# QUESTION

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| **TITLE:** Alternative Cardiopulmonary Resuscitation Techniques |
| **POPULATION:** | Adults and children of any age who suffer cardiac arrest, whether in-hospital or out-of-hospital |
| **INTERVENTION:** | Cough CPR; precordial thump; fist pacing |
| **COMPARISON:** | Standard CPR |
| **MAIN OUTCOMES:** | Survival with favourable neurological outcome until and beyond hospital discharge or 30 days; survival until and beyond hospital discharge or 30 days; Return of Spontaneous Circulation (ROSC); restoration of cardiac output / circulation |
| **SETTING:** | In-hospital or out-of-hospital |
| **PERSPECTIVE:** | Patient |
| **BACKGROUND:** | Cough CPR, use of precordial thump and fist pacing have been considered for the treatment of cardiac arrest, or to prevent cardiac arrest. The 2010 CoSTR recommends against the use of fist pacing, and suggests that cough CPR and precordial thump only be considered in witnessed monitored cardiac arrests in the in-hospital setting in the initial stages of a cardiac arrest.Unlike the 2010 CoSTR, this update: considers OHCA and IHCA separately; has assessed for evidence in both the adult and paediatric population; has excluded case series with fewer than five cases |
| **CONFLICT OF INTERESTS:** | None known |

**ASSESSMENT**

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| **Problem**Is the problem a priority? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * VARIES
 | The current evidence is very-low-quality and mainly limited to case studies and cohorts without a comparator group. The only paper we identified since 2010 reported on the use of a precordial thump in a cohort of EMS witnessed VF/VT cardiac arrests of presumed cardiac aetiology in out-of-hospital setting (Nehme 2013, 1691).We identified other studies not reviewed in 2010: Nieman 1980, 141 and Marozsan 1990, 401 (cough CPR); Rahner 1978, 1659, Pennington 1970, 1192, Rajagopalan 1971, 725, Gertsch 1992, 181, (precordial thump); Klumbies 1988, 348, Scherf 1960, 30 and Paliege 1982, 1094 (fist pacing)There is no evidence in a paediatric population | Reports of cough CPR circulate on social media and may be perceived by the public as an effective way of preventing cardiac arrest.Precordial thumping and fist pacing are techniques known to and previously recommended to healthcare professionals There is a need to clarify the difference between the OHCA and IHCA patient populations. |
| **Desirable Effects**How substantial are the desirable anticipated effects? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * VARIES
 | There is very-low-quality evidence from case studies that cough CPR and fist pacing may prevent syncope or loss of cardiac output at the start of a cardiac rhythm that would produce cardiac arrest in the exceptional circumstance of the witnessed, monitored, in-hospital situations. There is no evidence directly comparing cough CPR or fist pacing to standard CPR in either these situations. |  |

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|  | Very-low-quality evidence comparing the use of precordial thump first versus standard CPR techniques shows no improvement in survival to discharge (Nehme 2013, 1691 and Pellis 2009, 17. The rate of immediate ROSC following VF/VT OHCA is significantly higher following defibrillation than precordial thump (Nehme 2013, 1691). |  |
| **Undesirable Effects**How substantial are the undesirable anticipated effects? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * VARIES
 | There is no evidence for direct harm from cough CPR or fist-pacing in the witnessed, monitored, in-hospital situation. There is no evidence comparing the success of these techniques compared to standard CPRThe success of precordial thump for termination of malignant tachyarrhythmias varies, but evidence is from case series and so is very-low-quality. There is some very-low-quality evidence of rhythm deterioration (e.g. VT to VF) on occasion following precordial thump |  |
| **Certainty of evidence**What is the overall certainty of the evidence of effects? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * Very low
 | There are two studies (Nehme 2013,1691; Pellis 2009, 17) that directly compare precordial thump to standard CPR techniques. These are both at critical risk of bias from confounding (using ROBINS-I), and represent a very-low-certainty of evidence The remainder of the evidence for cough CPR, precordial thump and fist pacing is limited to case series or cohorts with no comparator group. Overall, there is a very-low-certainty of evidence for all of the outcomes described in this CoSTR |  |
| **Values**Is there important uncertainty about or variability in how much people value the main outcomes? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * No important uncertainty or variability
 | The CoSTR includes papers reporting on important and critical outcome measures, including the critical outcomes of ROSC and survival to hospital discharge.  |   |

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| **Balance of effects**Does the balance between desirable and undesirable effects favor the intervention or the comparison? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * Probably favors the comparison
 | The balance of effects probably favours standard CPR, although direct comparisons were rarely reported.  | The emphasis should be on the prompt initiation of defibrillation (for shockable rhythms) and chest compressions. A focus on cough CPR and fist pacing – excepting the circumstance in a witnessed, monitored, in-hospital event – and on precordial thump risks delaying these established interventions and worsening outcomes  |
| **Resources required**How large are the resource requirements (costs)? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * Negligible costs and savings
 | No studies assessed this.   | The only potential costs would be if there was training in standardized methods of delivering cough CPR, fist pacing or a precordial thump. However, we do not recommend systematic training in the delivery of these techniques |
| **Certainty of evidence of required resources**What is the certainty of the evidence of resource requirements (costs)? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * No included studies
 | No studies assessed this. |  |
| **Cost effectiveness**Does the cost-effectiveness of the intervention favor the intervention or the comparison? |

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| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * No included studies
 | No studies assessed this. |  |
| **Equity**What would be the impact on health equity? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * Don't know
 | No studies assessed this. |  |
| **Acceptability**Is the intervention acceptable to key stakeholders? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * Don't know
 | No studies assessed this. | There is a lack of evidence for the continued use of these techniques in most situations.  |
| **Feasibility**Is this intervention feasible to implement? |
| **JUDGEMENT** | **RESEARCH EVIDENCE** | **ADDITIONAL CONSIDERATIONS** |
| * Don't know
 | No studies assessed this. | We do not recommend systematic training in the delivery of these techniques |

# SUMMARY OF JUDGEMENTS

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|  | **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 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**

## Recommendation

## Cough CPR

We recommend against “cough CPR” for cardiac arrest (strong recommendation, very low certainty evidence).

