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| Question | |
| **Should Resuscitation teams with a CPR Coach vs. Resuscitation teams without a CPR Coach be used for treatment of cardiac arrest patients?** | |
| **Population:** | treatment of cardiac arrest patients |
| **Intervention:** | Resuscitation teams with a CPR Coach |
| **Comparison:** | Resuscitation teams without a CPR Coach |
| **Main outcomes:** | Clinical CPR performance; CPR performance in simulation; Guideline adherence in simulation; Teamwork in simulation; Workload in simulation; |
| **Setting:** | Any setting |
| **Perspective:** | CPR Coaching may improve CPR quality during cardiac arrest resuscitation and hence contribute to improved survival outcomes. |
| **Background:** | Despite CPR training, adherence to guidelines is low. Devices placed on the chest that provide visual feedback during CPR can improve chest compression (CC) quality, but there is substantial room for improvement. Resuscitation teams using visual feedback devices still have < 40% compliance for CC depth. Strategies are needed to help teams translate visual CPR feedback into optimized CPR delivery. Many institutions have introduced CPR feedback defibrillators into their acute care environments. Optimal incorporation of CPR feedback technology requires CPR providers receive information from the device and adjust CPR performance accordingly. To address this issue, researchers have proposed the integration of a CPR Coach within the resuscitation team. The CPR coach is a resuscitation team member whose primary responsibility is to provide real-time coaching and feedback of CC performance during cardiac arrest, thus allowing the team leader to focus on advanced life support and managing reversible causes. |
| **Conflict of interests:** | A. Cheng, J. Duff, and Y Lin were authors of some articles included in this review. Therefore, they did not participate in article selection and were not involved in data extraction and ROB assessment of studies on which they were authors. |

# Assessment

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| Problem Is the problem a priority? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know | Cardiopulmonary resuscitation quality is often substandard to guideline recommendations in spite of CPR feedback being used. CPR Coaching has therefore been implemented in some settings clinically to improve CPR performance. |  |
| Desirable Effects How substantial are the desirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial ○ Small ● Moderate ○ Large ○ Varies ○ Don't know | For the critical outcome of clinical CPR performance, Infinger 2014[1] found that implementation of a CPR Coach improved fraction of compressions at adequate depth from 69.8% to 80.4%; compression depth increased from 43.6mm to 47.2mm, and time to defibrillation was reduced from 13.2s to 7.2s. P-values or confidence intervals for comparisons were not reported.    For the important outcome of CPR performance in simulation, Cheng 2018[2] found higher fraction of excellent chest compressions (63% vs 31%, Diff: 31.8 (17.7, 45.9); higher fraction of compressions within guideline recommendations 38.0 vs. 69.5, Diff: 31.5 (15.7, 47.4); guideline compliant rate (88% vs 80%, p=0.07); CCF (82% vs 77%, p=0.04) for coached vs non-coached teams. Kessler 2021[5] found shorter overall pause durations for coached vs non-coached teams 98.6 s vs 120.85 s, diff: 0.6–43.9 s, shorter pauses for intubation and defibrillation with no significant difference in mean pause frequency. Badke 2020[7] found shorter time to backboard placement (22s vs. 55s, p=0.02); no difference in compression rate, no flow time, time to first epi, time to first shock, or perishock pause duration although this study was likely underpowered to detect important differences in outcomes.    For the important outcome of guideline adherence in simulation, Buyck 2021[6] measured a clinical performance tool for teams with vs. without a CPR coach. They found that scores were 73.4 for CPR coached teams vs 68.3 for non-coached teams, (difference: 5.2 points; 95% CI: 1.0-9.3; p=0.016).    For the important outcome of teamwork in a simulated setting, Jones 2021[3] found that CPR coached teams had more words/min compared to non-coached teams (160vs134; p<0.05) overall; team leaders and others said less/min (70.2 vs 88.4 and 30.4 vs 45.6, p<0,05), and total questions/min was lower (2.84 vs 3.66, p<0,05).    For the important outcome of workload in a simulated setting, Tofil 2020[4] found that workload for team leaders measured using the NASA TLX questionnaire was 54.1 (9.8) vs 52.7 (11.6) for teams without vs with a coach, difference: 1.4 (–5.5 to 8.3). There was also no difference for chest compressors: 55.2 (11.2) vs. 55.6 (9.1), diff: 0.4 (–4.9 to 4.2). For chest compressors, there was lower mental demand and higher physical demand for coached teams vs non-coached teams.  Badke 2020[7] found no significant differences on any subscales of the NASA TLX for team leaders between the coached vs. non-coached teams. No overall NASA TLX measurement was conducted. |  |
| Undesirable Effects How substantial are the undesirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ● Trivial ○ Small ○ Moderate ○ Large ○ Varies ○ Don't know | We did not find any data in the studies on undesirable effects of CPR Coaching. | In settings without adequate resources for a CPR Coach, it could potentially limit CPR task performance although none of the identified studies found this phenomenon. |
| Certainty of evidence What is the overall certainty of the evidence of effects? | | |
| Judgement | Research evidence | Additional considerations |
| ● Very low ○ Low ○ Moderate ○ High ○ No included studies | For the critical outcome of clinical CPR performance, we found very low certainty evidence (downgraded for risk of bias, indirectness, and imprecision).[1]    For the important outcome of CPR performance in a simulated setting, we found very low certainty evidence (downgraded for risk of bias and imprecision).[2,5,6,7]    For the important outcome of guideline adherence in a simulated setting, we found low certainty evidence (downgraded for risk of bias, indirectness, and imprecision).    For the important outcome of teamwork in a simulated setting, we found very low certainty evidence (downgraded for risk of bias, indirectness, and imprecision).[3]    For the important outcome of workload in a simulated setting, we found very low certainty evidence (downgraded for risk of bias, inconsistency, and indirectness).[4,7] |  |
| Values Is 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 outcome of clinical CPR performance is considered as a Kirkpatrick level 3 outcome that is generally considered as a clinically important and meaningful outcome. Measurement of e.g. teamwork and workload in simulated settings are considered Kirkpatrick level 2and some may value such outcomes more than others. |  |
| Balance of effects Does 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 | The evidence generally favored the intervention with no findings favoring the comparator. |  |
| Resources required | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large costs ○ Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ○ Varies ● Don't know | No evidence on required resources for a CPR Coach was found | In many hospital settings, over-crowding is a major issue during CPR.[9] Therefore, the resources required for implementing a CPR Coach on the team would likely already be there. Low-resource settings and out-of-hospital settings may differ. However, alternate models of CPR coaching, where CPR providers take turns coaching, may help to overcome this resource issue. |
| Certainty of evidence of required resources What is the certainty of the evidence of resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ○ Low ○ Moderate ○ High ● No included studies | No evidence was identified. |  |
| Cost effectiveness Does 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 | There was no included studies on cost-effectiveness | In many hospital settings, over-crowding is a major issue during CPR.[9] Therefore, the costs of using a CPR coach would likely be negligible in such settings and cost-effectiveness would be good. |
| Equity What 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 evidence was identified | There is no believe that use of a CPR Coach would affect equity in any way. |
| Acceptability Is the intervention acceptable to key stakeholders? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ○ Yes ○ Varies ● Don't know | We found no evidence on acceptability | CPR Coaches are already implemented as part of the resuscitation teams in several pediatric hospitals[8] and staff members to fill out this role are likely available[9] However, this may differ in low-resource settings and out-of-hospital settings. |
| Feasibility Is the intervention feasible to implement? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know | CPR Coaches are already implemented as part of the resuscitation teams in several pediatric hospitals[8] and staff members to fill out this role are likely available in most hospitals[9]. This may differ in limited resource settings and some out-of-hospital settings. However, alternate models of CPR coaching, where CPR providers take turns coaching, may help to overcome this resource issue. We found one clinical observational study in the out-of-hospital setting where a CPR Coach was implemented without evidence of lacking feasibility. |  |

