arrest is a serious and urgent problem well recognized as a major health issue as mortality remains very high. Any treatments to improve survival after cardiac arrest have high priority.  |  |
| Desirable EffectsHow substantial are the desirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ● Trivial○ Small○ Moderate○ Large○ Varies○ Don't know | Based on 5 RCTs the effectiveness of 90-180 seconds of CPR prior to defibrillation does not seem to have a large effect on any short- or long-term survival outcome when compared to an early defibrillation strategy.  |  |
| Undesirable EffectsHow substantial are the undesirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Large○ Moderate○ Small● Trivial○ Varies○ Don't know | Based on 5 RCTs the effectiveness of 90-180 seconds of CPR prior to defibrillation does not seem to have a large effect on any short- or long-term survival outcome when compared to an early defibrillation strategy.  |  |
| 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 | The overall certainty in effect size is regarded as low. After the initial small single centre study that suggested 3 min of CPR prior to defibrillation could be beneficial in cardiac arrest patients with EMS response intervals > 5 min (Wik 2003 1389), none of the subsequent studies reproduced this finding ( Jacobs 2005 39; Baker 2008 424; Ma 2012 806; Stiell 2011 787). Most notably, a large multi-centre RCT including 9933 patients did not report any signal for benefit for either strategy in any of the survival outcomes. (Stiell 2011 787) |  |
| 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 selected for this review were survival outcomes ranging return of spontaneous circulation to favorable outcome 1 year after cardiac arrest. Although people might be conflicted about the importance of short term survival that does not results in favourable long term outcome - the BLS Task Force still does not consider there to be important uncertainty about how much people value survival from sudden cardiac arrest.  |  |
| 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 | Based on the 5 identified RCTs the effect of 90-180 seconds of CPR prior to defibrillation does not appear to have an effect on survival after cardiac arrest. Likewise, no undesirable effects were detected.  |  |
| 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 | The difference in cost or resource use between CPR duration 90-180 sec and immediate defibrillation is negligible |  |
| 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 specific studies evaluating resource requirements were identified |  |
| 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 specific studies evaluating cost effectiveness were identified  |  |
| 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 | There are no plausible reasons for anticipating differences in relative effectiveness of the intervention for disadvantaged subgroups or different baseline conditions across disadvantaged subgroups that affects the absolute effectiveness of the intervention or the importance of the problem. |  |
| AcceptabilityIs the intervention acceptable to key stakeholders? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no● Probably yes○ Yes○ Varies○ Don't know | Both shorter and longer (up to 3 minutes) CPR intervals prior to defibrillation are likely to be acceptable to key stakeholders. Given the lack of both desirable and undesirable effects, key stakeholders are likely to emphasize importance of risk and cost associated with implementation of any new treatment strategy to support retaining current local practice. It is likely that various in- and out-of hospital CPR providers employ a range of strategies from early to delayed (up to 3 minutes) defibrillation for shockable rhythms. The certainty of current body of evidence does not provide further guidance within this range.  |  |
| FeasibilityIs the intervention feasible to implement? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes○ Yes● Varies○ Don't know | Changes to CPR interval prior to defibrillation are feasible to implement as professional CPR providers undergo regular training and certification. However, there is limited evidence to support any change in practice within the immediate (performing CPR until the defibrillator is ready for use) and up to 3 minute CPR duration range.  |  |

# 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 intervention | **Conditional recommendation against the intervention** | Conditional recommendation for either the intervention or the comparison | Conditional recommendation for the intervention | Strong recommendation for the intervention |
| ○  | **●**  | ○  | ○  | ○  |