We suggest cough CPR may only be considered as a temporizing measure in an exceptional circumstance in a witnessed, monitored, in-hospital setting (such as a cardiac catheterization laboratory) if a non-perfusing rhythm is recognised promptly before loss of consciousness (weak recommendation, very low certainty evidence).

Precordial Thump

We recommend against the use of a precordial thump for cardiac arrest (strong recommendation, very low certainty evidence).

Fist pacing

We recommend against fist pacing for cardiac arrest (strong recommendation, very low certainty evidence).

We suggest fist pacing may only be considered as a temporizing measure in an exceptional circumstance in a witnessed, monitored, in-hospital setting (such as a cardiac catheterization laboratory) if a non-perfusing rhythm is recognised promptly before loss of consciousness (weak recommendation, very low certainty evidence).

## Justification

## This topic was last reviewed in the 2010 CoSTR. In contrast with the current systematic review, the 2010 CoSTR considered alternative CPR techniques in adults only, and included case series with fewer than five patients.

The very-low-quality evidence available precludes meaningful meta-analysis. Two studies (both on precordial thump) had a direct comparator group (standard CPR), and both of these had a critical risk of bias. The others were limited case series or cohorts without a comparator group.

Cough CPR

There is no evidence of the effectiveness of cough CPR in established OHCA. Very-low-quality evidence from one study (Petelenz 1998, 326) addresses the use of cough CPR for prodromal symptoms of collapse in high-risk patients, where the cardiac rhythm was not known and the likelihood of progressing to cardiac arrest uncertain. Accepting the benefit of cough CPR for the general population would require us to accept that an untrained patient could reliably identify a cardiac arrest rhythm in time to initiate coughing to maintain a cardiac output. This seems highly unlikely.

There are periodic stories (on social media for example) instructing members of the public to perform cough CPR in case of imminent collapse, so it is important that we address this topic. We should be clear that it is not recommended in OHCA – the risk is 1) that it delays effective treatment (early call for help, early CPR and defibrillation if the patient loses consciousness and stops breathing normally) and 2) that members of the public confusing ‘cardiac arrest’ with ‘heart attack’ delay seeking help when suffering chest pain or other symptoms indicating a possible ischaemic cardiac event.

There is no evidence to contradict the position from CoSTR 2010 that cough CPR could be considered in monitored, witnessed cardiac arrests occurring in-hospital. There is limited very-low quality evidence that this may be effective in all arrhythmias that can cause cardiac arrest, and not just VF and VT. This evidence is limited to adults. There is some evidence that cough CPR increases aortic, left atrial and left ventricular pressures, but a causative link between cough CPR and termination of the malignant arrhythmia is lacking. It would not be appropriate to prioritise cough CPR over other measures with proven efficacy, but it may be considered as a temporary measure if there a delay to defibrillation.

## Precordial Thump

## A causal link between precordial thump and the critical outcomes of survival to hospital discharge and ROSC is lacking. Defibrillation is a more effective treatment for the termination of VF and VT and should be prioritised. There is concern from one study (very-low-quality evidence) that use of precordial thump could compromise first shock success (Nehme 2013, 1691)

## In many of the included studies it is unclear whether the tachyarrhythmia (VT) represents cardiac arrest or impending loss of cardiac output – it is very likely that this is not the case for many of the cases included in individual studies.

Across studies, there is a lack of standardization regarding the technique of precordial thump, the number of times it was used, other pharmacological treatments delivered before or after its delivery and, in some cases, its timing related to the onset of the tachyarrhythmia.

## Fist Pacing

## The evidence is limited to three cases series (100, 42 and 5 patients, respectively) in asystole or bradycardia, suggesting that cardiac output can be maintained if fist pacing is initiated very quickly after their onset. There is no evidence comparing fist-pacing with standard CPR (chest compressions) in established asystolic cardiac arrest. We again highlight the importance of prompt, high-quality chest compressions for the treatment of cardiac arrest.

## Subgroup considerations

## Implementation considerations

None of the techniques are in routine clinical practice. We have emphasized against the use of cough CPR, precordial thump and fist pacing in OHCA.

## Monitoring and evaluation

Little ongoing evaluation is required. Periodic update of CoSTR may be warranted.

For established cardiac arrest, standard CPR with prompt high-quality chest compressions and early defibrillation is the priority and should continue to be so. Use of these alternative techniques is already limited to the monitored, in-hospital situation in an attempt to maintain cardiac output immediately following a malignant tachyarrhythmia, and only when there is a delay to definitive treatment (for example, defibrillation of VT/VF or permanent pacing for asystole or prolonged bradyarrhythmias)

## Research priorities

## There is no high-quality evidence of the use of these techniques compared to standard CPR. However, it is unlikely that there is clinical equipoise here, and so no urgent priority for ongoing research into these techniques.