# 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** | **Trivial** | Small | Moderate | Large |  | 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 |
| The inclusion of a CPR Coach as a member of the resuscitation team during cardiac arrest resuscitation should be considered in settings with adequate staffing (weak recommendation, very low certainty evidence). |
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| Justification |
| - Use of a CPR Coach was generally associated with improved outcomes and no harmful effects of using a CPR Coach were observed.  - The certainty of evidence for the included outcomes was low or very low.  - Most of the evidence was based on one randomized simulation-based trial[2]. In addition, one clinical observational study[1] and a small pilot randomized simulation-based study was identified.[7]  - CPR Coaches are already implemented as part of the resuscitation teams in many hospitals[8] and overcrowding is very frequent in the hospital setting why it is believed that staff members to fill out this role are available.[9] However, this may differ in low-resource settings and out-of-hospital settings.  - In addition to the included evidence, one single center clinical study found that implementation of a CPR Coach as part of a bundled intervention was associated with improved fraction of excellent chest compressions.[10]  - Use of a CPR Coach may be considered a specific way of using shared leadership in resuscitation teams. Shared leadership has been suggested to be useful in several studies on in-hospital cardiac arrest.[9,11,12] |

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| Subgroup considerations |
| We did not identify evidence to address any of the prespecified subgroup analyses. |

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| Implementation considerations |
| CPR Coaches are already implemented as part of the resuscitation teams in many hospitals[8] and overcrowding is very frequent in the hospital setting why it is believed that staff members to fill out this role are available.[9] However, this may differ in low-resource settings and out-of-hospital settings.    Successful implementation of a CPR Coach may require training. However, one small simulated pilot study[7] suggested some possible benefits of using an untrained CPR Coach.    The effect and utilization of a CPR Coach may depend on the availability of automated chest compression feedback devices. In studies with feedback devices, the CPR Coach further improved chest compression quality, whereas in one small pilot study, an untrained CPR Coach without access to feedback devices was associated with shorter time to backboard placement and non-significant improvements in chest compression pause durations whereas chest compression quality was comparable between groups. This suggests that the potential implementation, role, and benefit of a CPR Coach may depend on available feedback devices. |

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| Monitoring and evaluation |
| No considerations. |

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| Research priorities |
| - The identified evidence was limited with most studies being based on one randomized simulation-based trial.[2] In addition, one clinical observational study[1] and a small pilot randomized simulation-based study were identified.[7] This suggests an overall need for further evidence on CPR Coaches including randomized trials specifically.  - We identified no evidence for the critical outcomes of adherence to guidelines in real cardiac arrest and patient survival outcomes.  - We identified insufficient evidence to address the prespecified subgroup analyses of: A) Adult vs. pediatric cardiac arrest, B) Trained vs. untrained CPR Coaching, C) Use of CPR feedback devices vs. no CPR feedback devices during resuscitation.  - In addition, the optimal role of a CPR Coach in the out-of-hospital setting and in-hospital setting may differ and the effectiveness may differ as well. This warrants further research.  - We identified no studies on cost-effectiveness or utilization of CPR Coaches in limited resource settings.  - No randomized clinical trials were identified. |

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