# Conclusions

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| 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)  |
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| Justification |
| This topic was prioritized by the BLS Task Force as it had not been reviewed since the 2015 ILCOR Consensus on Science and Treatment Recommendations. Given the availability of comparative data from several RCTs, we did not include non-RCTs. No new RCTs were identified since the 2015 review process, but as the outcome templates have been altered for the 2020 ILCOR review process, the review has been updated. Important issues remained in the evaluation of the 5 included RCTs, and lead to the BLS Task Force downgrading the certainty of the treatment recommendation. The trial by Jacobs et al. (Jacobs 2006 p39) did not use a random sequence generation and did not conceal randomization prior to rhythm analysis leading to potential bias. In all RCTs, the treating EMS personnel could not be blinded to the interventional strategy post randomization. There was also significant heterogeneity in these trials with regards to the duration of CPR provided before defibrillation with a range of 90 to 180 seconds. For the purposes of this review the 90 to 180 seconds of CPR was considered as a combined group. It is also important to note that the trials were conducted in different countries (Australia, Canada, Norway, Taiwan, United States) with varying EMS system structural configurations (BLS, ALS, physician on scene) as well as response times and treatment protocols. Only one of the included trials attempted to document and adjust for the quality of the intervention (or chest compressions) prior to defibrillation, (Stiell 2011 p 787) leaving the possibility that the intervention in the other trials were of various quality. The studies also only included adult (age ≥ 18) OHCA patients and cannot be generalized to the IHCA or pediatric populations.In making the recommendation to provide CPR until the defibrillator is ready for analysis and/or defibrillation in unmonitored cardiac arrest, we placed a high value on being consistent with previous recommendations. The BLS Task Force acknowledges that every change in guidelines comes with a significant risk and cost as CPR educators and providers are asked to change current practice and implement new treatment strategies for complex and high stress medical emergencies. |

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| Subgroup considerations |
| Two subgroup analyses were considered in the 2015 review. One subgroup analysis looked at enrolments based on EMS response interval, comparing those with intervals of less than 4 to 5 minutes versus those with intervals of 4 to 5 minutes or more. Within this subgroup, 1 study(Wik 2003 1389) found a favorable relationship with CPR for 180 seconds before defibrillation when the response interval was 5 minutes or more, but this relationship was not confirmed in 3 other RCTs.(Jacobs 2005 39; Baker 2008 424; Stiell 2011 787) The second subgroup analysis (Rea 2014 1) examined outcomes from early versus late analysis based on baseline EMS agency VF/pVT survival rates. Among EMS agencies with low baseline survival to hospital discharge (defined as less than 20% for an initial rhythm of VF/pVT); higher neurologically favorable survival was associated with early analysis and shock delivery, as opposed to CPR and delayed analysis and shock delivery. Yet for EMS agencies with higher baseline survival to hospital discharge (greater than 20%), 3 minutes of CPR followed by analysis and defibrillation resulted in higher neurologically favorable survival. Although no study has suggested harmful effects from up to 180 seconds of CPR before defibrillation, an exploratory analysis from 1 RCT (Stiell 2011 787) suggested a decline in survival to hospital discharge from a prolonged period of CPR (180 seconds) with delayed shock delivery in patients with an initial rhythm of VF/pVT that had received bystander CPR, compared with a shorter period of CPR (30–60 seconds) followed by shock delivery. These subgroup analyses underscore the difficulty in making “one size fits all” recommendations for resuscitation systems which may vary considerably in both population served and treatments offered.  |

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| Implementation considerations |
| The BLS Task Force recognizes the importance of risk and cost associated with implementation of any new treatment strategy for cardiac arrest. Although it is feasible to implement changes in CPR recommendations as professional CPR providers undergo regular training and certification, changes in practice has the potential to increase uncertainty, errors and stress is what is already a critical medical emergency.  |

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| Monitoring and evaluation |
| Only one of five the included trials attempted to document and adjust for the quality of the intervention (or chest compressions) prior to defibrillation, (Stiell 2011 p 787) leaving the possibility that the intervention in the other trials were of various quality. Any future trials assessing effects of CPR or chest compression prior to defibrillation is encouraged to monitor CPR quality.  |

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| Research priorities |
| Current knowledge gaps include but are not limited to:· What effect does the quality of bystander CPR have? · Can electrocardiographic waveform characteristics be used to determine optimal strategy? · If CPR first strategy is adopted, what is the optimal duration of CPR (90 seconds, 120 seconds, or 180 seconds)? · What system level characteristics might influence adopted strategy?  |